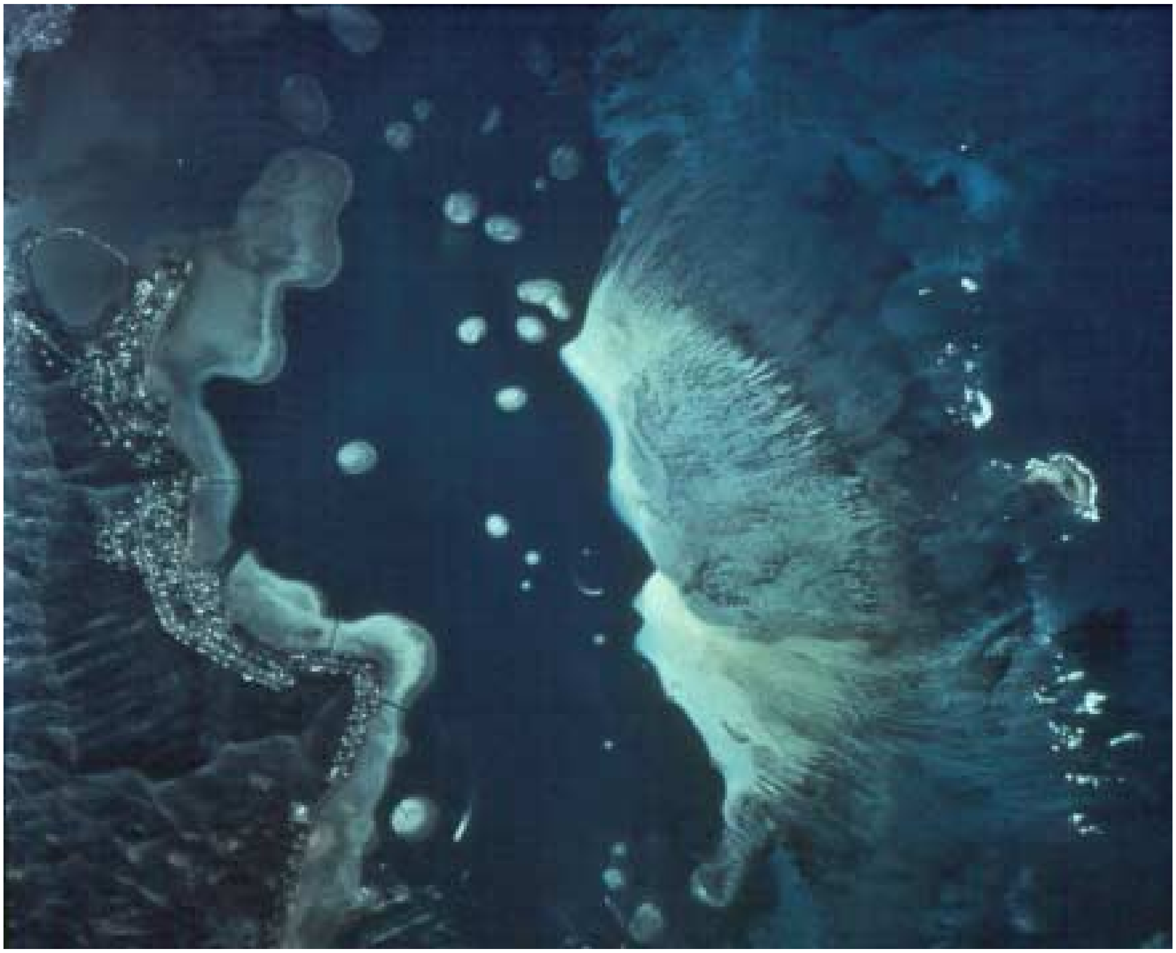

NONINDIGENOUS MARINE SPECIES IN
KANE`OHE BAY, O`AHU, HAWAI`I

June 2002

COVER

Areial view of Kane`ohe Bay from Kealohi Point (He`eia State Park) to Kahalu'u Fishpond showing barrier and patch reefs and Kapapa Island. Image provided by Paul Jokiel, Hawaii Instiitute of Marine Biology.

NONINDIGENOUS MARINE SPECIES IN
KANE`OHE BAY, O`AHU, HAWAI`I

Final Report prepared for the David and Lucile Packard Foundation
and the State of Hawai`i Department of Land and Natural Resources
Division of Aquatic Resources

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EXECUTIVE SUMMARY

The presence and impact of nonindigenous (introduced) marine organisms in Kane`ohe Bay, O’ahu, Hawaiian Islands are evaluated using a combination of historical records and on-site surveys and findings are compared with the results of similar studies conducted in Hawai`i and the Pacific. Observations and collections were made in November 1999 to January 2000 at 24 stations from variety of habitats and environments throughout the bay and from one site at Moku Manu Island outside the bay. A comprehensive literature review of published papers and books and unpublished reports was conducted to develop a listing of previous species reports, and the marine invertebrates, fish, mollusk and algae collections at Bishop Museum were queried for information regarding all organisms that had been collected from Kane`ohe Bay. The assembled data were developed into a relational data base used to determine the 1999-2000 percent component of the total biota that was nonindigenous or cryptogenic, the number of new reports for the bay versus the number of previous reports not found, and a chronology of first reports of introductions.

The 1999-2000 surveys observed or collected a total of 786 taxa including 617 species, more than six times the number of taxa previously reported by any single survey of biota in the bay. Of these, 59% of the total taxa and 51% of the named species were new reports for Kane`ohe Bay after consideration of nomenclatural name changes. However, only 24% of the total taxa previously reported for the bay were found by the present study. This may be due in part to misidentifications in previous studies, non-sampling of meiobiota and plankton by the present study, or actual disappearance of some species from the bay such as the introduced mollusk *Haliotis* sp. However, the results suggest that further sampling and observation would produce considerably more taxa and species.

Historically, 204 nonindigenous or cryptogenic species (collectively termed NIS) have been reported in Kane`ohe Bay since 1920, and 116 were found on the 1999-2000 surveys, the most that have been determined for any single study in the Hawaiian Islands or Johnston Atoll. In terms of the component of total identified species, NIS composed 18.8%, among the highest percentage components that has been found in Hawai`i and second only to the 23% value that was determined for Pearl Harbor. Fifty-two of the NIS were new reports for the bay. However, all but 16 of the new bay reports had previously been reported in Hawai`i, and those 16 are designated cryptogenic and subject to revision.

The distribution of NIS within the bay was concentrated in areas of harbors, piers and docks near the shoreline and on the Coconut Island reef where a metal artificial structure provides settlement opportunity and where introductions of nonindigenous algae have occurred historically. NIS of 25-36 or more occurred at these sites compared to 1-25 NIS at sites in coral rich areas with more open oceanic circulation. A contrasting pattern was found for species richness. Highest numbers of >150 total taxa occurred along the main channel of the bay or at Moku Manu island where corals and coral reef conditions were most dominant and circulation with the open ocean was relatively unrestricted. Sites with <100 total taxa and greatest numbers of NIS occurred at

inshore areas in harbors, along docks and piers, or in sedimentary areas dominated by nonindigenous or other macroalgae. This pattern of inverse relationship between NIS and species richness corresponds with previous observations in O'ahu's and on coral reef areas elsewhere in the Hawaiian Islands and in tropical areas of the Pacific.

Invasive nonindigenous species, i.e. those that have proliferated apparently uncontrolled by environmental conditions or biotic factors somewhere in Hawai`i, are dominated in the bay by five species of macroalgae, four of which were first introduced in Hawai`i into the bay in the 1970s. All five species now occur throughout the bay on reef flats and reefs slopes and often cover large areas of reef, overgrowing or restricting the habitat space available for reef coral or native algae. All five are either common to abundant elsewhere in Hawai`i or have recently been reported outside of the bay. Collectively, these nonindigenous marine algae constitute the most serious marine introduction problem for the Hawaiian Islands. Significantly, all but one species were purposely introduced to or redistributed in Hawai`i for aquaculture purposes. Of the four invertebrates and three fishes occurring on these surveys and considered invasive elsewhere in Hawai`i only two species, a stomatopod believed to have entered in the 195os and an intertidal barnacle that was not present in the early 1970s, occurred frequently within the bay. The remaining NIS were low in abundance and frequency and are not recognizably impacting coral reefs or other relatively undisturbed areas in the bay.

Historically, new NIS reports in Kane`ohe Bay steadily increased from 1920 through the end of the century, with first reports by decade showing distinct peaks in the 1930s, 1960s, 1970s and with the present study. An analysis comparing first reports prior to 1960 to post 1960 could be interpreted to suggest that introductions in the bay have accelerated in the last 40 years, with only 36% of first reports occurring before 1960 compared to 64% post-1960. However, comparing these first NIS reports with first reports for all taxa clearly indicates that the pattern is a reflection of a substantial increase in sampling and identification effort during this same period, with 75% of the 1364 total taxa in the bay been having been first reported after 1960. Furthermore, many of these recent nonindigenous species first reports in Kane`ohe Bay had previously been reported elsewhere in Hawai`i.

Analysis of origins of the Kane`ohe Bay NIS shows a similar pattern as previous studies in Pearl Harbor and the south and west shore harbors of O`ahu, with the majority of species with identifiable origins or distributions coming from the western (17%) or central Indo-Pacific (11%), the latter region equaled by the Caribbean (11%).

The study results support a developing paradigm of reduced invasion success in communities with greater species richness, which has been indicated by studies in both tropical and temperate marine systems and in temperate terrestrial communities. This has important management ramifications, since it suggests that an essential means for reducing nonindigenous species proliferation and spread is to restore or maintain environmental conditions that promote ecologically balanced, high diversity communities. Along with control measures to prevent the arrival and release of nonindigenous marine species, protection of species richness and diversity in receptor areas appears to be a potentially important mechanism for limiting the impacts of introduced species.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

A. Nonindigenous marine species introductions and their impacts on native populations.

The distributions of marine organisms throughout the world have been established with the influence of natural physical barriers such as landmasses, temperature or salinity gradients, or current systems, which isolated populations and promoted speciation through evolutionary time scales. However, the geographic ranges of formerly separated species populations have always been in flux as changing current systems, shifting temperature environments or disappearance of land barriers with sea level rise have permitted range extensions of organisms through natural means. What we often traditionally view as a relatively static marine ecosystem with defined boundaries dividing distinct populations has in fact been subject to continual transport, invasion, competition and changes in dominance at low rates of natural introduction.

When natural means causing redistribution of species populations in the sea become superceded by man-related activities, dramatic changes can occur in the resident communities of the areas receiving the introductions. As stated by Briggs (1974) “dominant species can not only succeed in colonizing when they manage to migrate across barriers but often show spectacular success as the result of man-made introductions, either purposeful or accidental”. Human-mediated transport of nonindigenous species is not a new phenomenon. For thousands of years vessels have transported boring organisms and fouling organisms (Carlton 1992; Carlton and Hodder 1995,Carlton 1999), and circumnavigation of the world by sailing vessels has been underway since the early sixteenth century. In fact, because classification and identification of marine organisms began only in the mid-eighteenth century, and few marine biological surveys were conducted prior to the mid-nineteenth century, the “natural” distributions of many widely distributed marine shallow water species remain in question (Carlton 1989; Carlton 1999).

In the last century, and more especially during the last two decades, man-related redistribution of marine shallow water organisms has become more frequent and ever more important in its impacts on native communities. These introductions of nonindigenous species have been promoted though six principal vectors (Carlton 1987; Ruiz et al. 1997; Thresher 1999; Barnes 2002):

- Transport of planktonic or larval forms in ship ballast water or benthic forms in ballast water sediments in large cargo vessels.
- Transport of fouling organisms attached to vessel hulls or of nonattached organisms associated with fouling communities (Rainer 1995; Taylor et al. 1999; Thresher 1999; Godwin 2001)
- Transport of fouling organisms on anthropogenic marine debris, which has been estimated to have increased 100 fold in the Southern Ocean in the 1990s, has doubled the propagation of bryozoans, barnacles, polychaetes, hydroids and molluscs in the subtropics and tripled it in high latitudes (Barnes 2002).
- Intentional or unintentional release or propagation in the natural environment of edible or commercially important organisms, or of organisms that are associated with organisms brought in for culture purposes.
- Ornamental organisms such as exotic fishes or algae, originally intended for aquarium observation,

teaching or research but escaping or released into the environment.

- Reconnection of formerly isolated bodies of water by canal construction, the primary example being "Lessepsian migration" of organisms through the Suez Canal between the Red and Mediterranean Seas (Por 1978; Zibrowius 1992; Galil 1999).

The primary vector responsible for recent invasions in coastal and inland waters is generally concluded to be worldwide commercial shipping. Ships may transport viable organisms within their ballast water or on their hulls as fouling organisms. These potential invaders may be discharged in harbors where, with no natural predators of controls, they may proliferate rapidly. The role of ballast water (Carlton 1985.; Hallegraeff and Bolch 1991; Smith et al. 1996; Carlton 1997; Chu et al. 1997; Gollasch 1999; Hines et al. 1999; McCollin et al. 1999; Pechenik 1999; Taylor et al. 1999; Wonham et al. 2000; Godwin and Eldredge 2001) and ship fouling (Carlton and Geller 1993; Rainer 1995; Smith et al. 1996; Chu et al. 1997; Godwin 2001; Godwin and Eldredge 2001). as transport vectors of nonindigenous species has been demonstrated in many parts of the world. Although these mechanisms for species transport are not new, aquatic species introductions may have accelerated in many areas of the world in the last decade (Cohen and Carlton 1998; Hewitt 1999) possibly due to more rapid ship movement and increased traffic to and from some areas such as China.

Since the 1970s, a striking surge of exotic species invasions has occurred in harbors, ports, and other coastal ecosystems around the world (See Carlton 1985.; Carlton and Geller 1993; Ruiz et al. 1997 for reviews). Introduced species can rapidly monopolize energy resources, act as voracious predators, overcome endemic species, or transmit parasites and diseases that can be passed to humans through the food chain or direct exposure. Because of the serious consequences that can result from nonindigenous introductions, marine species invasions have been ranked among the most serious potential perturbations of marine ecosystems (Carlton and Geller 1993). Many introductions of invasive marine nonindigenous species have occurred in the last two decades. Examples include the fouling mussel *Perna perna* along the Texas Gulf coast (Hicks and Tunnell 1993), the Japanese shore crab *Hemigrapsus sanguineus* on the US Atlantic coast (McDermott 1991; Brosseau et al. 1999; Larson et al. 1999; Seeley 1999; McDermott 1999; Tyrrell and Harris 1999) the North American ctenophore *Mnemiopsis leidyi* into the Black Sea (Shushknia et al. 1990) , the alga *Codium fragile tomentosoides* (Trowbridge 1996) and a variety of invertebrates (Hayward 1997; Taylor et al. 1999) into New Zealand waters, and Japanese dinoflaggelates (*Alexandrium* spp.) macroalga (*Undaria pinnatifida*), starfish (*Asterias amurensis*) and the European green crab *Carcinus maenus* into Australian waters (Sanderson 1990; Hallegraeff and Bolch 1991; Buttermore et al. 1993; Rodriguez et al. 1999).

San Francisco Bay, which has had a long history of direct commerce and exchange of shipping with Hawai`i, has been especially impacted by marine species invasions. Species introductions in San Francisco Bay have been so prolific and successful that no shallow water habitat in the bay is free of exotic species, and it is difficult to find any abundant native species (Carlton 1979; Cohen and Carlton 1995). Moreover, species invasions continue in San Francisco Bay (Gosliner 1995; Mills and Sommer 1995; Daehler and Strong 1996; Greenberg et al. 1996; Cohen 1999) which have the potential to be ecologically devastating. The Chinese river clam, *Potamocorbula amurensis*, has reached densities as high as 10,000 per m^2 in shallow areas of the bay, sufficient to strip the bay of phytoplankton blooms that form the basis of the food chain (Carlton et al. 1990) and to alter food webs (Thompson and Luoma 1999). The European green crab *Carcinus maenus* consumes a wide variety of prey (Grozholz and Ruiz 1999) and is capable of greatly altering the San Francisco Bay ecosystem (Cohen et al. 1995) through predatory consumption, competition and indirect effects such as hybridization. This crab has recently extended its range to Oregon coast (Behrens Yamada 1999) and Puget Sound (Cohen 1999). The estuarine Chinese mitten crab *Eriocheir sinensis* (Carlton and Cohen 1997) harbors a human parasite, damages levees and shorelines and interferes with fisheries (Cohen and Carlton 1998). Cohen and Carlton (1995, 1998) have estimated that a new invasion occurs in San Francisco Bay an average of every 10 to 12 weeks, and new invasions continue to be documented (Cohen et al. 1995; Gosliner 1995; Mills and Sommer 1995; Cohen and Carlton 1998).

B. Marine Nonindigenous Species Introductions in Hawai`i

The main Hawaiian Islands are among the most isolated land areas in the world, lying more than 4300 km from the North America and more than 6400 km from Japan, and the native biota of these islands have one of the world's highest rates of endemism in the world (Kay and Palumbi 1987). The Hawaiian islands have also been a principal port of call for ocean-going ships sailing from San Francisco Bay and elsewhere in the Pacific for more than 150 years. Located at the crossroads of the Pacific, Hawai`i receives ship traffic from all oceans, principally from the west coast of North America, Asia and the South Pacific (Carlton 1987). Virtually all international shipping passes to Hawai`i through Honolulu Harbor and Barbers Point Deep Draft Harbor on O`ahu, making these the most likely entry points for introduced marine species into Hawai`i.

Information concerning the abundance of nonindigenous marine species in Hawaiian waters has proliferated in the past five years. Prior to 1995 this type of information was limited primarily to fishes and macroalgae. Maciolek (1984) listed 19 species of diadromous and marine fishes to be present in Hawaiian waters, which was increased to 21 marine species by Randall (1987), about 4% of a total of 536 Hawaiian shore fish species (Randall 1992). Approximately 18 species of macroalgae have been introduced to Hawai`i since 1950 (Russell 1992), again about 4% of the approximately 430 estimated total macroalgal species for Hawai`i (J. Smith, pers. comm.). Carlton and Eldredge (in prep.) and Eldredge and Carlton (2002) reviewed the marine and brackish water invertebrates of Hawai`i and determined approximately 343 species to be demonstrably or potentially nonindigenous, or about 7% of the approximate 5000 marine species estimated for Hawai`i (Allison et al. 1995).

Baseline studies of Hawaiian nearshore marine biota directed toward the detection of introduced species and their impact (Coles et al. 1997; Coles et al. 1998; DeFelice et al. 1998; Coles et al. 1999a; Coles et al. 1999b; Coles et al. 2001; Coles and Eldredge 2002; DeFelice et al. 2002) have shown that nonindigenous species components of total taxa vary substantially from these average values, depending on the characteristics of the area surveyed. Findings have varied from 95-100 nonindigenous and cryptogenic species found in Pearl Harbor (Coles et al. 1997; Coles et al. 1999a) and O`ahu's south and west shore commercial and public harbors (Coles et al. 1999b), amounting to 23% and 17% respectively of the total number of species of invertebrates, macroalgae and fishes found. By contrast, nonindigenous components of total biota identified for studies on coral areas around Kaho`olawe Island (Coles et al.

1998), Midway Atoll and French Frigate Shoals in the Northwest Hawaiian Islands (DeFelice et al. 1998, 2002) and at Johnston Atoll (Coles et al. 2001) have ranged from only 0.4% (French Frigate Shoals) to 2% (Johnston Atoll). These low numbers of introduced species on previously studied Hawaiian reefs may be due, at least in part, to increased resistance to invading organisms being provided by the higher species richness and diversity of coral reef communities (Coles and Eldredge 2002; Hutchings et al. 2002). Alternatively, the results may be primarily due to the remoteness of these areas having limited the opportunity for species introductions to occur.

Kane`ohe Bay is virtually unique in Hawai`i in being a large semi-restricted marine system with characteristics of both coral reef and estuarine environments and habitats. It was a major Hawaiian population center prior to European contact and has been highly influenced by man’s activities over the last century. Shipping activity of medium-size vessels to the Kane`ohe Marine Corps Base (KMCB) and movement of ocean going sailing craft to the Kane`ohe Yacht Club has been frequent over the last 50-60 years, providing opportunity for vessel-related introductions. Aquaculture activities on Coconut Island and at an oyster production facility in that operated in south Kane`ohe Bay in the 1970s have provided additional mechanisms for species introduction. In many respects Kane`ohe Bay provides a natural laboratory to determine whether species introductions near coral reef areas have spread to the more diverse reef systems and what the impacts of such introductions has been.

Except for studies focused on the extent and impacts of introduced algae (Rodgers and Cox 1999; Woo et al. 1999; Smith et al. In press), information has been lacking about the quantity, distribution and impact of nonindigenous and invasive species in Kane`ohe Bay, and no study has comprehensively sampled for the full range of benthic macrobiota that occurs in the bay. The present study reports these conditions for surveys conducted November 1999 - January 2000 and compares findings with all information available for species reported in the bay prior to that time. Study findings are compared with previous studies conducted by the present authors and relates the Kane`ohe Bay introduced species composition and frequency with the pattern which has been developed for the Hawaiian Islands and elsewhere in the Pacific where information is available.

A. Historical Perspective

The history of Kane'ohe Bay and its watershed up through 1976 was reviewed in detail by Chave and Maragos (1973) and Devaney et al. (1976), who provided primary references for the events briefly described here. With its abundant water, fertile taro fields, numerous fish ponds and fishing provided by the largest embayment in Hawai`i, the Kane'ohe Bay region was a major Hawaiian population center prior to and early after European contact. The bay area included nine *ahupua'a* valleys extending from the mountaintop to the sea with about 30 fishponds and was highly productive. Population at the time of European contact has been estimated variously as around 15,000 to 17,000 or about one fourth of the 60,000 total estimated for O`ahu (Devaney et al. 1976).

Following European contact the population of the Kane'ohe Bay region fell precipitously, along with the rest of Hawai`i, due to introduction of diseases, disruption of native society and culture and emigration into the growing district of Honolulu. By the time of the first Hawai`i census in 1831 the population of the nine Kane'ohe Bay area *ahupua'a* was recorded as 3,019, with a total for the Koolaupoko district, which includes Kailua and Waimanalo, of 4,987. Population for the district reached its lowest in 1872, when only 2,028 persons were recorded, or about 40% of the 1831 value and only about 10% of the number estimated for Kane'ohe prior to European contact about 100 years earlier. Although population began to increase in the 1870s, the 1831 value was not reached until the 1920s. Population for Koolaupoko then doubled in less than 20 years, reaching 9000 in 1940, and then again in ten years with over 20,000 in 1950, with population distribution about evenly divided between the Kane'ohe and Kailua-Waimanalo areas. With the completion of the Pali Highway in 1957 and the Likelike Highway in 1960 and the rapid accessibility to Honolulu urban centers that these afforded, Koolaupoko district population soared exponentially, reaching 92,000 in 1970, 110,00 in 1980 and 122,000 in 1995 (U. S Census and Hawai`i DBEDT). Most of this population increase in the last 20 years has occurred in the Kane'ohe area, which accounted for 60,000 of the 110,000 for the district in 1980 (Smith et al. 1980).

Land and ocean usage also changed dramatically in the Kane'ohe Bay area throughout this period. With a native economy and culture based on subsistence agriculture and aquaculture, the land was intensely cultivated using a sophisticated system of terracing and fish pond construction and maintenance, "crowded with plantations of taro, sweet potatoes, sugar-cane, etc. interspersed with a great number of coconut trees" (Portlock 1789). Kane'ohe Bay, which was included in extensions of the valley-based *ahupua'a* was equally intensively cultivated, with 30 walled fishponds shown in a map based on an 1882 survey. These included the two largest (Heeia and Moli'i) fishponds remaining in Hawai`i. The open waters of the bay were also probably heavily fished within the limitations of the *kapu* system, and fishing rights were allocated as part of the respective *ahupua'a.*

This system of intensive but sustainable land and ocean utilization changed radically with the decline of the Hawaiian population, changes in land tenure rights with the Great *Mahele* in 1848, and increases in non-Hawaiian population and other land usage. The earliest attempt at non-traditional agriculture was in the 1850s, with the first sugar plantation on O`ahu at Ku'uloa, at the north end of the bay. By 1865 four plantations were in production, at Ku'uloa, Ka'alea, Waihee and Kan'eohe, and in the early 1880s, four more at He'eia, Kane'ohe, Kahalu`u and Ahuimanu, with a total of over 1000 acres in cultivation in 1880.

However, sugar cultivation in the Kane’ohe Bay area was short-lived, with only two plantations remaining in operation through 1985, and the last closing down in 1902-03.

Rice cultivation utilizing and expanding former taro ponds shortly followed sugar cultivation, with the first rice plantings in the early 1860s, and most rice farming occurring between 1880 and the 1920s. This process of converting abandoned taro fields involved increasing width and extent of old dikes, constructing a vast network of new irrigation ditches, and using livestock to plow and compress the soil of rice ponds to increase their water retention. Rice cultivation occurred primarily in the *ahupua’a* of Waihole, Waikane, Kahaluu, He’eia and Kane`ohe and was estimated in 1892 to total 700 acres of pond in 1882.

The decline of rice production from the 1890s to the 1920s coincided with a shift in acreage to pineapple cultivation, which was the major industry in the Kane’ohe area from 1910 to 1925. At its peak, 2500 acres were under pineapple cultivation, and photographs of the south Kane`ohe area in the 1920s indicate that most of the available land was devoted to this production. However, like other cash crops attempted in the Kane’ohe area, production and costs were found to exceed profitability, and the fields were abandoned to revert to wild conditions or ranching after 1925.

Stock grazing continued in the Kane`ohe Bay watershed throughout this entire period of experiments in commercial agriculture. Cattle and sheep were first introduced on O`ahu in 1793 by Vancouver, and hundreds of cattle and numerous goats were described grazing in the area in the 1840s and 1850s (Parker 1835-1862; Bates 1854). This activity increased steadily and continued after other large-scale agricultural activities ceased, rising from an estimated 700 acres in grassland and ranching in 1880 to nearly 3000 acres in 1969 (Chave and Maragos 1973). Ranching and overgrazing undoubtedly contributed to erosion and loss of native vegetation which was noted as early as 1917 (MacCaughey 1917), and by 1933 serious concern was conveyed to Kane`ohe Ranch by the Territorial Forester about erosion being caused by overgrazing by dairy stock (Devaney et al. 1976).

These agricultural and ranching activities significantly affected the environmental conditions and water quality of Kane`ohe Bay as runoff and sedimentation increased through time. Elimination of taro terraces that had acted to retain water and sediments also probably contributed to hillside erosion. This may have been somewhat counterbalanced by another factor that has influenced Kane`ohe Bay, the diversion of a substantial portion of the Kane`ohe Bay watershed groundwater and stream flow to leeward O`ahu, primarily for sugarcane production in the Ewa plain. This began with the completion of the Waihole tunnel in 1916 and continued with the Haiku, Kahalu’u, and Waihe`e tunnels in 1940, 1946 and 1955 respectively. This resulted in a combined >40% diversion and decrease in total stream runoff for the Kane`ohe Bay watershed, from ca. 315,000 to 182,000 m^3 day^{-1} (Chave and Maragos 1973; Devaney et al. 1976).

Kane`ohe Bay has long been recognized as a unique and marine environment that originally supported abundant reef corals and associated marine life. The earliest report was from James Macrae, botanist on Byron's voyage to Hawai`i in 1824-1826 who noted that Kane`ohe Bay was open, exposed and "full of rocks in many places above water which renders it unsafe for vessels to anchor. It is full of fish." (Wilson

1922). Agassiz (1889) described Kane`ohe Bay to have its bottom "covered in many places by numerous more or less circular patches of living corals in all stages of growth… with their sides covered with magnificent clusters of *Pocillopores* and *Porites*… and the simpler *Fungiae* so characteristic of the Pacific reefs." Mackaye (1915) mentioned "over a hundred varieties of corals are known to exist in Kane`ohe Bay" that were colored "yellow, red, green, brown, and lavender, with snow-white corals making bright spots along the reefs". He listed the 16 major coral species that composed the "coral gardens" in the south bay, which was in the vicinity of the present Makani Kai Marina. MacCaughey (1918) remarked that in Kane`ohe Bay there were "many small coral isles and atolls; some are of notable perfection and that in the bay "in protected waters of inner channels or lagoons that corals attain their finest development". Edmondson (1928) described the bay as "one of the most favorable localities for the development of shallow water corals" with "nearly all the reef-forming general known in the Hawaiian Islands … represented in certain areas of this bay and many species grow luxuriantly."

Considerable change occurred in the water quality and marine environment in Kane`ohe Bay with urbanization and development of the watershed in the second half of the 20th century. This phase of the history of windward O`ahu and Kane`ohe Bay began in about 1945 as residents of Honolulu began to utilize the improved Pali Road to frequently visit the area, with many people eventually making their homes in Kane`ohe-Kailua when the Pali and Likelike highways were completed. This "opening up" of the windward side culminated in the soaring populations of the Ko'olaupoko District previously described and in considerable impacts that affected Kane`ohe Bay. The hardened surfaces of roads, parking lots and building roofs diverted water into storm sewers and streams that previously would have percolated into ground, but now went directly into the bay, along with sediments from hillsides exposed of vegetation by construction and development. Nine of the bay's 30 fishponds that are indicated to have existed in the 19th century were filled between 1946 and 1948 and used for housing sites, and only 12 of the original ponds remain today. Principally as a result of extension and development of the Kane`ohe Marine Base just prior to World War II, large areas of the Bay were dredged and filled, especially in the south bay in the vicinity of Mokapu Peninsula. Between 1939 and 1941 over two million cubic yards of reef area were dredged in areas on the bay side of Mokapu and much of the material deposited extend the shoreline in the vicinity of the Marine Base's runways (Devaney et al. 1976).

The Marine Base was also the first source to release sanitary sewage into the bay, beginning in with the discharge of untreated primary sewage in the southeast bay in the 1940s. In 1971 sewage treatment at the Marine Base was upgraded to secondary (removal of suspended solids and reduction of organic load). Prior to 1963 municipal waste from Kane`ohe town was handled by a network of cesspools and septic tank and discharged into a stream. At that time the Kane`ohe sewage plant treatment became operational, which utilized secondary treatment and discharged the effluent in south Kane`ohe Bay in 8 m depth. In 1970 a small secondary treatment plant constructed for a housing development at Ahuimanu began discharging in northwestern Kane`ohe Bay. By 1975 the total sewage discharge from these three sources had risen to a total of about 17,000 m^3 day^{-1}, with about 70% of the total coming from the Kane`ohe municipal discharge in south Kane`ohe Bay.

By the early 1970s the water quality and marine environment of Kane`ohe Bay had been severely degraded, especially in the south basin where a residence time for water of approximately two weeks

(Bathen 1968) meant that nutrients and suspended solids discharged by the sewage outfalls, streams and shoreline runoff accumulated, stimulating phytoplankton uptake and growth. Biological conditions at that time in the bay were described in Banner and Bailey (1970), Maragos (1972, 1973), Smith et al. (1973) and Banner (1974). It had been evident for years that effluents were causing eutrophication and biological damage in the bay, especially in the south basin (Laws and Redalje 1979) where reef corals had become scarce (Maragos 1972). In place of corals the benthic community had become dominated by suspension and deposit feeders utilizing the increased organic load that was being generated by primary production stimulated by sewage discharge. Distributions of corals (Maragos 1972, 1973) as well as macroalgae (Soegiarto 1973) and reef fish (Key 1973) showed dramatic decreases in the south basin, and corals transplanted into this area failed to grow or survive (Maragos 1972). In the mid-bay the shallow reefs were dominated by an invasive native macroalga *Dictyosphaeria cavernosa*, which overgrew corals and weakened their skeletons and reef that was being formed by them (Banner and Bailey 1970; Maragos 1972). A study of the bay's bathymetry (Roy 1970) comparing depths from 1882 and 1927 charts with fathometer readings made in 1969 indicated no significant change between the two earlier dates, but a mean decrease of 1.6 m between 1927 and 1969. The composition of 72% of the sediment comprising this decrease was carbonate, suggesting that the reef had been degrading and that reef erosion was exceeding deposition during this period.

In order to counter the impacts of sewage induced eutrophication, construction began in 1975 for transfer and disposing Kane`ohe sewage effluents to an deep ocean outfall at about 30 m depth outside of Mokapu Peninsula. All sewage was permanently diverted from Kane`ohe Bay to the deep outfall by May 1978. The reduced nutrient loading in the bay quickly manifested itself in reduced plankton, suspended solids and turbidity in the south bay. The benthic community shifted from dominance by suspension and deposit feeding detritovores to autotrophic algae and reef corals which could utilize the improved light penetration of the water column (Smith 1981). Resurveys of reef sites in the bay in 1983 (Maragos et al. 1985; Alino 1986; Evans et al. 1986; Holthus et al. 1986; Holthus et al. 1989) revealed a remarkable recovery of corals, especially *Porites compressa* and *Montipora verrucosa* in the southern and middle lagoon, while *Dictyosphaeria cavernosa* algae declined greatly except for a minor increase in the northern lagoon.

Along with the impact of sewage discharge, an important environmental factor affecting Kane`ohe Bay has been periodic runoff from torrential rainstorms, and the effects of these have interacted with conditions in the bay to influence the characteristics of the biota following the storms. Major storms which occurred in 1965 (Banner 1968) and 1987 (Jokiel et al. 1993) resulted in quite contrasting conditions for the benthic communities over the long term. Both storms produced sediment-laden, low salinity water in shallow depths that resulted in extensive mortality for benthic organisms and fishes. Damage from the 1965 was long-term on some shallow reefs in the south bay directly impacted by the flood, which underwent a "phase shift' in the dominant benthic component from reef corals to the colonial anemone *Zoanthus* (Banner 1968; Maragos and Chave 1973). After removal of sewage discharge from the south bay, the *Zoanthus* population diminished, probably due to food limitation and the 1987 storm did not produce another shift to *Zoanthus* dominance, but rather a recovery of corals from tissues remaining in the apparently dead coral skeletons (Jokiel et al. 1993).

Measurement of nutrients and other water quality indicators during the early 1990s indicated that nutrients had remained near or below the lowered values that had been measured during monitoring following the removal of sewage discharge from the bay in 1978 (Coles and Ruddy 1995; Laws et al. 1996). Corals transplanted to four sites where (Maragos 1972) had shown high mortality in the south bay during the period of sewage discharge showed good survival and growth in 1991-92 (Coles and Ruddy 1995). However, surveys conducted on benthic coverage throughout the bay suggested that the rate of coral recovery established in 1970 and 1983 had slowed or, in some cases, reversed and *Dictyosphaeria cavernosa* had again increased at one third of the sites surveyed (Evans 1991; Evans and Hunter 1992; Hunter and Evans 1995). Since nutrient measurements in the south bay indicated values near lower limits of detectability (Coles and Ruddy 1995; Laws et al. 1996), and coral declines were greatest in the central bay, these changes may have been related to non-point discharges from sewage disposal through cesspools and septic tanks. Studies of the nutrient dynamics of *Dictyosphaeria cavernosa* (Larned and Stimson 1996; Stimson et al. 1996; Larned 1998) suggest that sediments function as localized nutrient sources, making sustained growth possible despite low nutrient concentrations in the water column, and that nutrient regeneration from sediments beneath thalli, and/or excretion by animals inhabiting these chambers, contribute to the elevated nutrient levels utilized by the algae.

The other prominent change in Kane`ohe Bay in the last two decades has been a growing dominance of the benthos by nonindigenous (alien) algae species (Rodgers 1997; Rodgers and Cox 1999; Smith et al. in press)]. The first introduced algae in Kane`ohe Bay was *Acanthophora spicifera,* which was reported by (Doty 1961) who mentioned Kohn's (1959) recording of this species in 1956 on the egg cases of *Conus quercinus* collected in Kane`ohe Bay. *A. spicifera* is believed to have been accidentally introduced on a barge in Pearl Harbor during WW II (Doty 1961; Russell 1992), but the remaining algal introductions were as potential aquaculture species that did not prove practical or profitable, but managed to proliferate on their own. The most thoroughly documented are various species of *Kappaphycus* (=*Eucheuma*) (Russell 1983) which were introduced by Doty in 1974 and rapidly spread over the reef on which they had been displaced from broken pens. Although originally proposed to be limited in its ability to disperse because of light limitations that prevent its survival in deep water (Russell 1983), subsequent surveys (Rodgers and Cox 1999) have shown *Kappaphycus* to have been spreading throughout the bay at an average rate of 250 m per year, or over 6 km from its point of introduction in 1974. Another algae introduced in that year, *Hypnea musciformis*, was originally planted on reefs in Kane`ohe Bay, O`ahu but is not as prominent in the bay. However, it has spread to many other locations on O`ahu and to other Hawaiian Islands, and is an especially invasive pest on the south and west coasts of Maui. The most recent introduction, *Gracilaria salicornia,* has spread over 5 km since its introduction in 1978, an average rate of spread of approximately 280 m per year (Rodgers and Cox 1999). This is now the most widespread and abundant alien nonindigenous alga in the bay and it covers large areas of shallow reef, especially in the south bay. Both *Kappaphycus* and *Gracilaria* smother and displace live coral in the shallow depths on reefs and prevent the utilization habitat by reef-associated invertebrates and fishes.

During the last two decades increasing popularity of Kane`ohe Bay and perception of its value as a recreational and income-producing asset has resulted in competition among user groups for the bay's space and resources. The bay is now heavily used by recreational and commercial fishermen, power and sailing boaters, tourist oriented business providing experiences in snorkeling, high speed watercraft, glass bottom boat tours, and research activities by the Hawai`i Institute of Marine Biology, from which scientists have studied the bay for over 50 years. The mix of activities from these various users sometimes impinge upon one another and optimizing usage among them has been the subject of the Kane`ohe Bay Task Force and the Kane`ohe Bay Decision Support System, a project to determine trade-offs among uses that might improve management of the bay's activities (http://www.coralreefnetwork.com/network/hcri.htm).

The history of Kane`ohe Bay illustrates a resource that has always been considered of high value, but over the last century has gone from a pristine condition to a highly degraded state, then through a degree of recovery and finally to the present condition, which shows some symptoms of re-decline. The bay has always been highly affected by activities within its watershed and shoreline, as well as those occurring directly within the bay's waters. The present study provides a further dimension of knowledge for Kane`ohe Bay by determining the present and historical condition of the bay in terms of both nonindigenous species and the total biota that has been reported through this period of development and use.

METHODS

A. Literature Search

A variety of sources of information on the environmental conditions and biological communities of Kane`ohe Bay were examined. Literature consulted included published papers in the open scientific literature, taxonomy-based monographs and books, unpublished reports for environmental studies in the harbors, and newspaper and magazine articles that were concerned with the development or environmental and biological communities of the harbors. Resources that were consulted in this search were the libraries of Bishop Museum, the University of Hawai`i, Manoa and Hawai`i Institute of Marine Biology and AECOS Inc. An annotated bibliography of the assembled literature is presented in Appendix A.

B. Bishop Museum Collections

Bishop Museum collections databases for algae, invertebrates, malacology and ichthyology were reviewed for all marine or estuarine organisms indicated to have been collected in Kane`ohe Bay. The retrieved data were assembled into a combined database containing taxa identity, taxonomic authority, collection location and date, collector and collectors notes, when available. This information is included with the general listing of all taxa for the study developed from all sources and presented in Appendix B.

C. Field Surveys

Samples were collected from 24 sites inside and one outside of Kane`ohe Bay (Figure 1) using methods previously employed on nonindigenous species surveys in Hawai`i, Midway and Johnston Atoll. Sampling station locations, dates, coordinates and depths are summarized in Table 1.

The sampling and analysis process for benthic organisms is summarized in Figure 2. Collections and observations were made by two experienced investigators sampling as large a variety of habitats as possible at each station while snorkeling or using Scuba. One diver recorded the sight-identifiable invertebrate macrofauna and macroalgae and all fishes swimming in the area, The second diver sampled organisms from hard surfaces and sediments from the intertidal zone to the base of the reef. Macro-organisms were collected by hand, hard surfaces were scraped with a chisel, and several liters of coral rubble were placed in an 80 µm mesh bag and transported back to the laboratory for later inspection and removal of cryptic organisms. When present at a survey site, whole macroalgae plants were collected and preserved in 70% ethanol, and epiphytic organisms were later rinsed from the algae and preserved in ethanol for future processing. Collected organisms and substratum, which ranged 4-8 liters in total volume for each station, were inspected on site, and selected hydroids, anemones and tunicates were removed and relaxed in a solution of Epsom salts and seawater before preserving in 5% formalin. The remaining

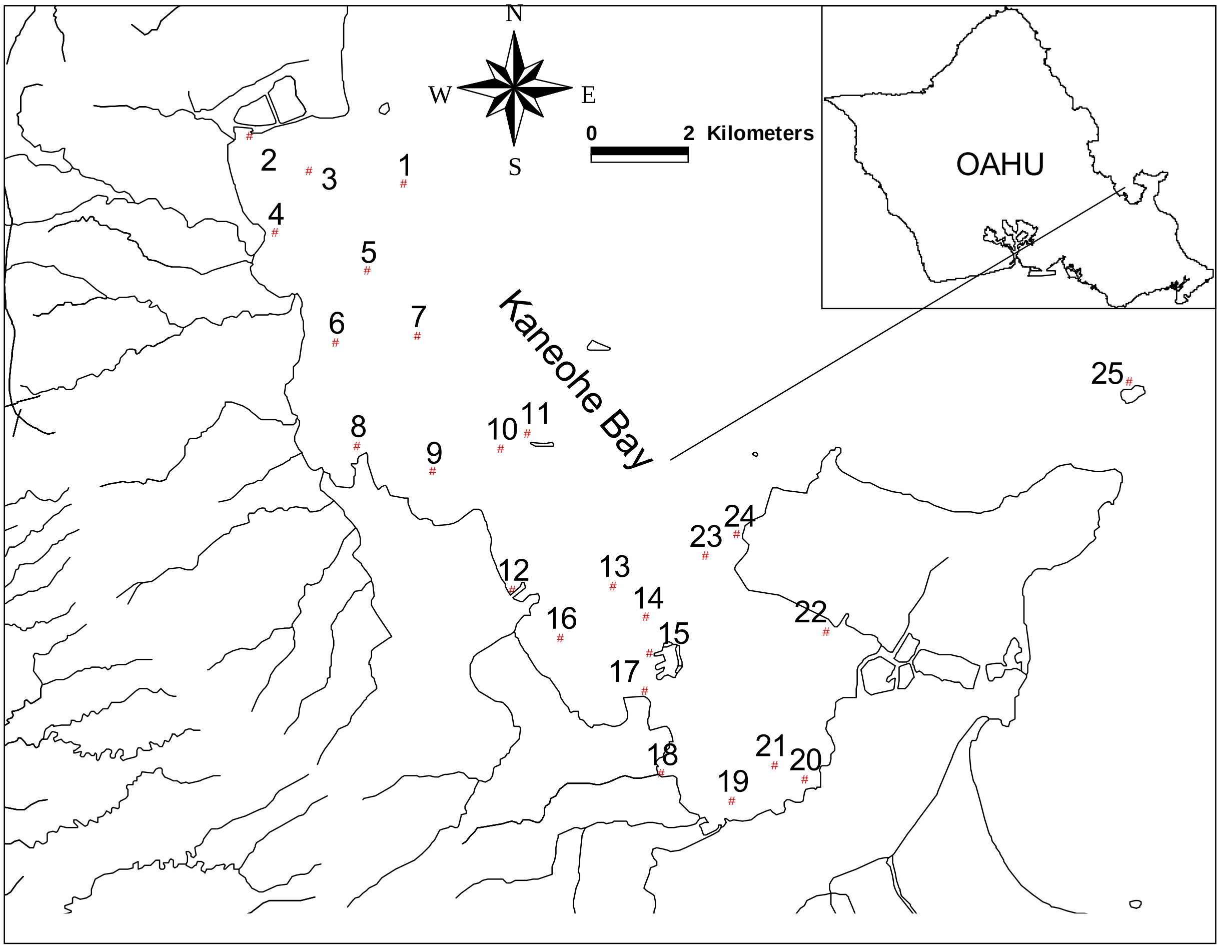

Figure 1. Locations of sampling stations in Kane`ohe Bay

organisms were preserved on site in 70% alcohol before returning the samples to the laboratory for sorting and identification of organisms.

Sediment dwelling organisms were sampled at each station, using cores 12.5 cm diameter by15 cm deep pushed into the substratum. Sediments obtained were sieved through a 0.5 mm mesh screen and the organisms retained by the screen which were placed in plastic bags and preserved in 70% alcohol until processing.

Specimens collected were sorted and identified to species or the lowest practicable taxa, using dissecting or compound microscope magnification when necessary. Identifications were made using descriptions available in Reef and Shore Fauna of Hawai`i Sections 1 to 4 (published), 5 and 6 (unpublished), various taxonomic references, and voucher specimens in the Bishop Museum collections. Specimens from various groups were sent to taxonomic experts for final identifications (see Acknowledgments).

Table 1. Dates and locations of Kane`ohe Bay Stations

		Fouling		Sediment		Latitude N			Longitude W		
Station	Location	Sampling Date	Depth (m)	Sampling Date	Depth (m)	Deg	Min	Sec	Deg	Min	Sec
1	North Channel	17-Nov-99	1-6	28-Jan-00	6.5	21	30	22.1	157	50	57.1
2	Moli'i Fish Pond	2-Nov-99	0.5-1	28-Jan-00	0.5	21	30	22.1	157	44	50.6
3	Hakipu'u Reef	17-Nov-99	1.5-5	28-Jan-00	3.0	21	30	3.9	157	50	25.7
4	Waikane Pier	2-Nov-99	0-3	28-Jan-00	3.0	21	29	33.6	157	50	43.9
5	Waiahole Reef	17-Nov-99	0.5-7	28-Jan-00	7.5	21	29	14.6	157	49	55.8
6	Pu'u Kauai	19-Nov-99	0.5-6	28-Jan-00	6.5	21	28	39.7	157	50	12.2
7	"Pristine" Reef	19-Nov-99	1-8	28-Jan-00	10.0	21	28	42.3	157	49	29.5
8	Kahaluu Landing	12-Nov-99	0-2.5	28-Jan-00	3.5	21	27	48.7	157	50	1.5
9	Channel Marker “12”	19-Nov-99	0.5-15	28-Jan-00	10.0	21	27	35.2	157	49	22.1
10	Wass Reef	12-Nov-99	1-9	28-Jan-00	10.0	21	27	46.7	157	48	45.9
11	Sand Bar	12-Nov-99	0-0.5	28-Jan-00	0.1	21	27	53.9	157	48	31.6
12	Heeia Kea Pier	19-Jan-00	0-7	19-Jan-00	0.5	21	26	36.8	157	48	40.3
13	Checker Reef	10-Nov-99	0.5-10	28-Jan-00	10.0	21	26	38.5	157	47	47.2
14	Floating City	10-Nov-99	0-4	28-Jan-00	4.0	21	26	23.1	157	47	30.2
15	Coconut Island Reef	8-Nov-99	0.5-7	28-Jan-00	6.0	21	26	38.5	157	47	47.2
16	Heeia Fish Pond Reef	10-Nov-99	0.5-2	28-Jan-00	4.0	21	26	13.2	157	48	15.2
17	HIMB Pier	8-Nov-99	0-4	28-Jan-00	7.0	21	25	46.9	157	47	31.1
18	Makani Kai Marina	8-Nov-99	0-3	28-Jan-00	3.0	21	25	6.0	157	47	23
19	Kokokahi Pier	5-Nov-99	0-4	28-Jan-00	5.0	21	24	52.2	157	46	45.6
20	Kane`ohe Yacht Club Dock	5-Nov-99	0-6.5	28-Jan-00	5.0	21	25	2.6	157	46	7.2
21	Kane`ohe Yacht Club Reef	5-Nov-99	1-5	28-Jan-00	6.0	21	25	9.5	157	46	22.6
22	MCB Fuel Dock	25-Jan-00	0.5-8	28-Jan-00	8.0	21	26	15.3	157	45	55.1
23	Rubble Island	26-Jan-00	0-2	26-Jan-00	0.2	21	26	53.0	157	46	58.9
24	SAG Harbor	25-Jan-00	0.5-8	25-Jan-00	10.0	21	27	3.3	157	46	42
25	Moku Manu Island	26-Jan-00	1.5-18	no sample	-	21	28	00	157	50	00

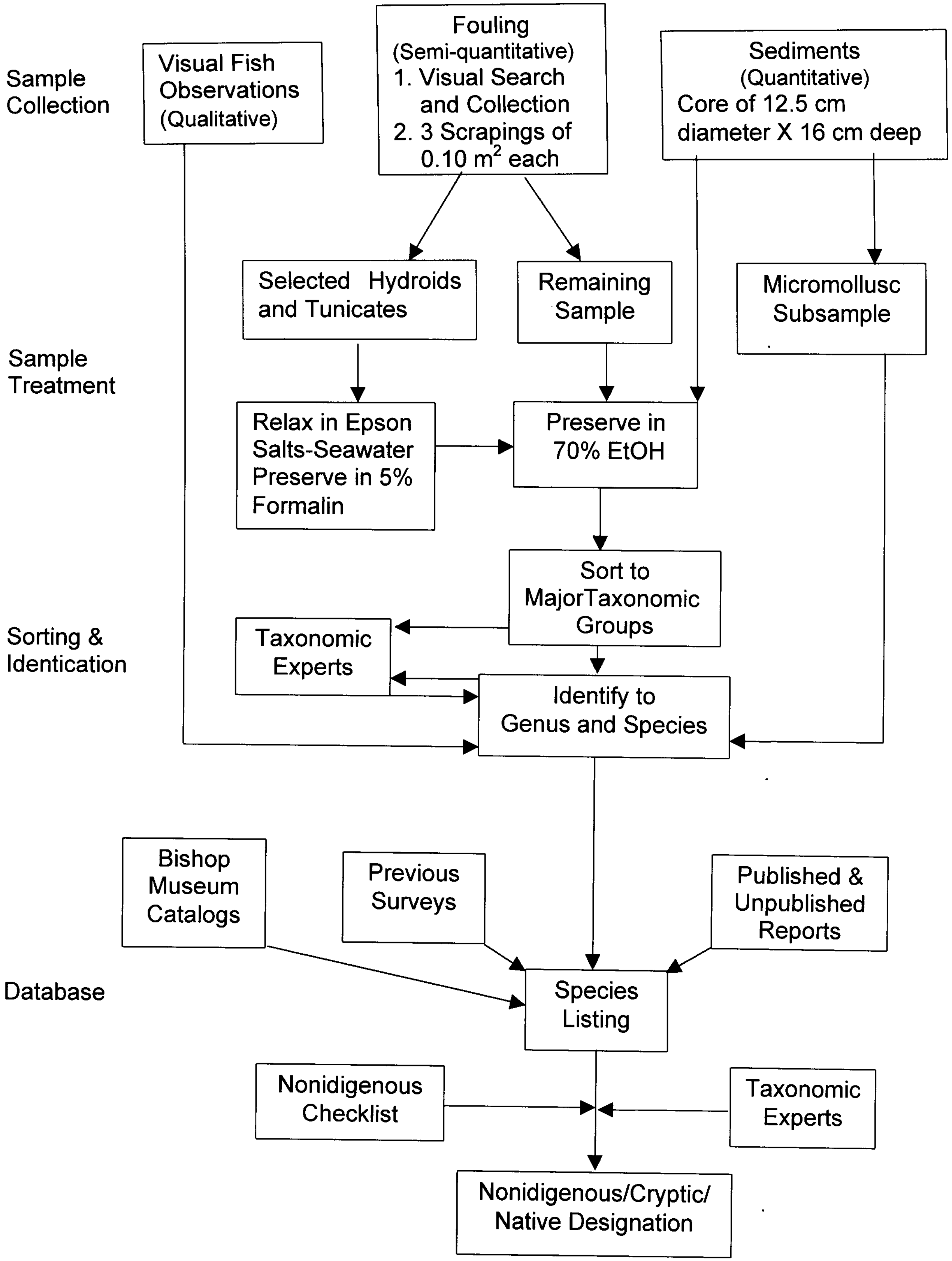

Figure 2. Methodology summary.

D. Data Analysis

All organisms identified from the field study were entered on an Access database relational with the databases for previous literature reports and museum collections of organisms from Pearl Harbor. The combined information was used to track the occurrence of species chronologically from the time of the first available reports for Kane`ohe Bay.

The Sorenson's Index of percent similarity, based on presence-absence of species at station pairs, was used to measure the degree of association among stations. By this index, the more species two stations share relative to their total species complements, the greater their ecological similarity. Based on a matrix of Sorensen Index values, cluster analysis was used to arrange stations into groups or clusters. Intercluster distances were calculated using an unweighted pair group average method. In this analysis, similar stations will form clusters distinct from other stations. These clusters are arranged in a hierarchical, treelike structure called a dendrogram. Calculation of the similarity measures and cluster analysis were performed using the Multi-Variate Statistical Package, ver. 3.1 (Kovach 1993).

RESULTS

A. Station Locations and Descriptions

Station 1 (Latitude 21°30’ 22.1’, Longitude 157°50’ 57.1”)
North Channel. Wave turbulent area along south side of near Bouy Marker 5, on reef area with abundant live coral extending from 4 to 6 m depth next to dredged channel. Outside of live coral area bottom is consolidated limestone with coarse sand and moderate *Halimeda* algae cover.

Station 2 (Latitude 21°30’ 22.1’, Longitude 157°44 50.6”)
Moli`i Fish Pond. Inshore area at north end of bay with abundant *Rhizophora mangle* mangroves growing along a muddy shore. Subtidal substratum is coarse sand with surface coating of fine, terrigenous silt. Abundant biotope on bottom is mats of nonindigenous *Acanthophora spicifera* and *Gracilaria salicornia* macroalgae mixed with nonindigenous *Hypnea musciformis, Kappaphycus* spp. and native *Caulerpa taxifolia* and *Dictyota acutiloba*. Burrows, probably of *Alpheus mackayi* and *Callianassa* sp. and nonindigenous *Sabellastarte spectabilis.*

Station 3 (Latitude 21°30’ 3.9’, Longitude 157°50 25.7”)
Hakipu`u Reef flat in 1.5 m depth with abundant *Montipora capitata, Sarcothelia edmondsoni. Porites compressa* and common *Dichtyosphaeria cavernosa* on top of reef. Approaching reef edge, *P. compressa* and *D cavernosa* become more abundant to 5 m depth then bottom is primarily fine sand and silt.

Station 4 (Latitude 21°29’ 33.6’, Longitude 157°50 43.9”)
Waikane Pier. Along wooden pier off leading ca. 200 m from the shoreline to a depth of 3 m. Pier pilings are heavily fouled with the introduced barnacles *Chathamalus proteus,* and *Balanus* spp. at the water surface and introduced *Pennaria disticha, Schizoporella* sp. and *Crassostrea* sp. below, with the wood of the pilings highly penetrated by burrows of introduced *Teredo* sp. shipworms. Bottom substratum is smooth, coarse coral rubble with a fine silt coating and little macrobiota apparent.

Station 5 (Latitude 21°29’ 14.6’, Longitude 157°49’ 55.8”)
Waihole Reef, near Channel Marker 4. Very abundant (75-90% coverage) of *Porites compressa, Montipora capitata, and Sarcothelia edmondsoni* and moderate cover of *Dichtyosphaeria cavernosa* in 1.5 m depth. Other corals present to moderately abundant were *Pocillopora damicornis, Pocillopora meandrina, Porites lobata* and *Montipora patula*. High *Porites compressa coverage* extends down to ca. 7 m.

Station 6 (Latitude 21°28’ 39.7’, Longitude 157°50’ 12.2”)
Pu`u Kauai Reef. Fringing reef extending from flat at 0.5 m to silty bottom at reef base in 6 m depth. Reef flat has coral cover of ca. 25%, mostly of *Porites compressa* and *Pocillopora damicornis*, with common *Hydrolithon* sp. calcareous and green *Dictyosphaeria cavernosa* algae

and occasional *Gracilaria salicornia* algae and *Montipora capitata* coral. Sand channels are interspersed on reef top with medium to coarse sand. Reef slopes gently with high coverage of mostly *P. compressa* to start of fine silt sediment covered bottom at ca 6 m.

Station 7 (Latitude 21°28' 42.3', Longitude 157°49' 29.5")
"Pristine Reef". Large patch reef in central north bay adjacent to barrier reef composed of numerous microatolls of *Porites compressa* and *Montipora capitata*, and rare *Pocillopora damicornis, Pocillopora eydouxi Porites lobata* and *Dictyosphaeria cavernosa* in 3-4 m depth among coarse sand and coral rubble. Coral off reef channel extends to 8 m depth at base of reef slope and silty bottom. Coral cover on reef is virtually 100% (ca. 80% *P. compressa* and 20% *Montipora capitata*). *D. cavernosa* is more abundant (30%) on the lee side of reef at 4-6 m.

Station 8 (Latitude 21°27' 48.7', Longitude 157°50' 1.5")
Kahalu`u Pier. Old pier pilings extending 200 m out from Wailau Point supporting fouling community. Fine silt bottom in 2.5 in 2.5 m depth shows abundant burrow openings and growth of seagrass *Halophila hawaiana*.

Station 9 (Latitude 21°27' 35.2', Longitude 157°49' 22.1")
Channel Marker "12" Reef. Reef with abundant coral c over to 15 m depth and intermittent coral colonies to 15 m. *Dictyosphaeria cavernosa* abundant on reef slope to 5 m depth.

Station 10 (Latitude 21°27' 46.7', Longitude 157°48' 45.9")
Wass Reef. Small patch reef near the Kane`ohe Bay sand bar that was the site of two comprehensive fish surveys utilizing total recovery by fish poisoning. Reef is steeply sloped from 1 to 9 m depth, with heavy *Dictyosphaeria cavernosa* coverage from the reef top to 7 m.

Station 11 (Latitude 21°27' 53.9', Longitude 157°48' 31.6")
Sand Bar. Subtidal zone of ca. 0.5 m depth sampled about 200 m from lagoon side . Substratum is coarse sand and fine coral rubble with abundant seagrass *Halophila hawaiana* interspersed with dense patches of introduced algae *Acanthophora spicifera*. and less abundant *Gracilaria salicornia, Dictyosphaeria cavernosa, Hypnea musciformis, Caulerpa taxifolia, Padina* sp. *Halimeda* sp. with clumps of broken coral *Montipora capitata*.

Station 12 (Latitude 21°26' 36.8', Longitude 157°48' 40.3")
Heeia Pier Northwest side of main Heeia and shallow reef flat separated from dock by a narrow channel. Pier pilings only sparsely covered with fouling organisms, mostly filamentous algae. Channel has abundant algae on bottom, and reef flat covered with coarse sand and heavy growths of algae, especially introduced *Gracilaria salicornia, Hypnea musciformis, Kappaphycus spp.* and *Acanthophora spicifer*a.

Station 13 (Latitude 21°26' 36.5', Longitude 157°48' 47.2")
Checker Reef. Sandy reef with sparse coral and abundant algae on flat at 0.5 m with coral increasing to 3 m depth, then decreasing down to reef base at 10 m. The macroalgae

Dictyosphaeria cavernosa and introduced *Kappaphycus* spp. are very abundant down slope from edge of reef. *Fungia scutaria* mushroom coral is more common here than at any other site in Kane`ohe Bay

Station 14 (Latitude 21°26' 23.1', Longitude 157°47' 30.2")
"Floating City". Iron structure originally deployed as prototype for "floating city" now sits on a sand bottom with upper sections protruding from water and now is the largest manmade object in the open waters of Kane`ohe Bay. Abundant fouling community includes the only specimens of the introduced octocoral *Carijoa riisei* that was found on the survey except at the dock area at Sag harbor (Station 24). The algae *Dictyosphaeria cavernosa* is very abundant around the base of the structure, and the seagrass *Halophila hawaiana* is common in the sand east of the reef at 3.5 m depth.

Station 15 (Latitude 21°26' 38.5', Longitude 157°47' 47.2")
Coconut Island Reef. West of the dolphin pens of Hawai`i Institute of Marine Biology (HIMB). This area is directly leeward of where nonindigenous algae *Kappaphycus* spp. were introduced in 1974-76 and escaped from their pens when they broke up in a storm. Consequently, this is the area mostly heavily impacted by these algae, which have formed an essential monoculture covering large areas of the reef flat, edge and slope with dense growths with algal thalli many cm thick. The introduced algae *Acanthophora spicifera* is also very abundant along with *Gracilaria salicornia, Dictyosphaeria cavernosa* and *Dictyosphaeria versluysii*. The habitat space is so completely monopolized by that few benthic invertebrates were noted.

Station 16 (Latitude 21°26' 13.2', Longitude 157°47' 15.2")
Heeia Pond. Reef outside of one of the largest former fishponds in the bay which is now filled with sediment and lined with introduce *Rhizophora mangle* mangrove trees along much of its perimeter. Large sandy area on reef top in 0.5 m has intermittent coral rubble and abundant introduced *Gracilaria salicornia* algae. Reef slopes down to 2 m with moderate cover of *Porites compressa* and *Montipora capitata* coral and abundant *Dictyosphaeria cavernosa* and common *Kappaphycus* spp.

Station 17 (Latitude 21°25' 46.9', Longitude 157°47' 31.1")
HIMB Pier. Floating docks and cement pilings for the HIMB ferry, built approximately 200 m out onto the edge of the fringing reef. Reef flat at 0.5-1 m depth is fine to coarse sand and coral rubble on limestone substratum, with abundant *Gracilaria salicornia, Acanthophora spicifera* and *Padina* sp. algae. Pier pilings and floating docks support abundant fouling invertebrates, and corals *Porites compressa, Montipora capitata* and *Pocillopora damicornis* common to abundant from reef edge to down slope.

Station 18 (Latitude 21°25' 6.0', Longitude 157°47' 23")
Makani Kai Marina. Floating docks and concrete wall in a harbor area nearly isolated from the bay by a rock jetty and much affected by fresh water runoff. Introduced oysters *Crassostrea sp.* fanworm *Sabellastarte spectabilis* and bryozoan *Amathia distans* are abundant along the

concrete wall along with numerous other fouling invertebrates. Few organisms seen on the floating docks. Only a single coral species *Montipora capitata* was seen, which occurred at 2 m depth well below freshwater lens.

Station 19 (Latitude 21°24' 52.2', Longitude 157°47' 45.6")
Kokokahi Pier. Abandoned wooden pier and nearby reef adjacent to Kokokahi YWCA at head of Kane`ohe Bay. Area is heavily silted due to runoff from two stream discharges and is closest station to site of the sewage outfall that formerly discharged in the south basin. Despite these impacts *Montipora capitata* and *Porites compressa* corals are present in low abundance, mixed with abundant *Gracilaria salicornia* and *Dictyosphaeria cavernosa* in medium grained sand and coral rubble. Fouling invertebrates are abundant on the wooden pier pilings and iron posts of signs marking the reef edge.

Station 20 (Latitude 21°25' 2.6', Longitude 157°46' 7.2")
Kane`ohe Yacht Club Floating Docks. Pier pilings and floating docks of the Kane`ohe Yacht Club, the largest marina in the bay, and which provides berthing to both motor and sailing craft. Channel entrance to the yacht club and its basins have been dredged from the reef to ca. 7 m depth. Docks and piling support an abundant fouling community, dominated by introduced species, especially the bryozoans *Schizoporella* sp. and *Amathia distans*, the fanworm *Sabellastarte spectabilis* and a few *Porites compressa* and *Pocillopora damicornis* corals occurred.

Station 21 (Latitude 21°25' 9.5', Longitude 157°46' 22.6")
Yacht Club Reef. Located between entrance channels to the Yacht Club, the reef extends form 0.5 m down to 10 m depth. Reef top is mixed *Montipora capitata* and *Porites compress* in coarse sand with abundant algae *Gracilaria salicornia, Dictyosphaeria cavernosa* and *Kappaphycus* spp. Introduced invertebrates, e. g. the fanworm *Sabellastarte spectabilis,* the ascidian *Phallusia nigra* and the hydroid *Pennaria disticha* were abundant, along with the synaptid holothurian *Opheodesoma spectabilis.*

Station 22 (Latitude 21°26' 15.3', Longitude 157°45' 55.1")
Marine Corps Base Fuel Dock. Concrete and iron pilings of the main docking area for the Marine Base on southwest side of Mokapu Peninsula and east of Base runways. Surfaces are densely fouled with heavy coverage of sponges and other invertebrates to the bottom in 9 m depth. Sponges are sediment coated and bottom is silty fine sediment with numerous borrow openings.

Station 23 (Latitude 21°26' 53.0', Longitude 157°46' 58.9")
Rubble Island. Small, unnamed island west of Mokapu Peninsula formed of dead coral rubble nearly awash at high tide. Shoreline is fringed by *Montipora capitata, Porites compress* and *Dictyosphaeria cavernosa,* with sparse *Pocillopora damicornis* and other invertebrates in low abundance. *Halophila hawaiana* seagrass occurs in sandy area off the island and its surrounding shallow reef.

Station 24 (Latitude 21°27' 3.3', Longitude 157°46' 42.0")
Sag Harbor. Docking area from small to medium size boats along northwest shore of Mokapu Peninsula with channel and basin dredged to 8 m depth. Area is within 100 m of a reef with high coral coverage, including the species *Porites compressa, Montipora capitata Pocillopora damicornis* and *Fungia scutaria*, and an abundance of a variety of reef fishes. The pier pilings support numerous introduced fouling organisms including the heaviest coverage of the nonindigenous octocoral *Carijoa riisei* that has been observed in any harbor area or embayment in Hawai`i.

Station 25 (Latitude 21°28' 0', Longitude 157°50' 0")
Moku Manu Island. Located approximately 9 km outside of Kane`ohe Bay, this site was the only one in truly oceanic conditions with clear water. Despite being on the leeward and landward west side of the island, the site is highly affected by both wind generated waves and ocean swells. The substratum is scoured rock with steep walls down to a flat sandy bottom at 18 m depth, and the areas sampled was at a large cave-like depression that extends back into the main island about 20 m. The steep walls and large boulders support abundant corals and associated epifauna, and an abundance of a large variety of reef fish, the most observed at any site, and it was the only station where the introduced reef fish *Lutjanus kasmira* was observed.

B. Benthos and Fish Surveys

A total of 787 taxa with 617 named species were observed or collected at the 25 stations on the surveys in 1999-2000 (Appendix C). This compares with a total of 1362 taxa reported for the bay in published and unpublished literature or Bishop Museum collections from 1902 to 1999. Of the 787 taxa determined from the present study over half, or 462 taxa with 315 named species, were new reports for Kane`ohe Bay, and 63 taxa with 35 named species were new reports for Hawai`i.

The distribution of taxa for major phylogenetic groups among the 25 stations is listed in Table 2 and shown graphically for 16 groups in Figure 3. Only a few of these groups showed recognizable patterns. Macroalgae had maximal values of 20 or more taxa at Stations 2, 11, 13, and 24, three of which were in shallow sedimentary environments nearshore at Moli`i Fishpond, on the Sand Bar or on the reef flat at Checker Reef. Sponges had 10 taxa or more at Stations 14 and 15 on or near Coconut Island Reef. Hydrozoans, gastropods and decapods had maximal values at Stations 1 and 25, the most open ocean environments of the stations surveyed. Bryozoans and fishes were maximal at Stations 1 or 7, both coral reef areas in areas of open circulation. Overall, Station 1 ranked first or second for seven of the 16 groups, and Station 25 ranked first or second for five groups, indicating the generally higher species diversity for these coral reef areas with unrestricted circulation.

Table 2. Distribution of total taxa and major taxonomic groups among Kane`ohe Bay Stations, 1999-2000.

	Station																									
Taxa	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**All**
Algae	10	24	10	4	12	14	9	6	6	1	20	17	32	11	5	11	7	0	9	2	8	0	11	20	0	97
Spermatophyta	0	1	0	0	0	0	0	1	0	0	2	0	1	2	0	1	0	0	0	0	0	0	1	0	0	3
Porifera	9	0	1	0	3	2	3	4	4	4	0	5	6	12	16	1	11	9	5	9	4	5	4	7	5	49
Hydrozoa	4	0	1	1	3	1	4	4	0	0	0	2	1	3	3	0	2	0	1	1	1	1	0	4	8	22
Anthozoa	7	0	5	2	9	7	5	3	6	5	1	1	6	6	4	1	3	1	3	3	2	1	3	6	9	19
Sipuncula	3	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	2	0	1	0	2	1	0	4
Polychaeta	26	21	24	10	21	14	24	25	21	25	19	25	29	24	30	27	31	17	21	25	20	27	17	17	22	62
Gastropoda	50	5	18	2	32	3	22	12	19	20	29	32	26	14	27	12	24	4	24	2	11	9	7	2	57	166
Bivalvia	9	2	6	4	16	1	6	8	4	5	1	5	4	7	4	5	12	5	6	2	5	3	3	1	10	51
Polyplacophora	1	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	2
Pycnogonida	3	0	2	1	1	2	4	1	0	0	0	1	1	1	3	1	1	0	0	0	0	0	0	0	4	10
Cirripedia	0	1	1	1	0	0	0	2	0	0	0	1	0	2	0	1	2	3	1	1	0	2	0	1	1	5
Peracarida	22	11	10	8	15	10	17	10	13	12	5	18	18	13	11	15	10	5	5	5	11	9	8	18	16	52
Decapoda	22	9	9	9	15	8	12	13	9	15	10	12	17	10	10	16	9	3	8	8	7	5	10	5	23	69
Ectoprocta	9	1	7	5	6	8	11	5	6	2	0	2	5	5	3	2	5	5	2	3	1	5	0	2	11	39
Brachiopoda	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Echinodermata	8	2	2	2	2	3	2	2	5	6	4	4	7	6	4	4	6	1	2	0	6	2	3	0	5	26
Ascidiacea	10	2	1	2	7	6	6	7	9	9	3	7	7	10	4	4	12	5	6	5	7	6	7	5	3	22
Fishes	33	0	19	2	16	20	27	5	14	23	0	3	14	16	11	10	10	5	4	3	9	5	8	22	21	88
Total	224	79	115	54	159	100	152	109	116	127	95	135	175	142	135	110	146	64	99	69	93	80	84	111	194	787

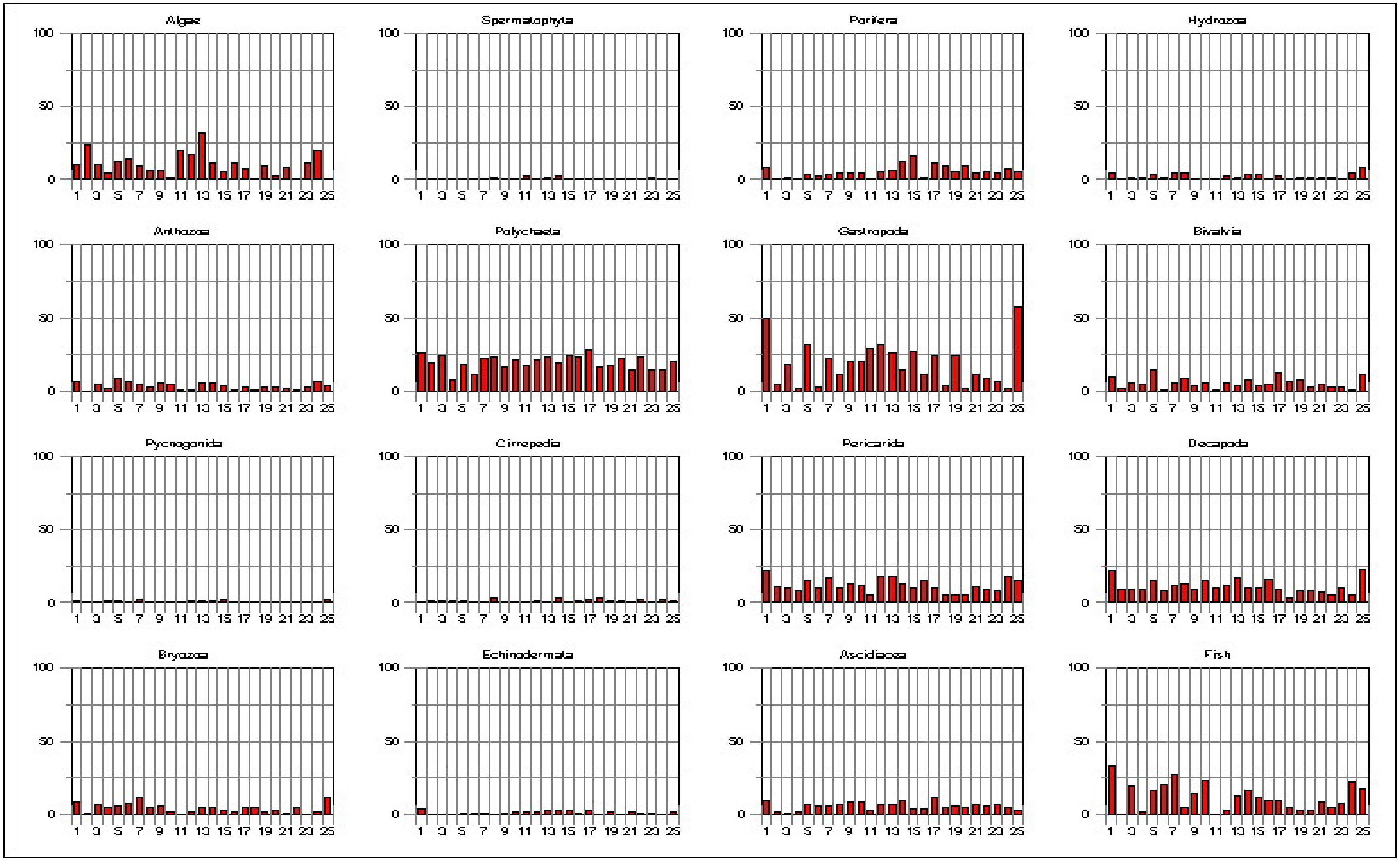

Figure 3. Distributions of major taxonomic groups observed or collected in Kane`ohe Bay, 1999-2000

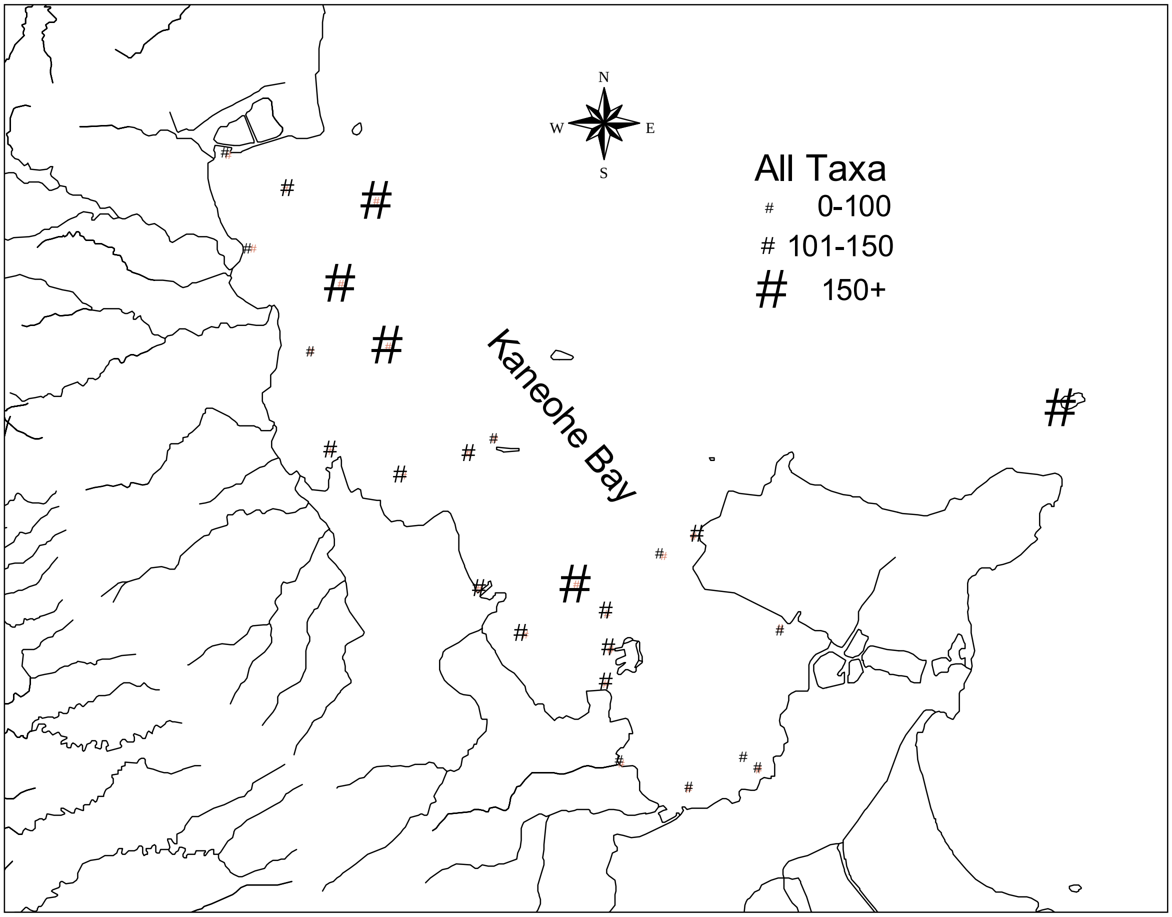

Figure 4. Pattern of total taxa observed or collected at Kane`ohe Bay stations

Figure 4 summarizes distributions of all taxa collected or observed at the 25 stations. Highest numbers of total taxa occurred at offshore stations along the Kane`ohe Bay main channel or at Moku Manu Island where corals and coral reef conditions were most dominant, i.e. at Station 1 (North Channel), Station 3 (Hakipu`u Reef), Station 5 (Waihole Reef), Station 7 ("Pristine" Reef), Station 13 (Checker Reef) and Station 25 (Moku Manu) . All but one of these reef-coral dominated areas showed 150 or more taxa and were in areas with high circulation (Bathen 1968) or, at Checker Reef (Station 13), was inshore of Sampan Channel which receives good water movement and has historically shown the highest coral coverage in this section of the bay (Maragos 1972; Maragos 1973). The lowest numbers of total taxa occurred in nearshore areas throughout the bay such as at Station 2 (Moli'i Fish Pond), Station 6 (Pu'u Kauai), Station 19 (Kokokahi Pier), Station 21 (Yacht Club Reef) Station 23 (Rubble Island), at the Sand Bar (Station 11) or in harbor and pier areas (Station 4, Waikane; Station 12, Heeia Kea; Station 18, Makani Kai; Station 19, Kokokahi; Station 22 Marine Corp Base Fuel Dock) where total taxa ranged 50-94 per station.

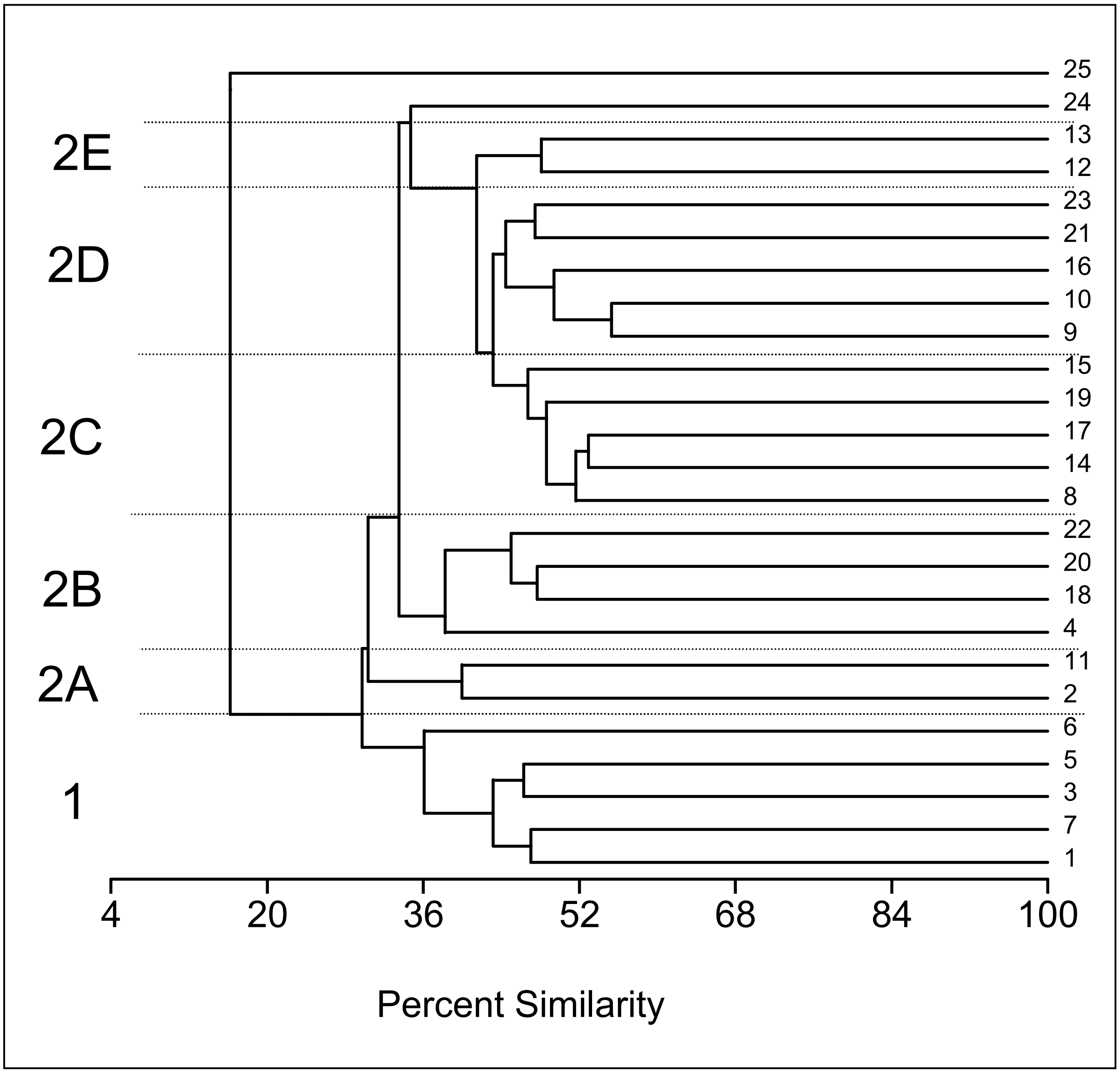

Figure 5. Dendrograph of similarity analysis for Kane`ohe Bay and Moku Manu Stations based on all taxa of algae, invertebrates and fishes.

Sorensen similarity coefficients using presence-absence of all identified taxa were calculated to determine patterns of community similarity among the 25 stations, and a dendrograph summarizing these results is shown in Figure 5. Two major clusters are indicated, with the second cluster subdivided into 5 subclusters, which correspond with locations and environmental characteristics of the stations. Cluster 1 contains six stations that are all coral-dominated reefs along or near the main channel in the north or midbay. Cluster 2A is comprised of two stations with sedimentary substratum near the Moli`i Fishpond and at the sandbar. Cluster 2B contains three stations from pier and harbor areas in the south bay at Makani Kai Marina, the Yacht Club and the Marine Corps Base Fuel Dock, and the small Waikane Pier in the north bay. Cluster 2C is comprised of sites in reef areas at the Floating City site, Coconut Island and HIMB and

Kokokahi Piers in the south bay and the Kahaluu Landing site near the shore in mid-bay. Cluster 2D is a mixture of sites from the south and midbay, most of them nearshore reef areas but including the offshore small Wass Reef seaward of the channel in midbay. Cluster 2E contains Heiea Kea Pier and Checker reef near the main channel in midbay. Two stations, Sag Harbor on the north side of Mokapu Peninsula and Moku Manu Island outside of the bay did not cluster with any other set of stations. These patterns suggest that the primary differentiating factor among the sites was the degree to which they were characterized by coral-reef conditions and associated organisms. Additional Sorensen Similarity analyses (not shown) ran for combined invertebrates, fishes, and the major taxonomic groups of sponges, polychaetes, gastropods, bivalves, pericarids, decapods, bryozoan and ascidians showed similar grouping among stations that were dominated by reef corals and representative of coral reef conditions.

C. Comparison with Previous Studies – All Taxa

Table 3 lists the numbers of taxa and named species by major taxonomic groups for all previous reports including Bishop Museum collections and for the present survey. Although the present study found more taxa and named species that any single previous study in the bay, a total of only 332 total taxa (1362 previous-1032 not found) were found in common between the present study and all previous reports, resulting in an average finding of only 24% of previous reported taxa. For groups with 20 or more taxa in the present study, the finding rates were quite consistent, ranging from a low of 19% for the bryozoans (Ectoprocta) to a high of 32% of the sponges (Porifera). By comparison, the proportions of the taxa and species found in the present study that had previously been reported averaged 41% for total taxa and 49% for named species. These percentages range wider by group, with around 75% of the fishes down to 22% of the total taxa of sponges in the present study having been previously reported or present in Bishop Museum collections.

D. Nonindigenous and Cryptogenic Species

Species previously reported in Hawai`i were categorized as native, nonindigenous or cryptogenic (i. e. of uncertain origin but with indications of being introduced) according to the designations in (Carlton and Eldredge In prep.) and (Coles et al. 1997; Coles et al. 1999a). For brevity, the term NIS is used hereinafter to refer to combined nonindigenous and cryptogenic species. For species new to Hawai`i, status was assigned using the criteria presented by Chapman (1988) and Chapman and Carlton (1991) and described in Coles et al. (1997; 1999a.) These criteria include new appearances in the region, association with known dispersal mechanisms or other introduced species and disjunct geographic distributions. Taxonomic specialists were also consulted for their input in assessing the status of newly reported species.

Of the 617 named species identified for Kane`ohe Bay in this study, 34 were categorized as cryptogenic and 82 as nonindigenous for a total of 116 NIS, or 19% of the 617 total identified species overall. The NIS species are listed in Appendix D and their distributions by major taxonomic group and by station are summarized in Table 4. The groups Porifera, Hydrozoa,

Table 3. Numbers of taxa and named species in major taxonomic groups previously reported and by the present study.

Taxa	All Taxa Prev. Stud.	Named Taxa Prev. Stud.	All Taxa Pres. Study	Named Taxa Pres. Study	Previous Taxa Not Found	New Taxa Pres. Study	Named New Taxa Present Study	% Prev. Taxa Found	% Present Taxa Prev. Reported	% Pres. Named Prev. Reported
Algae	81	80	97	83	49	64	50	39.5	34.0	39.8
Spermatophyta	3	3	3	3	0	0	0	100.0	100.0	100.0
Ciliophora	7	7	0	0	7	0	0	0.0		
Porifera	34	31	49	16	23	38	6	32.4	22.4	62.5
Ctenophora	4	4	0	0	4	0	0	0.0		
Cnidaria	85	70	41	36	66	22	18	22.4	46.3	50.0
Aschelminthes	2	1	0	0	2	0	0	0.0		
Platyhelminthes	16	15	0	0	15	0	0	6.3		
Polychaeta	117	106	62	38	90	35	20	23.1	43.5	47.4
Oligochaeta	2	2	0	0	2	0	0	0.0		
Phoronida	3	3	0	0	3	0	0	0.0		
Sipuncula	1	1	4	4	1	4	4	0.0		
Mollusca	332	298	219	175	253	141	103	23.8	35.6	41.1
Pycnogonida	3	2	10	8	3	10	8	0.0	0.0	0.0
Crustacea	262	245	126	104	203	71	46	22.5	43.7	55.8
Insecta	1	1	0	0	1	0	0	0.0		
Bryozoa	59	47	39	26	48	28	19	18.6	28.2	26.9
Brachiopoda	3	2	1	1	3	1	1	0.0	0.0	0.0
Chaetognatha	2	2	0	0	2	0	0	0.0		
Hemichordata	1	1	0	0	1	0	0	0.0		
Echinodermata	49	48	26	21	35	11	7	28.6	57.7	66.7
Ascidacea	30	25	22	17	23	15	12	23.3	31.8	29.4
Fish	259	248	88	85	192	21	21	25.9	76.1	75.3
Reptilia	2	2	0	0	2	0	0	0.0		
Other	4	2	0	0	4	1	0	0.0		
Total	1362	1246	787	617	1032	462	315	24.2	41.3	48.9

Table 4. Numbers of nonindigenous and cryptogenic species by station.

Taxa	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**All**
Algae	0	5	1	0	1	3	0	3	1	0	3	4	5	4	3	2	2	0	2	0	3	0	0	0	0	6
Spermatophyta	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Porifera	2	0	0	0	0	0	0	4	1	0	0	2	2	4	10	1	6	5	2	6	2	1	2	2	0	15
Hydrozoa	3	0	1	1	2	1	4	3	0	0	0	1	0	3	3	0	2	0	1	1	1	1	0	3	6	17
Anthozoa	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2
Polychaeta	1	1	0	0	0	1	2	4	3	2	2	3	3	4	5	3	4	5	5	4	2	6	1	2	1	9
Gastropoda	4	2	1	2	2	0	2	4	2	2	1	3	1	2	4	1	3	2	4	0	1	2	0	1	2	7
Bivalvia	1	0	0	0	0	0	0	1	0	0	0	0	0	3	1	0	2	3	0	1	1	0	0	0	1	8
Pycnogonida	0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	7
Cirripedia	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	1	2	1	1	0	1	0	1	0	3
Peracarida	2	2	0	3	0	2	2	3	0	1	0	3	2	2	1	2	1	1	1	1	1	2	0	4	2	10
Decapoda	2	2	1	3	1	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	2	1	1	3
Bryozoa	2	0	1	3	1	2	1	2	0	1	0	2	2	1	2	1	3	3	2	2	0	4	0	1	1	8
Ascidiacea	7	1	1	2	5	5	5	6	7	7	2	6	6	8	3	4	9	5	6	5	6	6	6	5	2	15
Fish	0	0	1	2	1	2	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	5
All	24	15	9	18	15	17	19	34	16	15	9	28	24	36	35	18	35	29	26	23	18	26	11	21	18	116

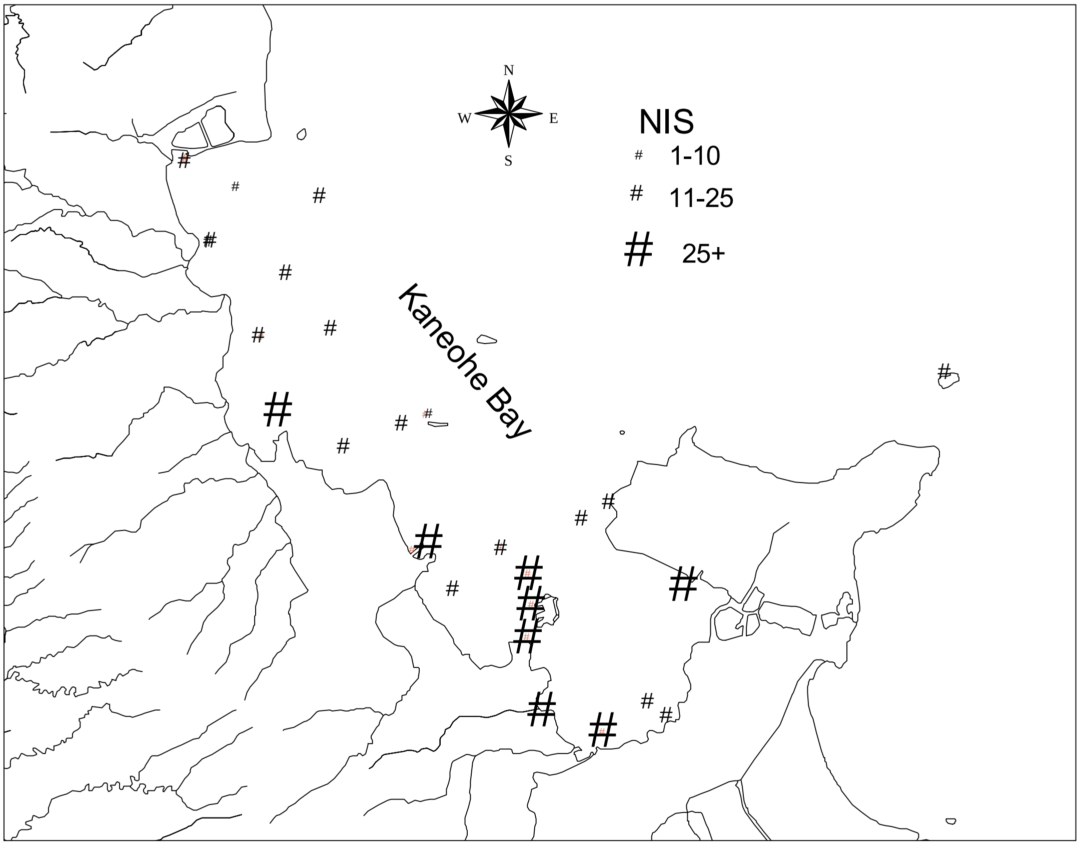

Figure 6. Pattern of nonindigenous or cryptogenic species observed or collected at Kane`ohe Bay stations.

Mollusca and Ascidiacea each had 15 to 16 nonindigenous or cryptogenic species, followed by Peracarida with 10 species, Bryozoa and Polychaeta with 9 and Pycnogonida with 7. The most widely occurring NIS groups were the Decapoda, with 1-3 species at all 25 stations, and the Ascidiacea, with 1 to 8 species present at all 25 locations. However, in terms of abundance, the macroalgae, with only six species, was by far the most dominant group. At most of the 15 stations where introduced macroalgae occurred, they usually occupied large areas on reef flats or lagoon reef slopes, and their impact and importance as invasive species is far greater than suggested by the numbers of species present or their distribution within the bay.

The pattern of nonindigenous and cryptogenic species occurrence among the 25 stations is summarized in Figure 6, and in many respects it contrasts the pattern for total taxa (Figure 4). Maximal numbers of >25 NIS occurred nearshore in harbor and pier areas at Stations 8 (Kahalu`u Landing), 12 (Heeia Pier), 17 (HIMB Pier), 18 (Makani Kai Marina), 19 (Kokokahi Pier) and 22 (MCB Fuel Dock) or at Stations 14 and 15 at the “Floating City” and Coconut Island Reef sites. The highest number of 38 species occurred at Station 14 (“Floating City”), where the variety of habitats provided by the abandoned iron structure and the adjacent reef supported at least one NIS from every major group, including the second highest numbers of NIS ascidians of any station. The second highest in total NIS with 37 were Stations 8 (Kahalu`u Landing) and 17 (HIMB Pier), each at a nearshore area with artificial surfaces provided by docks and piers. Station 8 had a relatively high number of NIS in all groups and Station 17 had the most NIS ascidians and second highest number of NIS sponges. Next in NIS abundance was Station 15 (Coconut Island Reef) with 35 total taxa and the most NIS sponges. Fewest NIS occurred at Stations 3 (Hakipu`u Reef) and 11 (Sandbar), both with 9 NIS. Both stations are remote from the shore and piers or harbors, but with the contrasting environments of a well-developed coral patch reef (Station 3) versus a sedimentary sand flat mostly supporting macroalgae (Station 11). Other sites which had fewer than 20 total NIS were all on coral reefs (Stations 5, 6, 7 9, 10, 21 and 25) or the muddy sand flat near Moli'i Fishpond (Station 2) with a similar environment as the sandbar.

Sorensen similarity coefficients were also calculated for NIS using presence-absence data of the 116 taxa at the 25 stations, and results are summarized in the dendrograph in Figure 7. The 25 stations fall into four major clusters and one outlier that can be related to their environmental characteristics and numbers of NIS. Cluster 1 contains all the offshore coral reef stations in the north bay, at Moku Manu and the station at Waikane Pier, each with totals of 9 to 23 NIS. Cluster 2 contains the two sedimentary environments at Station 2 and 11 and two reefs, one nearshore in the north bay and another at Checker Reef in midbay. Cluster 3 is the largest and contains all of the harbor and pier stations in the south and midbay, and the reefs near Coconut Island and the Yacht Club in the south bay. This cluster also contains all stations where more than 25 NIS occurred. Cluster 4 contains one nearshore and one offshore reef in the north bay and two nearshore south bay reefs, all of which had 17 or less NIS, among the fewest found. Station 24 at MCB Sag Harbor did not cluster with any other station.

E. Invasive species.

Of 116 NIS determined for Kane`ohe Bay, we consider only 12 to be invasive, i.e. uncontrolled by environmental conditions or biotic factors and attaining such abundance that they monopolize or alter habitats and displace native populations and/or cause environmental or economic damage in Hawaiian waters. These invasive species are five macroalgae (*Acanthophora spicifera, Gracilaria salicornia, Hypnea musciformis , Kappaphycus alvarezii and Kappaphycus striatum*) four invertebrates (*Carijoa riisei, Mycale armata Chthamalus proteus, Gonodactylaceus falcatus*) and three fishes (*Cephalopholis argus, Oreochromis mossambicus* and *Lutjanus kasmira*). Distribution of these species among the 25 stations is shown in Figures 8 and 9. Invasive macroalgae were by far the most apparent nonindigenous species and imposed the greatest and most pervasive negative impact on the bay's marine communities. All five species occurred throughout the bay and usually were the dominant benthic organisms on reefs where they occurred. With exception of *H. musciformis*, which was found at Stations 3 and 5 near the main channel, all invasive algae occurred on nearshore reefs throughout the bay or at stations on or near Coconut Island Reef. Abundances of all five invasive algae were generally greatest in the vicinity of Coconut Island. *Acanthophora spicifera* occurred on reef flats at nine sites from the furthest north to the furthest south station in the bay, where it was a frequent but not abundant

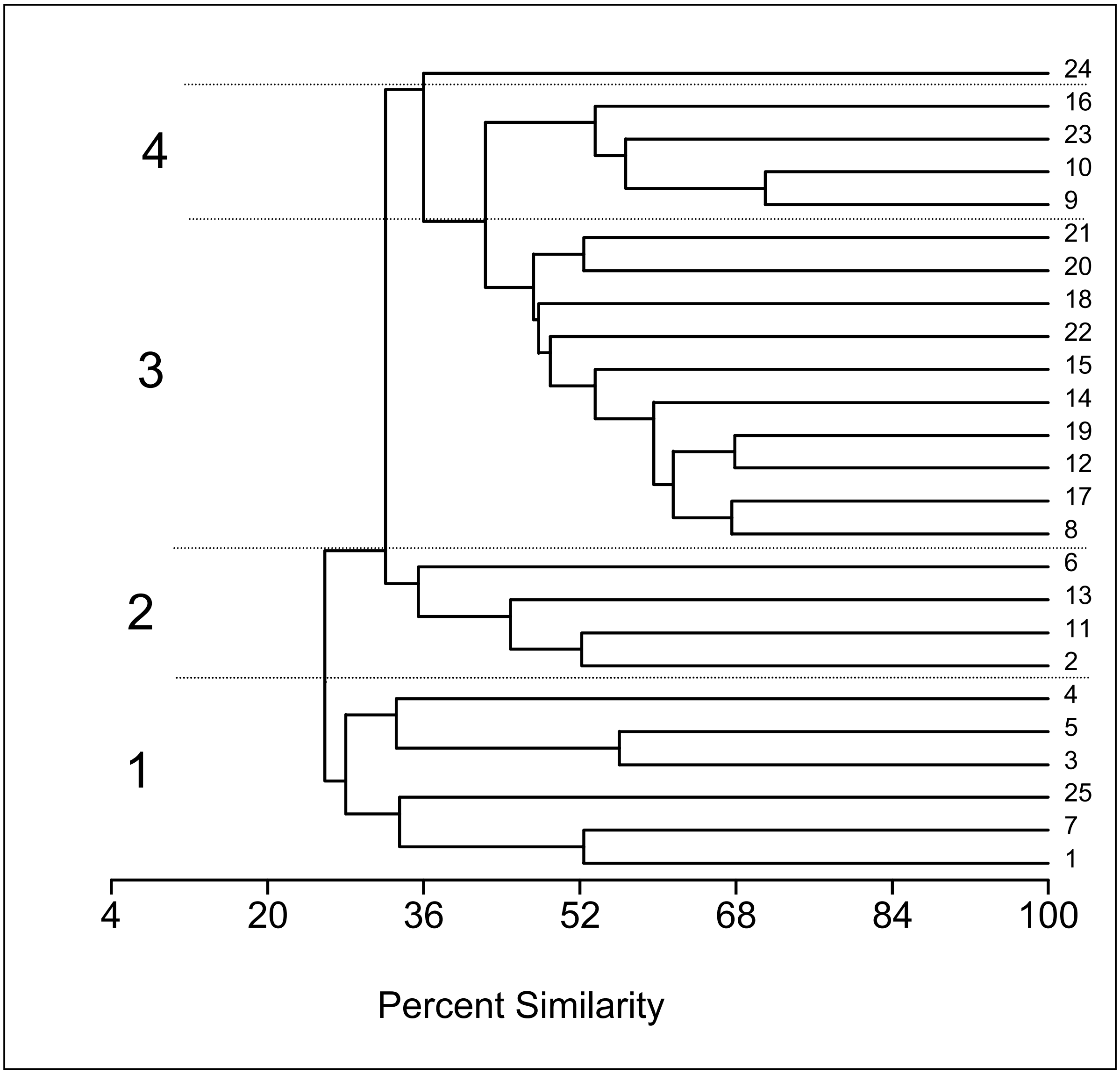

Figure 7. Dendrograph of similarity analysis for nonindigenous species distributions among stations.

segment of the algal community. *Gracilaria salicornia* was the most widely spread invasive algae, occurring at 12 of the stations, and it was also the most abundant and invasive species on the reef flats, where it forms large, thick mats that entirely cover large sections of reef. *Kappaphycus alvarezii* and *K. striatum* were usually very prominent at the 10 stations where they occurred. Greatest abundances were leeward of the area on Coconut Island reef where this species originally was introduced, but they now occur throughout the bay, forming large growths of branching algal thalli often resembling bushes or trees that may overgrow and kill live corals on reef margins and reef slopes.

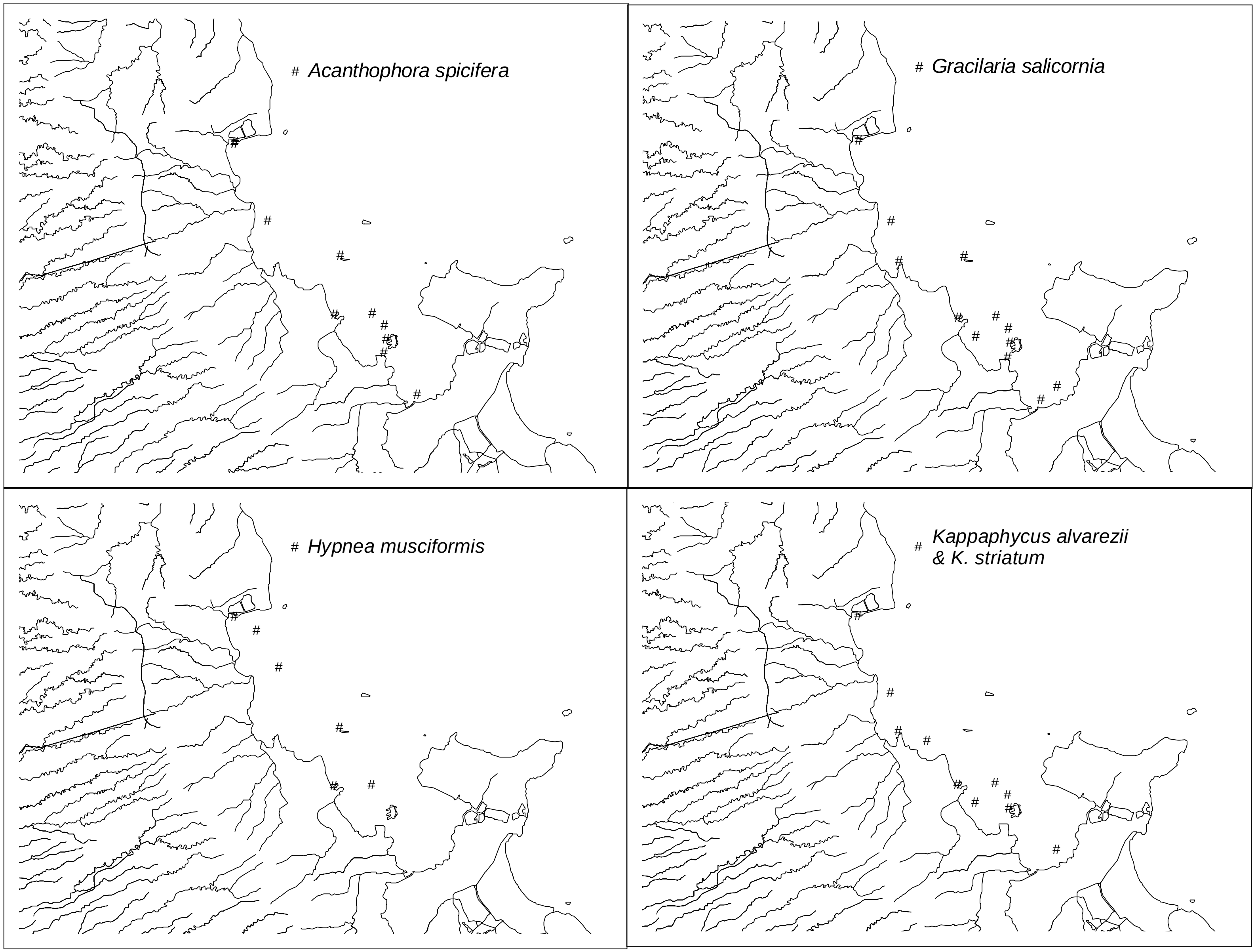

Figure 8. Occurrences of *Acanthophora spicifera, Gracilaria salicornis, Hypnea musciformis* , *Kappaphycus alvarezii and Kappaphycus striatum* at survey stations.

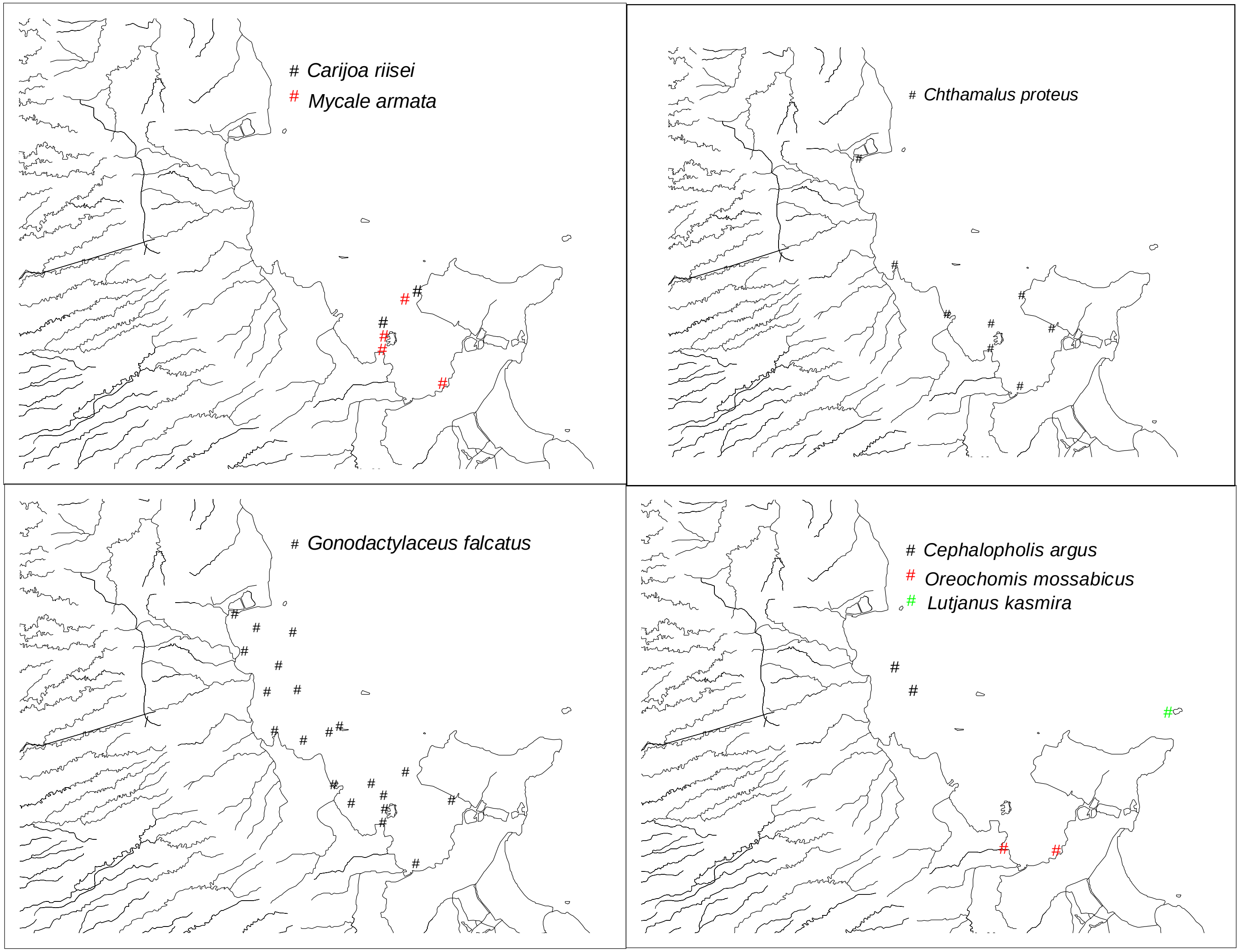

Figure 9. Occurrences of *Carijoa riisei, Mycale armata Chthamalus proteus, Gonodatylaceus falcatus, Cephalopholos argus, Oreochromis mossambicus* and *Lutjanus kasmira* at survey stations.

Of the four invasive invertebrate species found in Kane`ohe Bay, the stomatopod *Gonodactylaceus falcatus* is by far the most widely distributed, occurring at 21 sites in all sectors of the bay. This species was first reported in Waikiki in 1963 and in Kane`ohe Bay prior to 1968 Kinzie (1968) and has apparently been highly successful in establishing itself in all habitats where coral rubble occurs. Within the bay it was absent only at the harbor stations at Makani Kai, the Yacht Club and Sag Harbor and from one reef near the Yacht Club. The intertidal barnacle *Chthamalus proteus* also occurred throughout the bay at any station where an emergent hard surface was available for its settlement. Two invertebrates that are highly invasive in some areas elsewhere in Hawai`i did not occur at many sites on this survey. The introduced octocoral *Carijoa riisei* was found at only Station 14 on the iron structure at the "Floating City" and at Station 24 on cement pilings at Sag Harbor. At the former site only a single colony was found, but at Sag Harbor this species virtually covered many dock pilings with long, thick growths of the octocoral, excluding any other benthic organism. The sponge *Mycale armata* occurred at only four sites: Coconut Island Reef (Station 15), HIMB Dock (Station 17), Kane`ohe Yacht Club Floating Dock (Station 20) and Rubble Island (Station 23).

The three invasive fish species found in this study were not abundant or frequent. The introduced grouper *Cephalopholis argus* (Roi) occurred only on two reef stations in the north bay, and the tilapia *Oreochromis mossambicus* occurred only at the Makani Kai and Yacht Club harbor stations in the south bay. The introduced reef fish considered most invasive and widespread in Hawai`i, *Lutjanus kasmira* (Ta`ape), occurred only at the Moku Manu station outside of the bay, where only a few individuals were seen.

F. Comparison with Previous Kane`ohe Bay NIS Reports

Table 5 shows the NIS species which are new reports for Kane`ohe Bay and for Hawai`i. Of the total 116 NIS found in Kane`ohe Bay 53 (26 cryptogenic, 27 nonindigenous) were new reports for the bay, but of these only 16 (14%) were not previously reported for Hawai`i. All of the new Hawai`i reports are considered cryptogenic, and of these nine are hydroids and five are pycnogonids. Of the 53 new Kane`ohe Bay reports, 17 were previously found in surveys in Pearl Harbor in 1996, and 25 found in Honolulu Harbor or other O`ahu harbors in 1997-98 along with most of the remaining NIS. Therefore, most of the NIS determined for this study were already established in Hawaiian waters and the remaining 16 cryptogenic species still remain to be confirmed as nonindigenous introductions.

Figures 10 and 11 show the cumulative new NIS reports for Kane`ohe Bay in the last century and by decade, and Figure 12 compares new NIS reports by decade with the total new reports of all species. Including the present study, total new NIS reports for the bay reached over 200 by 2000, and Figure 10 suggests a relatively steady increase in NIS through the century. However, the decadal presentation of the same data in Figure 11 shows that steady accumulation of NIS in the bay has not been the case, but rather that new NIS reports have been highly periodic with new reports of >25 NIS occurring only in the 1930s, 1960s, 1970s and with the present study.

Table 5. Cryptogenic and Nonindigenous species newly reported for Kane`ohe Bay and Hawai`i, and previous reports in Pear Harbor and O`ahu south and west shore harbors

			New Reports		Previously Reported	
Taxa	Species	Status	Kane`ohe Bay	Hawai`i	Pearl Harbor	O`ahu Harbors
Porifera	*Biemna* sp.	Cryptogenic	1		1	1
Porifera	*Chalinidae* n. sp. (purple)	Cryptogenic	1			
Porifera	*Dysidea arenaria*	Cryptogenic	1		1	1
Porifera	*Heteropia glomerosa*	Cryptogenic	1		1	1
Porifera	*Toxiclona* sp.	Cryptogenic	1		1	1
Hydrozoa	*Antennella secundaria*	Cryptogenic	1	1		
Hydrozoa	*Anthohebella parasitica*	Cryptogenic	1	1		
Hydrozoa	*Clytia latitheca*	Cryptogenic	1	1		
Hydrozoa	*Dynamena crisioides*	Cryptogenic	1			1
Hydrozoa	*Plumularia floridana*	Cryptogenic	1	1		
Hydrozoa	*Plumularia strictocarpa*	Cryptogenic	1	1		
Hydrozoa	*Sertularella areyi*	Cryptogenic	1	1		
Hydrozoa	*Sertularella tongensis*	Cryptogenic	1	1		
Hydrozoa	*Sertularia ligulata*	Cryptogenic	1	1		
Hydrozoa	*Tridentata humpferi*	Cryptogenic	1	1		
Hydrozoa	*Ventromma halecioides*	Cryptogenic	1			
Anthozoa	*Sarcothelia* n. sp.	Cryptogenic	1	1		
Mollusca	*Chama fibula*	Cryptogenic	1		1	1
Mollusca	*Hipponix australis*	Cryptogenic	1			
Pycnogonida	*Anoplodactylus californicus*	Cryptogenic	1	1		
Pycnogonida	*Anoplodactylus digitatus*	Cryptogenic	1	1		
Pycnogonida	*Anoplodactylus marshallensis*	Cryptogenic	1	1		
Pycnogonida	*Callipallene* sp.	Cryptogenic	1	1		
Pycnogonid	*Tanystylum rehderi*	Cryptogenic	1			
Peracarida	*Stenothoe valida*	Cryptogenic	1		1	1
Ectoprocta	*Caberia boryi*	Cryptogenic	1	1		
	Total	Cryptogenic	26	16	6	7
Porifera	*Dysidea* sp.	Nonindigenous	1		1	1
Porifera	*Gelliodes fibrosa*	Nonindigenous	1		1	1
Porifera	*Mycale armata*	Nonindigenous	1		1	1
Porifera	*Sigmadocia caerulea*	Nonindigenous	1		1	1
Hydrozoa	*Obelia bidentata*	Nonindigenous	1			
Anthozoa	*Carijoa riisei*	Nonindigenous	1		1	1
Polychaeta	*Eulalia sanguinea*	Nonindigenous	1		1	
Polychaeta	*Hydroides brachyacantha*	Nonindigenous	1			1
Mollusca	*Chama macerophylla*	Nonindigenous	1		1	
Mollusca	*Diodora ruppelli*	Nonindigenous	1		1	1
Pycnogonida	*Anoplodactylus arescus*	Nonindigenous	1			1
Pycnogonida	*Pigrogromitus timsanus*	Nonindigenous	1		1	1
Peracarida	*Leucothoe micronesiae*	Nonindigenous	1			
Peracarida	*Mesanthura* sp.	Nonindigenous	1		1	
Peracarida	*Paraleucothoe flindersi*	Nonindigenous	1			1
Ectoprocta	*Bugula robusta*	Nonindigenous	1			1
Ectoprocta	*Caulibugula dendrograpta*	Nonindigenous	1			1
Ascidiacea	*Ascidia* sp. A	Nonindigenous	1			1
Ascidiacea	*Ascidia* sp. B	Nonindigenous	1		1	1
Ascidiacea	*Corella minuta*	Nonindigenous	1			1
Ascidiacea	*Didemnum perlucidum*	Nonindigenous	1			
Ascidiacea	*Eusynstyela hartmeyeri*	Nonindigenous	1			
Ascidiacea	*Herdmania* sp.	Nonindigenous	1			
Ascidiacea	*Polyandrocarpa sagamiensis*	Nonindigenous	1			1
Ascidiacea	*Polyandrocarpa zooritensis*	Nonindigenous	1			1
Osteichthys	*Centropyge flavissimus*	Nonindigenous	1			1
Osteichthys	*Cephalopholis argus*	Nonindigenous	1			
	Total	Nonindigenous	27	0	11	18
	Total	NIS	53	16	17	25

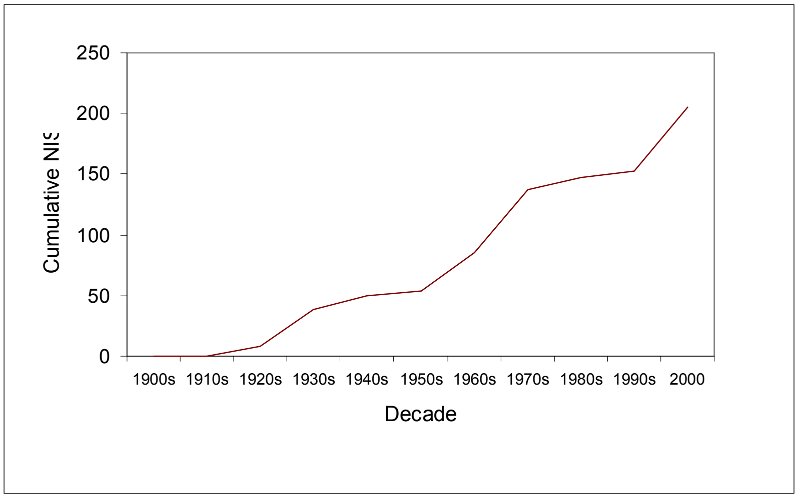

Figure 10. Cumulative numbers of total NIS reported for Kane`ohe Bay 1902-2000

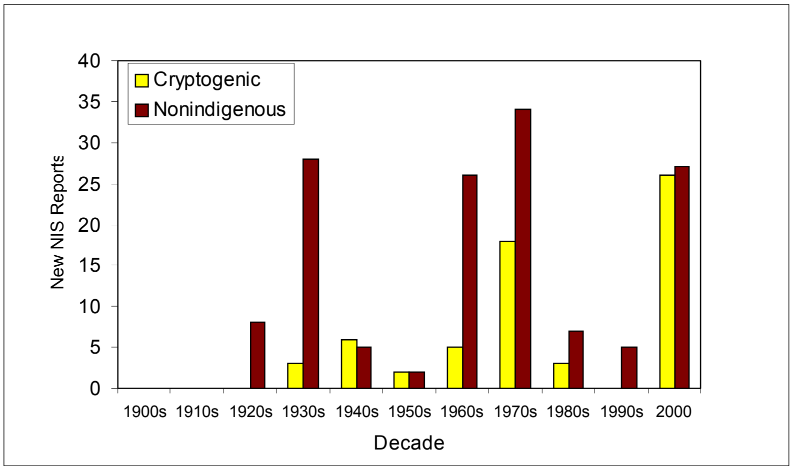

Figure 11. Numbers of first reports of nonindigenous and cryptogenic species for Kane`ohe Bay by decade

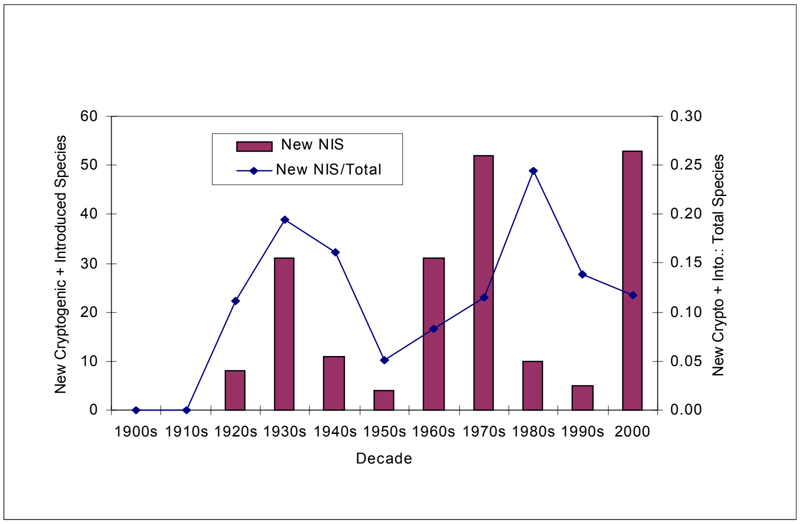

Figure 12. Comparison of first NIS reports to total first species reports for Kane`ohe Bay by decade

This suggests that new NIS reports have been highly effort related and maximal when sampling activities in the bay were high. This hypothesis is supported in Figure 12, which compares the total new NIS reports for the bay (bars) by decade with a ratio (line) of these to the total new reports for all species during the same periods. This ratio is high compared to new NIS only for the 1930s when 31 new NIS were reported, about 60% of the number for the 1970s (52) or the present study (53), but the ratio of NIS to total new species for the 1930s was nearly double the 1970 and present study. Given that the relatively high ratio for the 1930s reflects a truly high incidence of new NIS, this may be due to the 1930s having had the first relatively high sampling activity in the bay which could have collected NIS that had been present for a long time.

G. Chronology of Introductions to Hawai`i and Origin of NIS of Present Study

Appendix E provides detailed information on the nonindigenous status, first Hawai`i report date and location and estimated origin of the NIS found in the present study. Of the 116 total NIS, first reports occurred in Kane`ohe Bay for 52 (45%) of the total, followed by 30 (26%) first reports that occurred in Pearl Harbor. These two areas alone therefore account for about 70% of the first report locations for the 116 NIS found in the present study. The chronology of these NIS first report in Hawai`i is shown by decade in Figure 13. Over half (57) of the 116 total NIS were first reported in the last 30 years, with most of those that are designated nonindigenous first found in 1970s and 1990s, and most of those designated cryptogenic first detected in the present study. Interestingly, none of the NIS of the present study was first reported in Hawai`i in the 1980s, the only decade for which this was the case.

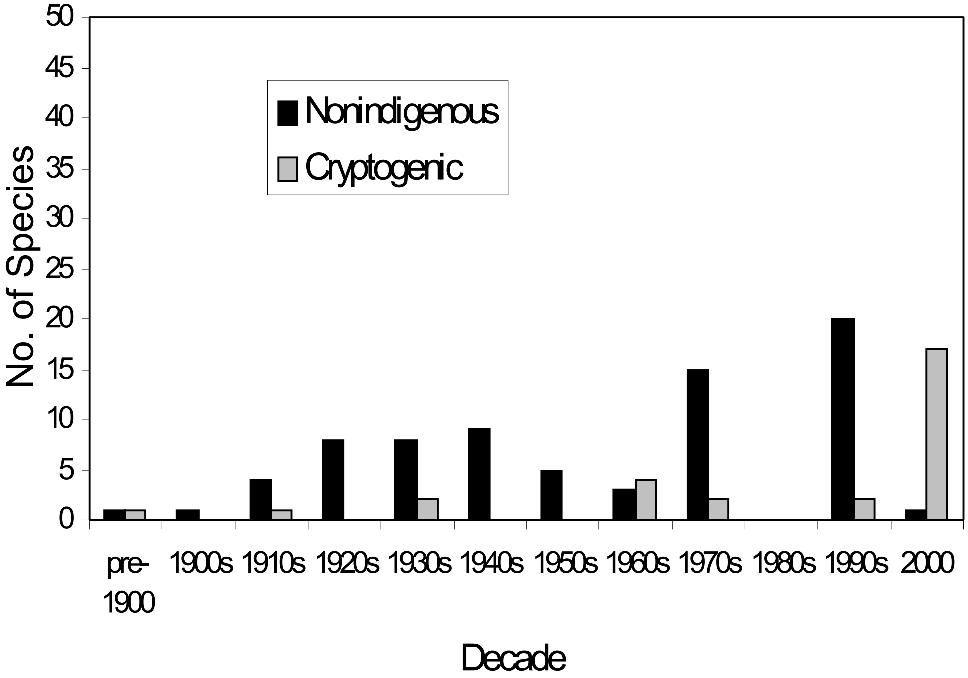

Figure 13. Chronology of first appearance in Hawai`i of NIS found in present study

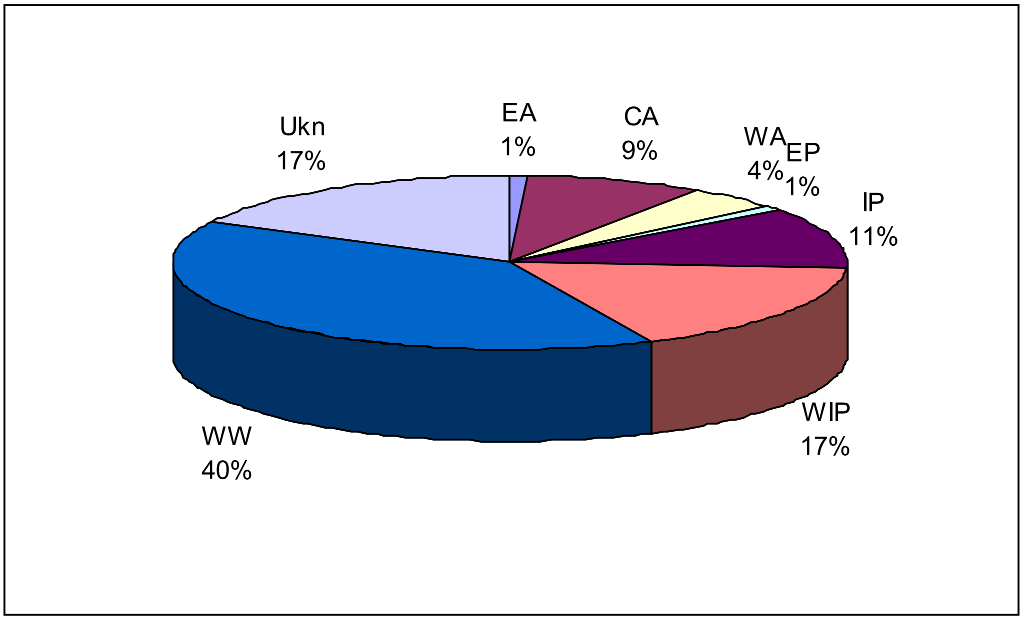

Figure 14. Reported origins or ranges of nonindigenous and cryptogenic species found in present study.

Figure 14 shows the estimated origin of the NIS for which information is available for their source area or geographic distribution. Sixty-six (57%) are from unknown source areas or have a worldwide cosmopolitan distribution. Of the remaining 50 species, most are from the western Indo-Pacific (17%) or the central Indo-Pacific (11%) and only a minor fraction (1%) are from the eastern Pacific. The rest come mostly from the Caribbean (11%) and the western Atlantic (4%), with only 1% from the eastern Atlantic.

DISCUSSION

Kane`ohe Bay is the most extensively and longest studied marine system in Hawai`i, with over 850 published and unpublished references relating to marine organisms and the Kane`ohe Bay environment (Appendix A) listing over 1360 algae, invertebrates and fishes (Appendix B). The present study has been the most intensive single program that has been conducted in Kane`ohe Bay and has produced by far the largest number of total taxa (787) and named species (617), with 59% to 51% of these, respectively, new reports for Kane`ohe Bay. By comparison, only five previous individual studies have listed more than 100 taxa (Taylor 1975; Brock 1976; Grovhoug 1976; Henderson et al. 1976; Lewis 1980), and the greatest number are from a laboratory study of mollusk prosobranch larvae sampled from the bay weekly over a 2 1/2 year period (Taylor 1975).

Despite the large number of taxa reported and new reports for Kane`ohe Bay from the present study, only 24% of the total taxa previously listed for the bay were found. This finding rate is in part due to some invertebrate groups (Ciliophora, Foraminifera, Nematoda, Phoronida) and plankton not being sampled or analyzed by the methods of the present study or identifications not yet having been received from taxonomists for some others (Actiniaria, Copepoda, Tanaidacea, Capreliidae, Pontoniidae). Also many of the previous reports were one time only occurrences such as for the Taylor (1975) study of mollusk prosobranch larvae, or are of indeterminate validity without voucher specimens available for verification. Nonetheless the results suggest that further sampling in the bay would yield considerably more taxa and species.

Including the present study, a total of 204 species designated nonindigenous (141) or cryptogenic (63) have been historically reported in Kane`ohe Bay, of which 116 (57%) were found in the present study and 53 (26%) were new reports for the bay. However, most of these new reports for the bay have been previously reported elsewhere in Hawai`i, and all 16 species from the present study which are new to Hawai`i are designated cryptogenic and subject to revision. This is similar to results for the two previous studies of introduced species in O`ahu's Harbors where 22 new NIS were found for Pearl Harbor (Coles et al. 1997) and 15 new NIS for O`ahu's south and west shore commercial and public harbors (Coles et al. 1999b).

The results of this study may be compared to the comprehensive analysis of nonindigenous species in San Francisco Bay (Cohen and Carlton 1995; Cohen and Carlton 1998) in which 234 nonindigenous marine and brackish water species were considered to have become established in the bay from 1851 to 1995. For their total data set 55% of the total nonindigenous species were first reported after 1960, compared to 45% in the previous 110 years. Similar analysis on a data set that excluded about one-third of the reports on the basis of extraordinary collecting effort, specialized taxonomic expertise, unsure report date or chance discovery of localized species produced a similar result of 50% of the first reports occurring after 1960. These results were interpreted to indicate an accelerating invasion rate of nonindigenous species in San Francisco Bay (Cohen and Carlton 1998).

Similar analysis for the present study for the 141 Kane`ohe Bay nonindigenous species that have been collected or observed in since the first report of *Venerupis philippinarum* in 1920 would result in only 42 of these having been first reported prior to 1960 and 99 from 1960 to 2000. However, nine of the post-1960 first reports for the bay were previously recorded elsewhere in Hawai`i, resulting in 51 (36%) of the first reports occurring before 1960, and 90 (64%) of them after 1960. This interpretation of the data would suggest even a greater post-1960 acceleration of species invasions in Kane`ohe Bay than derived for San Francisco Bay.

However, we conclude that these increased reports of nonindigenous species in Kane`ohe Bay are primarily due to increased sampling analysis in the bay that occurred in the 1960s, 1970s and the present study, which resulted in 75% of the 1364 total taxa having been first reported after 1960. The basis of new reports for NIS in Hawai`i is discussed in Coles et al. (1999b) and concluded to be due to three principal factors: 1) actual increases in transport, survival and propagation of introduced species; 2) increased sampling effort from extensive or intensive biotic surveys during a given period; 3) increased attention to taxonomic groups by specialists that results in identifications of organisms that may have been resident for a undetermined time. Given that new reports of both NIS total taxa have coincided with times of increased sampling and taxonomic effort for the present and previous studies throughout the last century (e.g. Figure 12), we interpret the present study's new reports to be due mostly to periodic intensive sampling and species identification rather than an indication of accelerating increases in nonindigenous species with time.

Overall, the results for numbers of nonindigenous and cryptogenic species and their percent component of the total identified species are remarkably similar to the two previous studies in Pearl Harbor and O`ahu's commercial and public harbors. Pearl Harbor was found to have 95 NIS or 23% of the total identified taxa (Coles et al. 1999a), while the five O`ahu harbors combined had 100 NIS or 17% of the total species (Coles et al. 1999b). The 116 NIS determined for the present study is the highest number that have been found in any study in Hawai`i, but comparison with the total of 617 named species results in a NIS component of 18.8%, intermediate between the previous values. This percentage is also remarkably identical to estimates made by one of us (SLC) from obsevations of the NIS and total taxa that could be identified in the field at the time of the surveys, in which 26 NIS were listed among a total of 138 taxa for an NIS component of 18.8%. By contrast, similar studies by the same investigators in coral reef environments at Kaho'olawe Island, Midway and Johnston Atolls and French Frigate shoals have shown NIS component of the total identified biota of 1.5% or less for up to 668 total taxa per study.

The present study is also similar to the Pearl Harbor and O`ahu harbors studies in showing a contrasting pattern of species richness versus NIS occurrence with proximity to open water circulation and reef coral-associated organisms. In both Pearl Harbor and Honolulu Harbor, maximal species richness of >175 taxa occurred at or near entrance channels where circulation with open ocean water was relatively unrestricted and reef corals were abundant compared to stations within the harbors. Sorenson similarity analyses of species presence-absence data for the harbors also indicated clustering associated with proximity to channels and with reef associated biota. In the O`ahu south and west shore harbors, only six NIS were found at the entrance to Honolulu Harbor and only one each at stations near the entrances to Keehi Lagoon and the Barbers Point Deep Draft Harbor. In the present study, total taxa >150 taxa occurred only on Kane`ohe Bay reefs with relatively high and diverse coral coverage along the main channel, at the end of Sampan Channel or offshore at Moku Manu Island. By contrast NIS of >25 occurred only at or near harbors and piers or at the two stations on Coconut Island reefs which have been subject to algal introductions or the construction of the artificial surfaces of the "Floating City". The occurrence of 18 NIS at the Moku Manu Island station, remote from the others in the bay and the most exposed to open ocean circulation, is somewhat inconsistent. However one third of these NIS are hydroids and cryptogenic first reports for Hawai`i that may become re-designated to native status.

Twelve of the 116 NIS are considered invasive in Hawai`i, and Kane`ohe Bay is well known for the degree that introduced and native invasive macroalgae have impacted and monopolizing the benthic habitat on the bay's reefs (Rodgers and Cox 1999, Smith et al. in press). Four of the five invasive algae found did not exist in the bay 30 years ago but are now the dominant benthic organisms by coverage on reef flats throughout much of the bay. Our results suggest that these species have continued to spread throughout the bay in the last decade. Surveys made in 1996 (Rodgers 1997; Rodgers and Cox 1999) did not find *Gracilaria salicornia, Kappaphycus alvarezii* or *K. striatum* to occur north of our Station 6 (Waikane Pier), and Smith et al (in press) state that *Gracilaria salicornia* was not found in the north bay on 1999 surveys. However we found all three species, along with *Acanthophora spicifera* and *Hypnea musciformis* all the way to the north end of the bay at Station 2 (Moli`i Fishpond), and *Kappaphycus* has recently been reported outside of the bay at Ka`a`awa (J. Smith, pers. comm.). This suggests that spreading rates of 250 m yr-1 estimated by Rodgers and Cox (1999) may be underestimates, and that *Kappaphycus* does have mechanisms for dispersal over deep water and out of depressions, contrary to conclusions by Russell (1983) for these species, previously referred to under the genus name *Eucheuma*.

Although Kane`ohe Bay was the site of introduction of *Hypnea musciformis* in 1974 (Russell and Balazs 1994) and was the dominant algae in the vicinity of Station 13 (Checker Reef) in 1977 (Russell 1992), *H. musciformis* was not common on Kane`ohe Bay reefs during surveys in 1999 (Smith et al. in press) when it was found at only on one of fifteen sites in low abundance. We found it to be common at six stations throughout the bay in November 1999 and January 2000, but did not find it on a rapid assessment follow-up survey in April 2002. The abundance of this species may fluctuate substantially with season and water temperature. Water temperatures during the November 1999-Janananuary 2000 surveys were low approaching 20°C while those in April 2002 were unseasonably high, above 25°C. *Acanthophora spicifera* was first reported as an accidental introduction in Hawai`i in 1950 and in Kane`ohe Bay in 1956 (Doty 1961). Once the only introduced algae 30 years ago when it was abundant on nearshore reef flats in the bay (Russell 1992), it still occurs throughout the bay in moderate abundance. It appears to have been out-competed by *Gracilaria salicornia* in the same locations where it was once the most common algae (SLC, pers. obs.) such as on the reef flat along the causeway leading to the HIMB pier (Station 17).

Of the four invasive invertebrates found on our surveys, only the stomatopod *Gonodactylaceus falcatus* occurred widely in the bay, at all 21 stations where coral rubble was sampled. First reported as *Gonodactylus falcatus* in 1954 in dead coral heads from Kane`ohe Bay and Waikiki, by 1963 it was determined to have virtually displaced the native stomatopod *Pseudosquilla ciliata* from the coral head habitat formerly inhabited by this species in Kane`ohe Bay (Kinzie 1968). Although this species has undergone considerable name changes and its status as an introduced species in Hawai`i has been debated (Manning and Reaka 1981; Kinzie 1984; Barber and Erdmann 2000; Ahyong 2001), it has been resolved to be an introduced species to Hawai`i under the revised genus name of *Gonodactylaceus falcatus* (Ahyong 2001; Coles and Eldredge 2002). Our results indicate that displacement of *Pseudosquilla ciliata* has continued to the present in Kane`ohe Bay with only one specimen of *P. ciliata* collected at only two stations, compared with around ten specimens of *G. falcatus* at most of the 21 stations where it occurred.

Chthamalus proteus was also widely distributed in the bay and occurred wherever a hard surface was available in the intertidal for its settlement. The origin of this species is the Caribbean (Southward et al. 1998) and It was first reported for Hawai`i in Kane`ohe Bay in 1995 (Hoover 1998; Southward et al. 1998) and shortly thereafter in Pearl Harbor (Coles et al. 1997; Coles et al. 1999a). It did not occur on O`ahu in 1972-73 at the time of a barnacle survey of by Matsuda (1973) nor in Pearl Harbor from a comprehensive survey of harbor biota conducted in 1971-73 (Evans et al. 1974). In the past 30 years it has become the dominant organism in harbors and embayments in the high intertidal zone throughout Hawai`i where it can totally monopolize habitat space, and it occurs as far west as Midway (DeFelice et al. 1998) and Guam (Southward et al. 1998). Its rapid dissemination, proliferation and success as an introduced species indicates that nonindigenous species introductions continue to occur at an unpredictable rate in Hawai`i and can rapidly invade available ecological niches.

The red sponge *Mycale armata* is considered invasive in Hawai`i (RCD, pers. obs.), and along with other introduced sponges, it forms a virtual sponge reef in the path of the thermal discharge from the Waiau power plant in Pearl Harbor (Coles et al. 1997). In Kane`ohe Bay it is more cryptic and probably occurs more widely than the four stations indicated, where it was sufficiently abundant to have occurred in collected samples. It is frequently observed in the recesses of dead coral rubble or in small areas on the surface of the ref flat.

The introduced octocoral *Carijoa riisei* was first reported (as *Telesto riisei)* in Pearl Harbor in 1972 (Evans et al. 1974; Devaney and Eldredge 1977) and shortly thereafter in Honolulu Harbor (SLC pers. obs.) and a number of other locations around O`ahu by 1979. Although this is its first documented report for Kane`ohe Bay, it has occurred at the Station 14 site for at least five years (D. Gulko, pers. comm.). Although only one small colony still exists at that site, the abundance of *C. riisei* on the Station 24 SAG Harbor pier pilings was the densest coverage of this species that we had observed to that time in all of O`ahu's harbors, the environment most frequently colonized by this species. Interestingly, no *C. riisei* occurred on surfaces in any other of the other Kane`ohe Bay harbors or piers at the Kane`ohe Yacht Club, Makani Kai Marina, the HIMB pier or the Heeia public harbor, suggesting that currents in these areas were insufficient to sustain its growth. Since the time of these surveys, *C. riisei* has been found to be extremely abundant on a sunken ship at 30 m depth off Waikiki and under a bridge covering a channel from the Hawai`i Kai marina, where it covers piling up to the intertidal zone. Although one of the few introduced marine invertebrates that have spread from harbors and embayment to oceanic coral reefs in Hawai`i, *C. riisei* was previously considered a relatively benign introduction with no recognized negative impacts (Coles and Eldredge 2002). However, recent observations and information have elevated its invasive status. It is now known to monopolize benthic surfaces under conditions optimal for its growth from the intertidal zone to as deep as >100 m, where it can overgrow and kill black coral trees that may provide necessary recruits for commercially harvested coral beds in more shallow water (R. Grigg, pers. comm.).

None of the three invasive fishes (*Cephalopholis argus, Lutjanus kasmira Oreochromis mossambicus*) observed in this study were either frequently encountered or abundant in the bay. *C. argus,* and *L. kasmira* are normally more abundant in deeper water offshore *and Oreochromis mossambicus* is usually found a dominant fish in brackish or fresh water. For the other two nonindigenous fishes found, *Lutjanus fulvus* was the most frequent but occurred as only single specimens at five stations, and the Lemon Peel *Centropyge flavissimus* only as individual sightings at two stations. This is the first documented report for *C. flavissimus* in Kane`ohe Bay, but it has been known to occur there for many years (R. Pyle, pers. comm.) and probably was introduced as an aquarium release.

The pattern of estimated origins of the NIS in Kane`ohe Bay is similar to those found for Pearl Harbor and O`ahu's commercial and public harbors (Coles et al. 1997; Coles et al. 1999a; Coles et al. 1999b), an expected result since most of the same species are involved. Over half of the species are of cosmopolitan or unknown origin, but the remainder are dominated by those originating from the western Indo-Pacific (17% Asia to Africa), followed by the general Indo-Pacific (11% South and North Pacific to Asia), and Caribbean (9%). The eastern Atlantic and Eastern Pacific coastal areas accounted for only 1% each of the total 116 NIS. Chapman (1999) has noted a similar pattern in that nearly all nonindigenous species of peracarid crustaceans in estuaries of the North America or Europe are from the western sides of the Pacific or the Atlantic oceans and that few native northeast Pacific species have invaded western ocean estuaries. He attributed this pattern to environmental conditions that allow proliferation of introductions in the mild northeast Pacific maritime climate compared to the harsher conditions to be endured by organisms transported in the opposite direction. By contrast Hewitt (2002) found the greatest proportions of nonindigenous species in Australian ports to be from the northeast Atlantic and third highest from the northeast Pacific, indicating that the majors sources of ship traffic were the primary determinant of the origin of species introductions. In the case of Hawai`i the prevailing pattern is probably primarily due to the dominance of ship traffic to Honolulu by Japanese and other Asian vessels (Carlton et al. 1993), particularly by fishing boats that may carry fouling organisms on seldom cleaned hulls, or from Asian origins of introductions such as aquacultured algae, mollusks and fish. The relatively high contribution to Hawai`i NIS from the Caribbean is remarkable, considering that that those organisms that may come as fouling must endure freshwater exposure while in transport thorough the Panama Canal. However, for organisms such as the barnacle *Chthmalus proteus*, which can enclose itself within its calcareous plates, freshwater exposure has apparently not been a limiting factor.

Findings of studies of nonindigenous marine species in the tropical Pacific have been reviewed by Coles and Eldredge (2002) and these are compared with studies conducted in temperate regions in Table 6. The 82 nonindigenous species of the present study are the highest of any Hawaiian study or for anywhere within the tropics. The Kane`ohe Bay and O`ahu harbors values are about intermediate between the maximum 240 reported for the Mediterranean Sea and numbers ranging down to zero for Australian tropical ports and for coral reef areas in the Hawaiian Islands and Johnston Atoll. Overall, the data suggest a pattern of decreasing occurrence of nonindigenous species with tropical conditions and/or a coral reef environment. Numbers >100 occur only in temperate regions and numbers <20 only for the tropical ports of North Queensland or coral reef communities exposed to open oceanic conditions in Hawai`i or Johnston Atoll. Values for Australia indicate a clear distinction between temperate and tropical regions and ports, with 24 to 80 nonindigenous species reported for states or individual studies south of the Tropic of Capricorn and 0 to 16 occurring within the tropical zone. Nonindigenous species numbers for Guam are higher than for any other tropical areas except Kane`ohe Bay and O`ahu ports, but the Guam studies also found high total taxa values of 682 for the Apra Harbor study and 4,635 for the island wide study. This resulted in nonindigenous component values of only 4% and 0.8% respectively for Guam, indicating that that nonindigenous species comprise a relatively low proportion of the diverse Guam marine fauna, despite the high degree of shipping activity that has occured in Apra harbor.

These results support a previously proposed hypothesis (Coles et al. 1999b; Coles and Eldredge 2002) that tropical areas and coral reef systems are more resistant to nonindigenous species introductions and disruptions of native populations and communities than has been found to occur in temperate regions. Additional support and analysis by Hutchings et al. (2002) concludes that these tropical systems may be less at risk to invasions because of greater species diversity and higher endemism of native biota offering fewer opportunities for successful proliferation of new arrivals than in lower diversity temperate areas. This paradigm has been substantiated by findings within a temperate marine system as well, where increased species richness of sessile organisms significantly decreased invasion success in coastal New England habitats (Stachowicz et al. 1999). Moreover, biodiversity as a barrier to ecological invasion has been confirmed experimentally for terrestrial grassland systems by Kennedy et al. (2002) who found that increased species richness enhanced invasion resistance by increasing crowding and competition for space in localized plant neighborhoods. However, Hewitt (2002) did not find a significant relationship between species richness and decreased invasion success for eight port surveys around Australia, although invasion success was found to decrease significantly with latitude along with a linear but non-significant increase in species richness. However, this inability to significantly relate invasion resistance with species richness may have been due to the scale at which the comparisons were made and comparisons made at a finer level such as used by Stachowicz et al. (1999) or Kennedy et al. (2002) might support the relationship (Hewitt 2002).

Table 6. Numbers of marine nonindigenous species found in various world locations

Location	Nonindigenous Species	Source
Mediterranean Sea	240	Ruiz et al. 1997
San Francisco Bay	234	Cohen and Carlton 1998
Chesapeake Bay	116	Ruiz et al. 1997
Puget Sound	39	Mills et al 1997
Hawai`i		
Pearl Harbor, Hawai`i	69	Coles et al. 1997, 1999a
South and West O`ahu Harbors,	73	Coles et al. 1999b
Kane`ohe Bay	82	Present Study
Kaho`olawe Island	3	Coles et al. 1998
Midway Atoll	4	DeFelice et al 1998
French Frigate Shoals Atoll	2	DeFelice et al 2002
Johnston Atoll	5	Coles et al. 2001
Australia		
Victoria (Australia)	80	Hilliard et al. 1997
New South Wales	43	Hilliard et al. 1997
South Australia.	36	Hilliard et al. 1997
Tasmania	33	Hilliard et al. 1997
Freemantle Port, Western Australia	33	Hewitt 2002
Newcastle Port, New South Wales	25	Hewitt 2002
Eden Port, New South Wales	24	Hewitt 2002
Port Hedland, Western Australia	16	Hewitt 2002
Bunbury Port, Western Australia	12	Hewitt 2002
Mackay Port, N. Queensland	12	Hewitt 2002
Hay Point Port, N. Queensland	10	Hewitt et al. 1998, 2002
Darwin Port, Northern Territories	5	Hewitt 2002
Lucinda Port, N. Queensland,	2	Hoedt et al. 2001
Mourilyan Port, N. Queensland,	2	Hoedt et al. 2000
Abbott Point Port, N. Queensland,	0	Hoedt et al. 2000
Guam		
Apra Harbor	27	Paulay et al. unpublished report
Island wide	40	Paulay et al. in press

CONCLUSIONS AND MANAGEMENT CONSIDERATIONS

A number of factors other than the species richness of the native community influence the resulting success of invading organisms, including introduction frequency, proximity to sites of introduction, environmental characteristics of the source and arrival sites and the makeup of the biotic community at the arrival site, to name a few. All of these factors have undoubtedly acted to produce the mix and distributions of nonindigenous and cryptogenic species that exist in Kane`ohe Bay. Kane`ohe Bay is a virtually unique environment for Hawai`i, showing a large variety of habitats characteristics of both an semi-enclosed estuary and a variety of coral reef environments within its approximate 55 km^2 area, and it has been high influenced by anthropogenic factors during the last century. Not surprisingly, it has the highest number of nonindigenous and cryptogenic species that have been reported anywhere in the state of Hawai`i, historically having had 204 reported NIS, compared to a total of 343 marine and brackish-water NIS estimated to occur for all of Hawai`i (Eldredge and Carlton 2002). It has been a site of introduction for many of the most invasive species, i.e. macroalgae, that have resulted in the greatest disturbances of marine systems both in Kane`ohe Bay and elsewhere in Hawai`i. The distribution of NIS that have been established within the bay follow predictable patterns, with greatest numbers of nonindigenous and cryptogenic species occurring near harbors and piers in areas of overall lower species richness, and fewest NIS in coral reef areas with open circulation and overall high species richness. This replicates patterns previously observed in O`ahu's harbors where maximum species richness and fewest NIS were near harbor mouths and reef corals and coral reef conditions occurred.

Most of the NIS that occur in Kane`ohe Bay are cryptic, few in number and encountered infrequently, and many have been a part of Hawai`i's marine biota for over 50 years and are of little management concern. For established, abundant, invasive species, eradication is problematical. Invasive species such as macroalgae and the octocoral *Carijoa riisei* that have reached high abundance and frequency levels either within or outside of the bay, mechanical removal or poisoning have limited potential except where populations are in early stages of establishment and can be isolated from the surrounding environment. Biotic controls using predators or parasites focused on target invasives may have long-term potential, but virtually nothing is known in this subject for marine invasive species, in Hawai`i or elsewhere. Management efforts should focus in two areas to prevent new introductions and spread of existing invasives. First, the main vectors of introduction, i.e. moment in ships ballast water or as hull fouling, accidental or intentional release of aquaculture organisms or their adventitious biota, and "enhancement" of fisheries by release of imported species should all be strictly controlled or curtailed. Because Hawai`i is a net importer of goods and fuel, ballast water carried to Hawai`i is minor compared to other U. S. ports (Godwin and Eldredge 2001) and probably not a major source of NIS at present. However, hull fouling, especially of Asian fishing boats, barges and sailing craft may be a source of introduction as well as movement of NIS around the Hawaiian Islands. Vessels bound for areas which have been found to be virtually free of NIS such as Kaho`olawe and the Northwestern Hawaiian Islands should be routinely inspected to assure that they do not transport NIS. No aquaculture operation should be allowed to dispose effluent directly into Hawai`i's ocean or freshwater environments, and an information outreach should be made to inform the general public of the potential detrimental impacts of release of exotic aquarium organisms or favorite imported live food organisms. Failed programs such as the introduction of reef fishes in the 1950 and algae in the 1970s should never be repeated.

The second approach that this and other studies suggest will help limit the spread of established nonindigenous marine species is to establish or continue land and ocean management practices that will maintain and enhance a diverse, species rich, marine biota. The developing paradigm relating decreased invasion success with higher diversity both in marine and terrestrial systems suggests that loss of diversity may result in greater susceptibility to invasions when geographical barriers to species movement are breached. Moreover, the pattern of association of NIS with disturbed, low diversity areas within Kane`ohe Bay and O`ahu's harbors indicates that this relationship is maintained on a local level even within the same body of water. Efforts such as controlling land runoff, ground injected or discharged sewage and overfishing which are directed to preserving a balanced and diverse coral reef community may also be the best measures to limit the proliferation and spread of invasive introduced marine organisms.

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Smith, S., R. E. Brock, W. J. Kimmerer, E. A. Laws and T. Walsh. 1980. Kane`ohe Bay sewage diversion experiment: perspectives on ecosystem responses to nutritional perturbation. University of Hawai`i, Hawai`i Institute of Marine Biology,, USEPA Grant No. R803983, Kane`ohe.

Smith, S. V. 1981. Responses of Kane`ohe Bay, Hawai`i, to relaxation of sewage stress. p. 391-410 *in* B. J. a. C. Neilson , L. E., ed. Estuaries and Nutrients. Humana Press,

Smith, S. V., K. E. Chave and D. T. O. Kam. 1973. Atlas of Kane`ohe Bay: A Reef Ecosystem Under Stress. University of Hawai`i, Sea Grant Program, UHIHI-SEAGRANT-TR-72-01, Honolulu.

Soegiarto, A. 1973. Benthic algae in the bay. p. 67-90 *in* S. V. Smith, K. E. Chave and D. T. O. Kam, ed. Kane`ohe Bay: a reef ecosystem under stress. University of Hawai`i Sea Grant, Honolulu.

Southward, A. J., R. S. Burton, S. L. Coles, P. R. Dando, R. DeFelice, J. Hoover, P. E. Parnell, T. Yamaguchi and W. A. Newman. 1998. Invasion of Hawaiian shores by an Atlantic barnacle. Mar. Ecol. Prog. Ser. 165: 119-126.

Stachowicz, J. J., R. B. Whitlatch and R. W. Osman. 1999. Species diversity and invasion resistance in a marine ecosystem. Science 286: 1577-1579.

Stimson, J., S. Larned and K. Mcdermid. 1996. Seasonal growth of the coral reef macroalga *Dictyosphaeria cavernosa* (Forsskal) Borgesen and the effects of nutrient availability, temperature and herbivory on growth rate. J. Exp. Mar. Biol. Ecol. 196: 53-77.

Taylor, J. B. 1975. Planktonic prosobranch veligers of Kane`ohe Bay. Ph. D. thesis, Dept. of Zoology, Univ. of Hawai`i, Honolulu. 599 pp. pp.

Taylor, M., C. Hay and B. Forrest. 1999. Patterns of Marine Bioinvasion in New Zealand and Mechanisms for internal Quarantine. Marine Bioinvasions. MIT Sea Grant Program, Cambridge, Mass. 289-.

Thompson, J. K. and S. Luoma. 1999. Food web and contaminant flow effects of an exotic bivalve in San Francisco Bay, California. Marine Bioinvasions. MIT Sea Grant Program, Cambridge, Mass. (Abstr.).

Thresher, R. E. 1999. Key Threats from Marine Bioinvasions: A review of current and future issues. Marine Bioinvasions. MIT Sea Grant Program, Cambridge, Mass. 24-.

Trowbridge, C. D. 1996. Introduced versus native subspecies of *Codium fragile*: how distinctive is the invasive subspecies *tomentosoides*? Mar. Biol. 126: 193-204.

Tyrrell, M. C. and L. G. Harris. 1999. Potential impact of the introduced Asian Shore Crab, *Hemigrapsus sanguineus*, in northern New England: diet, deeding preferences, and overlap with the Green Crab, *Carcinus maenas*. Marine Bioinvasions. MIT Sea Grant Program, Cambridge, Mass. 208-.

Wilson, W. F. 1922. With Lord Byron at the Sandwich Islands in 1825, Being Extracts from the Diary of James Macrae, Scottish Botanist. W. F. Wilson, Honolulu. pp.

Wonham, M. J., J. T. Carlton, G. M. Ruiz and L. D. Smith. 2000. Fish and ships: relating dispersal frequency to success in biological invasions. Mar. Biol. 136: 1111-1121.

Woo, M., C. M. Smith and W. Smith. 1999. Ecological interactions and impacts of invasive *Kappaphycus striatum* in Kane`ohe Bay, a tropical reef. Marine Bioinvasions. MIT Sea Grant Program, Cambridge, Mass. 186-191.

Zibrowius, H. 1992. Ongoing modification of the Mediterranean marine fauna and flora by the establishment of exotic species. Mesogee 51: 83-107.

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APPENDIX A

Annotated Bibliography of Literature for Kane`ohe Bay

The bibliography has been compiled from sources which include but are not limited to:

Gordon, J. A. and P. Helfrich 1970. A bibliographic species list for the biota of Kane`ohe Bay. HIMB Tech. Rep. No. 21

Hawai`i Wildlife Fund and AECOS, Inc. 1999. Hawai`i Coral Reef Initiative computer interactive bibliography

Coral Reef Assessment and Monitoring Program (CRAMP) web site: http://cramp.wcc.hawaii.edu/

Acevedo, R. (1991). "Preliminary observations on effects of pesticides carbaryl, naphthol, and chlorpyrifos on planulae of the hermatypic coral *Pocillopora damicornis*." Pac. Sci. 54: 287-289.

Aeby, G. S. (1991). "Behavioral and ecological relationships of a parasite and its hosts within a coral reef system." Pac. Sci. 45: 263-269.

Aeby, G. S. (1998). "A digenean metacercaria from the reef coral, *Porites compressa*, experimentally identified as *Podocotyloides stenometra*." J. Parasitology(84): 1259-1261.
Feeding *Porites compressa* infected with a digenean metacercaria to the coral-feeding butterflyfish, *Chaetodon multicinctus*, established that the metacercaria was *Podocotyloides stenometra*. Those and field examinations finding a prevalence of 100% and an average intensity of infection of 6.5 worms/fish in 28 *C. multicinctus* off Kane`ohe Bay, O`ahu, Hawai`i, established this fish as a definitive host. *Plagioporus* sp. of Cheng and Wong, 1974 is a synonym of *P. stenometra*.

AECOS Inc. (1981). O`ahu Coastal Zone Atlas. Honolulu, U.S. Army Corps Of Engineers, Pacific Ocean Division, Fort Shafter, Hawai`i.
Used for GIS substrate/habitat maps. There is no location data form associated with this reference.

AECOS Inc. (1982). Marine baseline ecological reconnaissance off the east shore of Kualoa Beach Park. Kane`ohe, O`ahu, Sea Engineering Inc.**:** 15.
This report describes baseline biological studies undertaken in September 1982 on a reef flat off Kualoa Beach Park (Ko'olaupoko, O'ahu) as an adjunct to marine survey work in preparation for placement of surge breaker structures. The report includes both a review of recent marine survey work conducted in the area and the results off a diving survey on the reef flat in the area of expected impacts of the proposed action.

Agassiz, A. (1889). "The Coral Reefs of the Hawaiian Islands." Bull. Mus. Comp. Zool. 17: 121-170.
A recapitulation of the older theories of coral reef formation along with the author's own observations of the living and ancient Hawaiian coral reefs made during the winter of 1885. Discussion on the elevated reefs and sand beaches as-well as the living coral reefs suggests that the Hawaiian Islands have not been uplifted more than 20-25 feet. The Kane`ohe Bay reef is described along with the other fringing reefs of O`ahu. The author mentions seeing "a few Gorgoniae" in Kane`ohe Bay as well as some corals. British Admiralty Charts are included to show the Position of the coral reefs on O`ahu, including one bathymetric chart of Kane`ohe Bay.

Aguirre, A. A., G. H. Balazs et al. (1995). "Adrenal and hematological responses to stress in juvenile green turtles (*Chelonia mydas*) with and without fibropapillomas." Physiolog. Zool 68: 831-854.
This study reports baseline adrenocortical, hematological, and plasma biochemical values for clinically healthy juvenile green turtles from a discrete population at Kane`ohe Bay, island of O`ahu, Hawai`i. Using a general linear modeling program, we compared mean values for these parameters with mean values of a group afflicted with green turtle fibropapillomas (GTFP). Turtles of similar size classes from both groups were collected under the same conditions in the same study area and season at the same time of the day. Corticosterone, hematological, and enzymatic responses to acute and chronic stress were characterized for each group at four different sampling periods: 0 h (within 2 min of capture), 1 h, 3-4 h, and 24 h postcapture. On the basis of the differences identified between groups and times within a group, we conclude that turtles with GTFP are chronically stressed and immunosuppressed.

Aguirre, A. A., G. H. Balazs et al. (1994). "Organic contaminants and trace metals in the tissues of green turtles (*Chelonia mydas*) afflicted with fibropapillomas in the Hawaiian islands." Mar. Poll. Bull. 28: 109-114.
Environmental contaminants have been listed as a possible cause of green turtle fibropapillomas (GTFP). Brain, fat, liver, and kidney tissues from 10 juvenile green turtles (*Chelonia mydas*) afflicted with GTFP, were tested to determine exposure to selected environmental pollutants and any possible relation to GTFP. One juvenile green turtle free of the disease, one pelagic green turtle, and one pelagic loggerhead turtle (*Caretta caretta*) served as controls. Egg shells and tissues from three green turtle hatchlings were also tested. The tissues and shells analysed in this study indicated that none contained any of the listed organochlorine, polychlorinated biphenyl, organophosphate, or carbamate insecticides in concentrations above the stated method of detection limits. Most of the concentrations of selenium and heavy metals were also considered to be below levels reported normal in other animal species. No correlation was found between the contaminants tested and GTFP because of the low levels detected. Trace metals and other pollutants tested in this study play a minor role in the aetiology of GTFP in a discrete green turtle population at Kane`ohe Bay, Island of O`ahu, Hawai`i.

Aguirre, A. A., G. H. Balazs et al. (1994). "Evaluation of Hawaiian green turtles (*Chelonia mydas*) for potential pathogens associated with fibropapillomas." J. Wildlife Dis. 30: 8-15.

Thirty-two juvenile green turtles (*Chelonia mydas*) were captured alive in Kane`ohe Bay, Island of O`ahu, Hawai`i, during September 1991. Ten of the turtles sampled were afflicted with green turtle fibropapillomatosis (GTFP) in varying degrees of severity. Virus isolation attempts were negative in all individuals. Using nasopharyngeal and cloacal swabs, we isolated 28 Gram negative bacteria, five Gram positive cocci, Bacillus spp., and diphtheroids. The most common isolates included *Pseudomonas fluorescens* (68%), *P. putrefaciens* (66%), *Vibrio alginolyticus* (50%), non-hemolytic *Streptococcus* (50%), *V. damsela* (47%), and *V. fluvialis* (47%). Chlamydial antigen was detected in four of the turtles sampled. The primary lesions in animals with GTFP were hyperplasia of squamous epithelial cells and mesodermal proliferation with a marked degree of orthokeratotic hyperkeratosis. Mites, leeches, and other organisms were associated with the surface of papilloma lesions. The etiologic agent of GTFP was not isolated.

Akiyama, D. M. (1982). Epizootilogical studies of a granulomatous disease of the topminnow *Poecilia mexicana*. Animal Science. Honolulu, University of Hawai`i: 90.

Parasites occurring in livers of "diseased' topminnows from American Samoa studied in comparison with "clean ' topminnows collected from Kane`ohe Bay in 1980.

Alender, C. B. (1963). The venom from the heads of the globiferous pedicellariae of the sea urchin, *Tripneustes gratilla* (Linnaeus). Department of Zoology. Honolulu, University of Hawai`i: 126.

A study of the biochemical nature of the venom in the pedicellariae heads of the sea urchin, *T. gratilla* (Linnaeus), its extraction, partial purification, general chemical nature and physical properties. To determine the mode of action, techniques of physiology and pharmacology were applied from the standpoint of biological assay and pharmodynamics. Venom from other sea urchin species was collected and compared with *T. gratilla*. The sea urchins were collected on the reef flats and slopes on the leeward side of Kapapa Island, Kane`ohe Bay.

Alino, P. M. (1986). A comparison of coral community structure on reef flats in Kane`ohe Bay, Hawai`i. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01): 91-100.

Coral colony size-frequency distribution, species composition and total coral coverage was estimated for various reef flat stations. The data provide additional evidence that reef recovery had proceeded in the five years following termination of sewage discharge into Kane`ohe Bay. Proximity to stream mouths is an important factor controlling reef coral community structure, suggesting that occasional "fresh water" kills are an important factor in this region

Allen, J. A. (1998). "Mangroves as alien species: the case of Hawai`i." Global Ecol. Biogeog. Letters 7(Mangrove Special): 61-71.

Prior to the early 1900s, there were no mangroves in the Hawaiian Archipelago. In 1902, *Rhizophora mangle* was introduced on the island of Molokai, primarily for the purpose of stabilizing coastal mud flats. This species is now well established in Hawai`i, and is found on nearly all of the major islands. At least five other species of mangroves or associated species were introduced to Hawai`i in the early 1900s, and while none has thrived to the degree of *R. mangle*, at lest two have established self-maintaining populations (*Bruguiera gymnorrhiza* and *Conocarpus erectus*). Mangroves are highly regarded in most parts of the tropics for the ecosystem services they provide, but in Hawai`i they also have important negative ecological and economic impacts. Known negative impacts include reduction in habitat quality for endangered waterbirds such as the Hawaiian stilt (*Himantopus mexicanus knudseni*), colonization of habitats to the detriment of native species (e.g. in anchialine pools), overgrowing native Hawaiian archaeological sites, and causing drainage and aesthetic problems. Positive impacts appear to be fewer, but include uses of local importance, such as harvesting *B. gymnorrhiza* flowers for lei-making, as well as some ecological services attributed to mangroves elsewhere, such as sediment retention and organic matter export. From a research perspective, possible benefits of the presence of mangroves in Hawai`i include an unusual opportunity to evaluate their functional role in coastal ecosystems and the chance to examine unique or rare species interactions. Heeia Swamp, Kane`ohe Bay, O`ahu was studied along with other sites on O`ahu.

Anderson, S. L. (1986). Glutamine synthetase activity in the symbiotic dinoflagellate, *Symbiodinium microadriaticum*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea

Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01): 424-429.

Anon. (1947). Building the Navy's Bases in World War II. History of the Bureau of Yards and Docks and the Civil Engineers Corps, 1940-1946, Vols. I and 2. Washington, D. C., U. S. Gov. Printing Office: 522.
A report of the work accomplished by the Bureau of Yards and Docks, the Corps of Engineers, the Construction Battalions or "Seebees", and many civilian employees, engineering firms and contractors. Information pertaining to Kane`ohe Bay may be found on the following pages of volume two: p. 121--the first CPFF contract awarded by the Navy during the war construction program was on August 5, 1939, to cover the construction of a new naval air station at Kane`ohe as well as other bases in the Pacific p. 155--construction of the MCAS began in September of 1939 under a PNAB contract; p. 138-139--the major project (of MCAS) entailed extensive dredging to provide the necessary seaplane runways. The dredging continued for 3 years during which time 11,000,000 cubic yards of material was removed.

Anon. (1966). Annual Report 1964-66. Honolulu, Hawai`i Depart. Land and Nat. Resources.
An extensive population of clams *Venerupis philippinarium* was discovered in the SE section of Kane`ohe Bay. This provided recreation for 10,000 clam diggers during the 1965 season. To extend the distribution of the clam, approximately 1,500,000 seed clams were transferred from the original bed to other areas in the Bay, to Pearl Harbor, Keehi Lagoon and Maunalua Bay.

Anon. (1968). Annual Report 1967-68. Honolulu, Hawai`i Depart. Land and Nat. Resources.
In this year's report it was reported that an estimated 41,000 persons participated in the clam season and harvested about 10,700 gallons of Manila clams (*Venerupis philippinarium*) from the southeastern section of Kane`ohe Bay. After the close of the season, about 253,000 seed clams were collected and transferred to waters off Wailupe, O`ahu. Two large specimens of the quahog clam, *Mercenaria mercenaria* from the eastern U. S. were discovered in Kane`ohe Bay. These clams were traced to an unrecorded introduction into the Bay during the 1930's by a private citizen. A total of 985 Quahog clams were imported from Connecticut and planted in Kane`ohe Bay and in the Nomilo fishpond on Kauai.

Anon. (1969). Annual Report 1968-69. Honolulu, Hawai`i Depart. Land and Nat. Resources.
The annual report of the Department of Land and Natural Resources for 1968-69. The Division of Fish and Game reports that the topshell, *Trochus niloticus*, was introduced from Guam into the vicinity of Pyramid Rock in Kane`ohe Bay. Later monitoring made at the site of release gave counts of 72 and 44 live *Trochus* respectively. As yet, evidence of *Trochus* reproduction had not been uncovered. After a year in Hawaiian waters the quahog clams introduced from Connecticut into Kane`ohe Bay have grown from an average size of 1/14 1/34 " in length. The clams have adjusted well with a survival rate of 80%. An experimental introduction of abalone into Kane`ohe Bay was carried out by HIMB on Coconut Island. Two species, the Green Abalone (*Haliotis ens*) and the Pink Abalone (*H. corrugate*) were shipped periodically from the California Fish and Game Department.

Atkinson, M. J. (1981). Phosphate metabolism of coral reef flats. Dept of Oceanography. Honolulu, Univ. of Hawai`i,.
Phosphate uptake experiments were conducted on collections of reef organisms incubated in aquaria. Field (water) samples were taken to determine the net changes of phosphate ratios were determined for reef autotrophs. Uptake rates of phosphate is proportional to the reactive phosphate concentrations, and ambient phosphate concentrations of 0.15 uM the uptake and release of phosphate between the reef benthos and the water column is approximately 0.1% of community dark respiration.

Au, W. W. L. and K. Banks (1998). "The acoustics of the snapping shrimp *Synalpheus paraneomeris* in Kane`ohe Bay." J. Acoustical Soc. Am. 103: 41-47.
Snapping shrimp are among the major sources of biological noise in shallow bays, harbors, and inlets, in temperate and tropical waters. Snapping shrimp sounds can severely limit the use of underwater acoustics by humans and may also interfere with the transmission and reception of sounds by other animals such as dolphins, whales, and pinnipeds. The shrimp produce sounds by rapidly closing one of their frontal chela (claws), snapping the ends together to generate a loud click. The acoustics of the species *Synalpheus paraneomeris* was studied by measuring the sound produced by individual shrimp housed in a small cage located 1 m from an H-52 broadband hydrophone. Ten clicks from 40 specimens were digitized at a 1-MHz sample rate and the data stored on computer disk. A low-frequency precursor signature was observed; this previously unreported signature may be associated with a "plunger" structure which directs a jet of water forward of the claw during a snap. The peak-to-

peak sound pressure level and energy flux density at 1 m (source level and source energy flux density) varied linearly with claw size and body length. Peak-to-peak source levels varied from 183 to 189 dB re: 1 muPa. The acoustic power produced by a typical snap was calculated to be about 3 W. A typical spectrum of a click had a low-frequency peak between 2 and 5 kHz and energy extending out to 200 kHz. The spectrum of a click is very broad with only a 20-dB difference between the peak and minimum amplitudes across 200 kHz. A physical model of the snapping mechanism is used to estimate the velocity, acceleration, and force produced by a shrimp closing its claws.

Bachman, R. (1963). Fluctuations and trends in the abundance of nehu (*Stolephorus purpureus* Fowler) as determined from catch statistics. Depart. of Zoology. Honolulu, University of Hawai`i: 100.
The catch reports from 1948 to 1960 for the tuna fleet fishing in Kane`ohe Bay and Ma'alaea Bay were used to compile the statistics for this study. An estimate of the relative abundance within each area was derived from the "link-chain-relative" method which was considered to be a better measure of centralized tendencies than the arithmetic mean based on catch per unit effort. The relationship between nehu and tuna abundance and that between effort expended to catch nehu and tuna were examined to determine whether either fishery had an effect on the other.

Baer, L. J. (1980). Intraspecific and interspecific agonistic communication and behavior among surgeonfishes (Family Acanthuridae). Dept. of Zoology. Honolulu, Univ. Of Hawai`i: 276 pp.
Relationships between communication and various social, physical, biological, ecological, morphological and phylogenetic factors were investigated in four species of surgeonfishes. Specimens were trapped from various locations in Kane`ohe Bay for laboratory studies. Field observations were made at unspecified sites.

Bailey-Brock, J. H. (1976). "Habitats of tubicolous polychaetes from the Hawaiian Islands and Johnston Atoll." Pac. Sci 30(1): 69-81.
Forty-seven species of tube-building polychaetes, belonging to the families Spionidae, Chaetopteridae, Sabellariidae, Terebellidae, Sabellidae, and Serpulidae, were collected from the Hawaiian Islands and Johnston Atoll. Eight different habitat types or zones were distinguished, each having a characteristic polychaete fauna.

Bailey-Brock, J. H. (1984). "Spawning and development of *Arenicola brasiliensis* (Nonato) in Hawai`i (Polychaeta; Arenicolidae)." Proc. 1st Intern. Polychaete Conf., Sydney 1: 439-449.
Spawning and development of *Arenicola brasiliensis* from a shallow Hawaiian reef flat on Coconut Island, Kane`ohe Bay, are described. Mucus cocoons containing fertilized eggs are extruded from burrows and remain attached for 4-5 days. Newly spawned cocoons contain embryos that are evenly distributed throughout the cocoon. There is some correlation between lunar phase and spawning, with more cocoons appearing during neap tides than spring. Pelagic larvae settle after 4-5 days, the trochs are lost at the 6 setiger stage and post larvae secrete mucus tubes.

Balazs, G. H. (1978). "A hawksbill turtle in Kane`ohe Bay, O`ahu." Elepaio(38): 128-129.

Baldwin, W. J. (1972). "A new genus and new species of Hawaiian gobiid fish." Pac. Sci. 26: 125-128.
Recent fish collections made primarily in the southeast sector of Kane`ohe Bay and near Coconut Island, O`ahu, have provided several series of specimens of an undescribed goby.

Baldwin, W. J. (1978). Suitability of cultured topminnow *Poecilia vittata*, family Poeciliidae, as a live baitfish for skipjack tuna, *Katsuwonus pelamis*, in the tropical Pacific. Wash. D. C., U. S. Dep. Commerce: 149-155.
Poecilia vittata were collected from mangrove habitat in SE Kane`ohe Bay in 1970 and tested for use as baitfish. Optimum biological and technical factors that can be applied toward intensive culture of this baitfish are discussed and recommendations for a facility design are made,

Baldwin, W. J. (1984). "A note on the occurrence of the gold spot herring, *Herklotsichthys quadrimaculatus* (Ruppell) in Hawai`i." Pac. Sci. 38: 123-126.
The occurrence of the gold spot herring, *Herklotsichthys quadrimaculatus*, is reported for Hawai`i from the islands of O`ahu, Molokai, and Lanai. This species was first collected in Kane`ohe Bay, O`ahu in 1975, and appears to have largely replaced the Marquesan sardine, *Sardinella marquesensis*, introduced to Hawai`i in the 1950s. Notes on the separation of the gold spot herring from other Hawaiian clupeids are provided in addition to a comparison of the Hawaiian specimens with specimens of gold spot herring from Red Sea and tropical Pacific localities.

Ball, G. H. (1963). "*Cephaloidophora caepilodei* n. sp. and *C. pinguis* n. sp., gregarines of a Xanthid Crab in Hawai`i." J. Protozool. 10(3): 321-327.
A descriptive study of two new species of gregarines collected from a xanthid crab, *Carpilodes rugatus*, found on Coconut Island, Kane`ohe Bay. The hosts were examined live and the infected portions of gut were fixed in Bouin-Duboscq fluid, while the contents of the gut were Smeared on cover slips and fixed with Schaudinns fluid at 50-60 deg. C. Sections of the digestive tract were 7 u thick and stained in Delafield's haematoxylin and eosin.

Banaszak, A. T. and M. P. Lesser (1995). Survey of mycosporine-like amino acids in macrophytes of Kane`ohe Bay. Honolulu, University of Hawai`i Seagrant**:** 171-179.

Banner, A., H. (1940). The Hawaiian crustacea of the family Crangonidae. Depart. of Zoology. Honolulu, University of Hawai`i**:** 147.
A study of the family Crangonidae found in the Hawaiian Islands. Of the eighteen genera in the family, only 4 are found in Hawai`i: *Crangon* having 21 species; *Synalpheus* having 5 species, *Alpheopsis* having 1; and *Jouseaumea* having 2 species. The author reviews the systematics of each of the Hawaiian species.

Banner, A. H. (1953). "The Crangonidea or snapping shrimp of Hawai`i." Pac. Sci. 7: 3-144.
A study of the crangonid fauna of the Hawaiian Islands. Nine species are listed from Kane`ohe Bay.

Banner, A. H. (1959). "Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part IV. Various small collections from the Central Pacific area, including supplementary notes on alpheids from Hawai`i." Pac. Sci. 13: 130-155.
Descriptions of specimens from various collections, those specimens reported from Kane`ohe Bay include: *Alpheus lanceloti* Coutiere -Ahoolaka (Sand Island), Kane`ohe Bay. Collected from silty sand flats at tide level by A. H. Banner, max. length 20 mm. *Alpheus rapax* Fabricus -Kane`ohe Bay in shallow burrows on inshore mud flats in the intertidal zone. Also found in the intertidal zone on Ahoolaka (Sand Island) in Kane`ohe Bay by A, H. Banner, 1955, 1956, *Alpheus platyunguiculatus* (Banner) - collected from silt-buried coral heads in intertidal mud flats behind the shoreward reefs of Kane`ohe Bay by A, H. Banner, max. length 34 mm.

Banner, A. H. (1959). "A dermatitis-producing alga in Hawai`i." Hawai`i Medical Journal 19: 35-36.
A study of the distribution and toxicity of the blue-green alga, *Lyngby majuscula* Gomont conducted at the Hawai`i Marine Laboratory, Kane`ohe Bay This alga is found on many beaches in O`ahu, Molokai and Kauai although is not toxic in all areas--Kane`ohe Bay and Hanauma Bay have non-toxic strains of *L. majuscula*.

Banner, A. H. (1968). A fresh-water "kill" on the coral reefs of Hawai`i, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 29 pp.
A study of the effects of a fresh water kill of organisms on the reefs shorelines of Kane`ohe Bay caused by the heavy rainfall on May 2-8, 1965. The author describes the hydrography of the bay and includes a description of the storm by G. P. Ingwersen, Lt. Col., Corps of Engineers. Observations of the animals before and after the rainfall were made by author and numerous people working at the Hawai`i Marine Laboratory on Coconut Island.

Banner, A. H. (1974). "Kane`ohe Bay, Hawai`i: Urban pollution and a coral reef ecosystem." Proc. 2nd Intern. Coral Reef Symp.: 689-702.
The submarine topography and small tidal exchange of Kane`ohe Bay, Hawai`i give it a rather poor circulatory pattern which has heightened the effects of man upon the marine environment. Coral dredging in preparation for WWII, heightened urban development, water runoff, increased siltation, sewage runoff, and other impacts have had serious side effects. The results are that in 1/3 of the bay no coral is left growing, in 1/3 almost all coral has been over-grown by an alga, and only in the last third are the coral reefs reasonably intact. At the time of writing, it appears that the urban pollution will increase at least until 1976 and more of the remaining coral reef ecosystem will be eliminated.

Banner, A. H. and J. Bailey (1970). The effects of urban pollution upon a coral reef system. A preliminary report., University of Hawai`i, Hawai`i Institute of Marine Biology. HIMB Tech. Rept. No. 25**:** 66.
Changes in water quality in Kane`ohe Bay are shown to parallel changes in the population of the watershed, and in particular parallel development of new subdivisions and operation of two sewage systems that discharge into the southern part of the bay. Evidence is presented to show that profound changes occurring in the benthic community probably result from population growth and land

development in the Kane`ohe Bay watershed: the eutrophication,,of the bay from sewage discharge and the combined siltation and lowered salinity in times of storm. This report also contains the results of an extensive survey conducted in August 1970 to ascertain the extent of the Dictyosphaeria cavernosa coverage.

Banner, A. H. a. Banner, D. M (1974). "Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part XVII. Additional notes on the Hawaiian alpheids: new species, subspecies, and some nomenclatorial changes." Pac. Sci. 28: 423-437.
Update to a previous monograph on the Alpheidae for the Hawaiian archipelago. This study recommends changes in nomenclature and describes several new species and records. Many specimens were collected in the Bay.

Barnard, J. L. (1955). "Gammaridean amphipoda (Crustacea) in the collections of the Bishop Museum." Bishop Mus. Bull. 215: 1-46.
A taxonomic study of the gammaridean amphipod collection in the Bishop Museum. Kane`ohe Bay is the type locality for one species, *Photis hawiensis* nov. sp.

Barnard, J. L. (1970). "Sublittoral Gammaridea (Amphipoda) of the Hawaiian Islands." Smithson. Contrib. Zool. 34: 1-286.
A taxonomic study of the gammaridean amphipod collection in the Hawaiian Islands.

Barnard, J. L. (1971). "Keys to the Hawaiian marine Gammaridea, 0-30 meters." Smithson. Contrib. Zool. 58: 1-135.
A taxonomic guide to the gammaridean amphipod collection in the Hawaiian Islands.

Barry, C. K. (1965). Ecological study of the decapod crustaceans commensal with the branching coral, *Pocillopora meandrina* var. *nobilis*. Department of Zoology. Honolulu, University of Hawai`i**:** 64.
A study in which an attempt was made to determine the factors imposed by the host limiting its decapod crustacean community. The host coral was viewed as a microhabitat which is both a biotic and a physical component of the symbiont's environment, thus both the physical and biotic roles of the coral were considered. Intra and inter-specific interactions of the symbionts were also considered. The coral head communities were studied on five patch reefs on the north side of the Sampan Channel in Kane`ohe Bay.

Results showed that the differences among coral heads are mainly quantitative and that the coral head microhabitat is qualitatively uniform. The species composition of the community in *P. meandrina* is relatively constant-a total of 11 obligate decapod crustacean commensals are found with 4 ubiquitous species. The biomass, numerical composition and species diversity of the community varies with the size of the coral head. Food is supplied by the coral head to its commensals. The decapod community is probably limited by the amount of subsurface area available in the coral- head. The exact composition of the community is most likely dependent on intra and interspecific interactions of the symbionts.

Barry, K. L. and C. W. Hawryshyn (1999). "Effects of incident light and background conditions on potential conspicuousness of Hawaiian coral reef fish." J. Mar. Biol. Assoc. U. K 79: 495-508.

Bartholomew, E. F. (1973). The production of microcopepods in Kane`ohe Bay, O`ahu, Hawai`i. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 43 pp.
These microcopepods were found to be the most abundant microcopepods during the year in south Kane`ohe Bay. Total densities ranged from 220,000/m3 during warmer months to 16,000/m3 in colder months. About half of the planktonic primary production in south Kane`ohe Bay was consumed by the three species during the summer months. Twenty-four microplankton samples were made with paired vertical double drop nets.

Bassim, K. M. (1998a). Effects of temperature-induced "bleaching" on reproductive output in *Montipora verrucosa* Vaughan (Scleractinia). Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 53-59.
Thirty nine *Montipora verrucosa* colonies of statistically similar diameters were randomly subdivided into 3 treatment groups of equal number. One group of colonies was induced to expel at least 50% of its zooxanthellae, as measured by the use of computerized image-analysis, 2 weeks prior to the expected spawning date (the 2-week group); another was 'bleached' 1 week before spawning (1-week group). The control group was not bleached. The control group produced the most egg bundles (□3000), although not statistically different from the 2-week group (□2000). The 1-week group,

however, produced only 162 bundles. Possible explanations for what occurred and the potential ecological significance are discussed. On June 19, 1997, *M. verrucosa* were collected from Checker Reef, Kane`ohe Bay, O`ahu.

Bassim, K. M. (1998b). Effects of elevated temperature and 20 □M ammonium enrichment on survivorship in symbiotic and aposymbiotic larvae of *Fungia scutaria* (Fungiidae) and *Montipora verrucosa* (Acroporidae). Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH: 83-92.

Changes in survivorship of groups of the larvae of *Montipora verrucosa* (Acroporidae), and *Fungia scutaria* (Fungiidae), were measured in response to elevated seawater (27, 28, 29, and 30□C treatments), and ammonium concentrations (0 and 20 □M ammonium sulfate added). *M. verrucosa* larvae contained zooxanthellae during embryonic development, were studied in both an aposymbiotic and symbiotic state. Increasing temperature, the effects of which was significant in all groups, decreased survival in *M. verrucosa*, and had an unpredictable response in both of the *F. scutaria* subgroups. Elevated ammonium values, on the other hand, slightly increased survivorship over time in all groups. Temperature had a much more pronounced effect upon the larvae than ammonium. In the environment where *M. verrucosa* is most common, seawater temperature averages 27□C. On the reef flats where *F. scutaria* is typically found, water temperatures may reach as high as 29□C. Both species occur in waters where the ammonium concentrations are extremely low (□0.2 □M). The responses to ammonium found in this experiment are in contrast to earlier experiments (Bassim 1997), in which aposymbiotic *Diploria strigosa* were found to be adversely affected by ammonium.

Bates, G. W. (1854). Sandwich Island Notes by a Haole. New York, Harper Bros.

A collection of notes written by Bates during his travels to and around the Hawaiian Islands in 1853. Bates describes not only the physical features of Honolulu but also the cultural, social and political aspects of the city prior to annexation. There are delightful narratives of trips taken around O`ahu, including a chapter of a trip to Kane`ohe. Other trips include Kauai, Molokai, Maui and Hawai`i

Bathen, K. H. (1968). A descriptive study of the physical oceanography of Kane`ohe Bay, O`ahu, Hawai`i, University of Hawai`i, Manoa.

The results of a 13 month hydrographic survey of Kane`ohe Bay are presented in this primarily descriptive study. The subjects covered are the hypsographic conditions, tides, circulation patterns, volume transports, sewage distribution, heat budget, precipitation, runoff and the distribution of water properties in the bay. Interrelations between these subjects are also examined.

Bathen, K. H. (1974). Baseline description of the marine and shoreline environments existing in Kane`ohe Bay between Waiahole and Waikane, O`ahu, Hawai`i. Honolulu, Environmental Communications, Inc.: 65.

Bell, J. L. (1985). " Larval Growth and Metamorphosis of a Prosobranch Gastropod associated with a Solitary Coral." Proc. 5th Intern. Coral Reef Congr., Tahiti 5: 159-164.

In Hawai`i *Epitonium ulu* has been only on the solitary coral, *Fungia scutaria*. Larvae were reared in culture to investigate length of larval life, growth of larval shell and tissue, and the metamorphosis of competent larvae. Shell length and tissue mass increased steadily after hatching, with shell length leveling at 390 um on day 27. Metamorphosis was induced with seawater which had been in contact with *Fungia* for 24 hours. Using this method, larvae were first capable of metamorphosis on day 26 post-hatching. Larvae began non-specific metamorphosis (without contact with *Fungia*) on day 29. With a larval life of 26 days and non-specific metamorphosis, *Epitonium ulu* did not fit either hypothesis. The lack of ability to remain in the plankton until its encounters its host may be balanced by the high fecundity of *Epitonium*.

Berg, C. J., Jr. (1971). A comparative and ontogenetic study of the behavior of strombid gastropods. Dept. of Zoology. Honolulu, Univ. of Hawai`i: 170 pp.

The behavior of ten species in two genera, *Strombus* and *Lambis*, was compared with respect to convergence and divergence of basic forms of behavior with both the Strombidae and the superfamily Strombacea. Studies of modal action patterns comprising such essential behavior as feeding, locomotion, righting and escape were stress because the differences in these kinds of behaviors would reflect significant ecological and morphological determinants of behavior. *Stombus maculatus* were collected in Kane`ohe Bay from the intertidal on solution benches at Kapapa island and in 1-2 m of water on the reef extending from Kapapa Island to Sampan Channel.

Berg, C. J., Jr. (1972). "Ontogeny of the behavior of *Strombus maculatus* (Gastropoda: Strombidae)." Amer.

Zool. 12: 427-443.

The ontogeny of strombid behavior was studied by observing the behavior of *Strombus maculatus* veligers collected from the plankton and reared past metamorphosis to adults, and by observing juvenile strombids collected in the field. Complete adult modal action patterns (MAP's) associated with locomotion, feeding, and righting of overturned shells are performed by *S. maculatus* juveniles immediately after metamorphosis. There are changes in the frequency of the use of certain MAP's which are associated with variations in shell shape and size. Planktonic tows were made throughout the year in Sampan Channel, Kane`ohe Bay, Hawai`i during flood tide.

Bergquist, P. R. (1967). "Additions to the sponge fauna of the Hawaiian Islands." Micronesica 3: 159-174.

A study describing fifteen sponges from the Hawaiian Islands, two of which were previously recorded, the remainder are new. Two sponges, *Psammophysilla purpurea* (Carter) and *Clatharia procera* (Ridley) have only been found in Kane`ohe Bay and nowhere else in the Hawaiian Islands.

Berrill, M. (1965). The ethology of the synaptid holothurian, *Opheodesoma spectabilis* Fisher. Depart. of Zoology. Honolulu, University of Hawai`i.

A study investigating the activities and reactions of the holothurian, *0. spectabilis*, in both the laboratory and in its endemic natural habitat of Kane`ohe Bay. The author discusses the habitat, distribution and anatomy of the holothurian and then presents an analysis of the animal's behavior with emphasis on orientation, activities and the diurnal rhythm of some behaviors, as well as their affinity to the brown alga *Sargassum echinocarpum*.

Bigger, C. H., P. L. Jokiel et al. (1983). "Cytotoxic transplantation immunity in the sponge *Toxadocia violacea*." Transplantation 35: 239-243.

The Hawaiian sponge, *Toxadocia violacea*, collected from Kane`ohe Bay, exhibited discriminating transplantation immunity in an extensive series of allogenic and xenogenic parabioses. Cytotoxin alloincapatibility occurred without exception, but with differing degrees of severity. The allorejection reactions developed more rapidly than has been observed in any other animal species. Xenographic reactions between *Toxadocia violacea* and *Callyspongia diffusa* were characterized by acute cytotoxicity, immune memory and qualitative change in secondary versus primary responses.

Bigger, C. H., P. L. Jokiel et al. (1982). "Characterization of alloimmune memory in a sponge." J. Immunology 129: 1570-1572.

Allogenic tissue of the marine sponge *Callyspongia diffusa*, collected in Kane`ohe Bay, was grafted/parabiosed to examine critically the essential features of alloimmune memory in this least complex metazoan phylum. Although sponges lack and organized circulatory system, the immunologic memory spreads rapidly through body tissue. Heightened reactivity persisted only 3-4 weeks after primary sensitization, in contrast to the long term alloimmune memory found among vertebrates.

Bishop, S. E. (1916). Reminiscences of Old Hawai`i. Honolulu, Hawaiian Gazette Co. Ltd.

A collection of personal memories, reminiscences and writings of Serena Edwards Bishop. This is the first such "history" book published about Hawai`i. The book includes a brief biography of *S.* E. Bishop by Lorrin A. Thurston. Bishop did most of his missionary work on the Kona coast of Hawai`i, but he made several trips to the other islands and during one of these trips he met Rev. B. W. Parker and his wife in Kane`ohe (p. 51).

Bohm, A. (1931). "Distribution and variability.of *Ceratium* in the northern and western Pacific." Bishop Mus. Bull. 87: 1-46.

A paper presenting the results of a plankton study collected by Dr. V, Pietschmann (1927-1928) during the course of a journey from Honolulu to Yokohama, Moji, Shanghai, Hong Kong and Singapore. The material was obtained by using the ship's pump for two or more hours at a time and then it was filtered through nets. The distribution of *Ceratium* sp. was studied and the variation was studied by observing those characters which showed themselves to be relatively constant, i.e., transdiameter, total length and expanse of horns. A sample from Nuupia fish pond, Kane`ohe Bay, contained only two specimens of *Ceratium furca* and two of *Ceratium fuscus*.

Boone, L. (1938). "Coelenterata: Hydroida. Scientific results of the world cruises of the Yachts Ara, 1928-1929, and Alva, 1931-32. Alva Mediterranean cruise 1933, and Alva South American cruise, 1935, William Vanderbilt, Commanding." Bull. Vanderbilt Marine Mus. 7: 33-34.

Booth, D. J. (1991). "The effects of sampling frequency on estimates of recruitment of the domino damselfish *Dascyllus albisella* Gill." J. Exp. Mar. Biol. Ecol. 145: 149-159.

Booth, D. J. (1995). "Juvenile groups in a coral-reef damselfish: density-dependent effects on individual fitness and population demography." Ecology 76: 91-106.
Costs and benefits to group living in animals may affect the fitness of individual group members and also demography of the population. The effects of grouping on the growth, survival, and attainment of maturity of juveniles of an Hawaiian coral-reef damselfish (*Dascyllus albisella*) were evaluated from 1987 through 1989. In this species, pelagic larvae settle (at approximately 14 mm total length) on coral heads, joining temporary groups of up to 15 juveniles. Group members establish a dominance hierarchy based on size, and fish leave these groups upon reaching mature size (70 mm total length) to enter the nearby adult population. Previously, I had demonstrated that larvae preferentially join larger groups and I expected to find clear advantages to group membership. Survival, especially of smaller fish, was enhanced in large groups, but growth, especially by individuals of low social status, was reduced. Consequently, the time to reach maturity increased with group size in both years of the study, suggesting a more rapid entry into the adult population of fish in smaller groups or living alone. However, the probability of reaching mature size (a function of size-specific growth and survival) increased with group size in 1988 but not in 1987, thus indicating a benefit to group living during only one of the two years of the study. Although this study demonstrated density-dependent juvenile growth and survival, with consequent fitness effects of group living, it has also highlighted considerable inter- and intra-annual variability in these relationships. Such variability will have major consequences for predictions of the effects of juvenile ecology on the demography of organisms.

Boroughs, H. and D. F. Reid (1958). "The role of the blood in the transportation of Strontium^{90}-Yttrium^{90} in the teleost Fish." Biol. Bull. 115: 64-73.
A study conducted at Coconut Island, Kane`ohe Bay, on certain aspects of the transportation of the radioactive isotope, strontium^{90}-yttrium^{90}, in the blood of the teleost fish, *Tilapia mossambica*. The Sr^{90}-Y^{90} dose was injected into the ventricle of the heart and at a series of predetermined times, as much blood as possible was withdrawn through the kidney sinus. Radioactivity of the plasma and the cells was monitored. Separate organs and tissues were ashed and their radioactivity was also monitored.

Boroughs, H., S. J. Townsley et al. (1956a). "The metabolism of radionuclides by marine organisms I. The uptake, accumulation and loss of strontium by fishes." Biol. Bull. 3: 336-351.
A study conducted at the Hawai`i Marine Laboratory, Kane`ohe Bay, measuring the uptake, accumulation and loss of radiostrontium by the various tissues and organs of fish from three trophic levels:
Fourth Trophic Level - *Euthynnus yiato*, black skipjack; *Eeothunnus macropterus*, yellowfin tuna; *Coryphaena hippurus*, dolphin
Third Trophic Level - *Carangoides ajax*, papio caught in Kane`ohe Bay; *Kuhlia sandvicensis*, aholehole caught in Kane`ohe Bay
Second Trophic Level - *Tilapia mossambica*
The inter-relationships of these trophic levels to the passage of the isotope by way of the food chain was also discussed. Pelagic fishes were shown to excrete the ingested isotope within a few hours, although various tissues retained varying amounts of residual isotope. *Tilapia mossambica* excreted the isotope much more slowly and most of the radioactivity was found in the structural tissues, The retention of radioactivity in various organs and tissues of the different fishes is discussed in relation to their habitat.

Boroughs, H., S. J. Townsley et al. (1956b). "The metabolism of radionuclides by marine organisms II. The uptake, accumulation and loss of yttrium by marine fish and the importance of short-lived radionuclides in the sea." Biol. Bull. 3: 352-357.
A study conducted at the Hawai`i Marine Laboratory, Kane`ohe Bay, to determine the metabolism of yttrium by the fish, *Tilapia*. Although yttrium is closely related to strontium, only 2% of the ingested dose of yttrium remains after 2 days, which is very much less than a similar dose of strontium. The distribution of the remaining ingested isotopes also differs widely.

Boroughs, H., S. J. Townsley et al. (1956c). "The metabolism of radionuclides by marine organisms III. The uptake of Calcium^{45} in solution by marine fish." Limnol. Oceanogr. 2: 28-32.
A study conducted at the Hawai`i Marine Laboratory, Kane`ohe Bay, using *Tilapia mossambica* to determine whether marine fish required calcium in their diets or whether they could take up an adequate amount of calcium from the seawater showed that marine fishes can take up calcium directly from seawater, and do not need a dietary source for this element. In comparison with a similar

experiment using radiostrontium, it was found that marine fishes discriminate in favor of calcium.

Bosch, H. F. (1965). "A gastropod parasitic on solitary corals in Hawai`i." Pac. Sci. 19: 267-268.
A study of the relationship between the wendletrap gastropod, *Epitonium ulu* Pilsbry and the solitary coral, *Fungia scutaria* Lamarck collected in Kane`ohe Bay. The author feels that this relationship might be correlated with the breeding cycle of the snails and is probably only intermittent or temporary.

Bosch, H. F. (1967). Growth rate of *Fungia scutaria* in Kane`ohe Bay, O`ahu. Dept. Zoology. Honolulu, University of Hawai`i**:** 38.
A study on the annual growth rate of the solitary coral, *F. scutaria,* by observing increases in skeletal length and width during a period 1963-1964. Measurements were made in situ in Kane`ohe Bay. Estimates of growth, made on the basis of large sampling, were used to assess the effects of the environment upon variations in growth rate. The environmental effects were substratum, waves and currents, siltation, other physical and chemical factors, biotic factors, population density and local distribution patterns.

Bowers, R. L. (1965). Observations on the orientation and feeding behavior of barnacles associated with lobsters. Dept. Zoology. Honolulu, University of Hawai`i.
A two part study: 1) A study in which the orientation of *Balanus trigonus*_on a single specimen of *Panulirus japonicus* was measured using a previously published method. Barnacles on various areas of the lobster's carapace were measured and an attempt was made to correlate the results with the results of previous workers and the general habitat of the lobster. The lobster was collected at Coconut Island, Kane`ohe Bay, with the adhering organisms: *Balanus trigonus, Chelonibia patula, Sagartia longa*, and *Hydroides norvegica*. 2) A study of the orientation of the barnacle, *Trilasmis (Temnaspis) fissum hawaiense* (Pilsbry) epizoic on the lobsters, *Panulirus japonicus* (DeSiebold) and *Panulirus penicillatus* (Oliver) involving orientation to jets of seawater and to jets of seawater and lobster meat juice. Observations were also made on the feeding behavior of the barnacle. Species epizoic on the lobsters: *Balanus trigonus* (Darwin), *Chelonibia patula* (Ranzani), *Trilasmis (Temnaspis) fissum* patula (Ranzani), *Trilasmis (Temnaspis) fissum hawaiense* (Pilsbry) *Octolasmis (Octolasmis) lavei* (Darwin), and *Paralepas palinuri urae* (Newman).

Bowers, R. L. (1970). The behavior of *Alpheus clypeatus* Coutiere (Decapoda, Alpheidae). Dept. of Zoology. Honolulu, Univ. of Hawai`i**:** 148 pp.
The behavior and ecological adaptations associated with the construction and inhabitance of algal tubes by A*lpheus clypeatus* were examined. Shelter procurement of this type differs from that of most other alpheid shrimps which utilize shelter, such as crevices in coral or the canals within sponges, that require little or no modification. Field collections were conducted regularly over a 15 month period in 1968-69 at stations at 60-80 ft immediately seaward of Kane`ohe Bay and in Kane`ohe Bay at 2-8 ft form dead heads of *Pocillopora meandrina*. The ability to utilize a portion of the habitat with reduced levels of intraspecific competition is discussed with respect to the adaptive significance of tube construction.

Bowers, R. L. (1977). Biological reconnaissance of coral communities near stream mouths in Kane'ohe Bay - summary of results. Honolulu, Dept. of the Army, Engineer Division, Pacific Ocean.
Description and data for condition of reef coral assemblages near Kane`ohe Bay stream mouths in 1977.

Bowser, G. (1880). An Itinerary of the Hawaiian Islands with a Description of the Principal Towns and Places of Interest, The Hawaiian Kingdom - Statistical and Commercial Directory and Tourists Guide: 1880-1881**:** 435-576.
An itinerary of a trip around the Hawaiian Islands with chapters on Honolulu, O`ahu, Maui, Hawai`i, Kauai, and Ni'ihau and Molokai, Lanai and Kaho'olawe. Chapter two is a short account of a horseback trip around O`ahu--the author left Honolulu to travel over the Pali to Waimanalo, then to Kane`ohe, Waikane, Laie and back to Honolulu. At this time, most of the land in Kane`ohe was cultivated with sugar, there being three plantations and the Honorable C. C. Harris, Chief Justice of the Kingdom had the largest plantation. In the Heeia district, the big sugar plantation belonged to John McKeague. Rice was also planted in Heeia, cultivated by Mr. Ah Kau. Mr. John Crowder maintained a fishery ground in an area 3 miles along the beach to the sea. At the far end of the bay, near Waiahole and Waikane, most of the land was cultivated with rice. Horse raising was the chief industry of Kualoa, there being over one hundred head of horses on the land which was at one time a sugar plantation.

Boylan, D. B. (1966). The chemical nature of the toxic secretions of the boxfish (*Ostracion lentiginosus*

Schneider). Department of Zoology. Honolulu, University of Hawai`i.
A chemical investigation of the pure toxic component isolated from the crude secretions of the boxfish, *0. lentiginosus.* The synthesis of the toxic principle was attempted in an effort to elucidate the mechanism of biological action. The boxfish were caught off Waikiki and Kane`ohe Bay reefs.

Brewer/Bradman Associates (1989). Baseline marine, estuarine and stream surveys: Bayview Golf Course expansion, South Kane`ohe Bay, O`ahu, Hawai`i. Final Environmental Impact Statement, Bayview Golf Course Expansion, Kane`ohe, O`ahu, Hawai`i. Honolulu, Pacific Atlas (Hawai`i) Inc.
Qualitative/semi-quantitative study of fishes, corals, invertebrates and algae. Water quality measurements.

Brick, R. W. (1970). Some aspects of raft culture of oysters in Hawai`i. Kane`ohe, Hawai`i Institute of Marine Biology**:** 45 pp.
Results of experimental treatments of oysters held in Kahaluu Pond in Kane`ohe Bay. Oysters used were nonindigenous *Crassostrea virginica* collected from Pearl Harbor and *C. gigas* collected in Kane`ohe Bay. Oysters were negatively affected by the flatworm *Stylochus* sp. predation, suspended sediments and turbidity. Confirms an Edmondson (1946) report of oysters in Kane`ohe bay being killed by a parasitic worm.

Brick, R. W. (1974). "Effects of water quality, antibiotics, phytoplankton and food on survival and development of larvae of *Scylla serrata* (Crustacea: Portunidae)." Aquaculture 3: 231-244.
Larvae of the portunid crab *Scylla serrata* were successfully reared using a combination of antibiotics (penicillin-G+polymyxin-B), phytoplankton (*Chlorella* sp.) and appropriate food ((*Artemia salina* nauplii). Antibiotics enhanced pre-metamorphic survival of zoea while leaving rate of zoeal development and success of metamorphosis to megalopa unaltered. Water filtration and ultraviolet sterilization had no significant effect on rates of zoeal survival or development. Although antibiotics did not effect metamorphosis of megalopa to the crab stage, the antibiotic mixture may have been detrimental to survival of megalopae.

Bridges, K. W. (1967). Aspects of the feeding dynamics of the aholehole (*Kuhlia sandvicensis*). Department of Zoology. Honolulu, University of Hawai`i.
A study investigating two aspects of the feeding dynamics of the aholehole: the relationship between the food, growth and metabolic requirements of the fish and the provision of a quantitative expression of the relationship between the food growth and metabolic requirements. The fish were caught by angling with live shrimp along the breakwater at the entrance to the Anchorage, Coconut Island, Kane`ohe Bay.

The use of regression analysis on the data was shown to be the most complete description of the food and growth relationship. It was found that an increased level of swimming did increase the maintenance requirement of the fish but not the net efficiency. The maintenance requirement for a 63 gm aholehole was estimated to be 0.534 /day at zero activity and the cost of swimming at 4.5 in/sec was 41% of the total maintenance requirement. Rate of weight loss of starving fish was shown to be related to the weight of the fish and this provided an estimate of the rate of metabolism. Weight loss values recorded during periods of activity compared favorably with oxygen consumption studies for the same levels of activity.

Brill, R. W., G. H. Balazs et al. (1995). "Daily movements, habitat use, and submergence intervals of normal and tumor-bearing juvenile green turtles (Chelonia mydas L.) within a foraging area in the Hawaiian islands." J. Exp. Mar. Biol. Ecol. 185.
Depth-sensitive ultrasonic transmitters monitored the horizontal and vertical movements of 12 juvenile (65 cm carapace length) green turtles (*Chelonia mydas* L.) in Kane`ohe Bay, O`ahu (Hawai`i, USA). This site was chosen because of its accessibility, its importance as a foraging area, and the high incidence (approx. 50%) of fibropapillomatosis, a tumor disease of unknown etiology. Our objectives were to determine the daily movements, habitat use, and submergence intervals of normal and tumor-bearing animals. The presence of tumors had no obvious effects on movement patterns or habitat use. All turtles remained within a small portion of the bay where patch reefs and shallow coral-covered areas are common, and algal growth most abundant. During daylight, two normal and two tumor-bearing animals remained within known feeding areas, all other turtles studied stayed within deep mud bottom channels or within crevices on the sides of reefs. All, except one tumor-bearing turtle, moved up on to shallow patch reefs or shallow coral-covered areas at night. Submergence intervals for both groups were short (over 90% were 33 min or less and none exceeded 66 min) compared to maximum breath-hold times (up to 5 h) measured in the laboratory by earlier workers. Juvenile green turtles in

Hawai`i, therefore, most likely maintain aerobic metabolism while submerged and surface before oxygen stores are significantly depleted. Tumor-bearing turtles had a higher frequency of longer submergence intervals during the night, indicating they may have been somewhat less active at night. Normal turtles showed no such day-night difference.

Brock, J. H. (1976). Benthic marine communities of shoreline structures in Kane`ohe Bay, O`ahu. Honolulu, University of Hawai`i Environmental Center**:** 161 pp.
Detailed study with 19 stations (up to 20 substations at each). Data are mixed (some quantitative and some qualitative), which presents problems with comparisons of species abundance. The appendix has a detailed species list.

Brock, R. E. (1979). The effects of grazing by parrotfishes (Family Scaridae) on selected shallow Hawaiian marine communities. Dept. Of Fisheries. Seattle, Univ. Of Washington**:** 174 pp.
This study has been conducted to: 1) assess the quantitative effects that rasping parrotfishes in a coral reef ecosystem have on the structure of benthic communities; 2) describe the standing crop of parrotfishes and 3) examine scarid recolonization patterns on a fish-depopulated patch reef. Field studies were conducted at Johnston Atoll and Kane`ohe Bay. Fishes were collected at 3 study sites (sites other than Reef 22) and various other reefs in the bay. Reef 22 was completely denuded of fishes with rotenone in August 1966 (Wass, 1967) and in October 1977 (this study) to record recolonization of all fish species.

Brock, R. E. (1979). "An experimental study on the effects of grazing by parrotfishes and role of refuges in the benthic community structure." Mar. Biol. 51: 381-388.
In an experimental study on the effect of parrotfish (probably *Scarus taeniurus*) grazing on the structure of benthic reef communities, fishes in densities of 0.6 to 1.5 parrotfish per m^2 or 9 to 17 wet wt. of fish per m^2 were found to have an optimum effect. resulting in the greatest benthic species richness and biomass on 2 dimensional surfaces. However, the presence of refuges (i. e. 3 dimensional surface) has a greater impact on benthic community structure than does parrotfish density.

Brock, R. E. (1982). "A critique of the visual census method for assessing coral reef fish populations." Bull. Mar. Sci. 32(1): 269-276.
Many investigators have noted that estimates of coral reef fish populations by visual census are biased but its precision has never been quantitatively determined. It is still used, however, because this technique is usually assumed to be the best non-destructive method of population assessment. This study compares the results of visual censuses conducted on an isolated 1,500 m^2 patch reef to the collection of all fishes made subsequently with rotenone on that reef. The visual censuses missed the presence or underestimated abundance of cryptic fish species. Diurnally active species were reasonably well censused, but the most common were often underestimated. Thus comparisons between fish communities based on visual census data should be restricted to the diurnally exposed species. This study was conducted on an isolated patch reef in Kane`ohe Bay, O`ahu, Hawai`i.

Brock, R. E. and J. H. Brock (1977). "A method for quantitatively assessing the infaunal community in coral rock." Limnol. Oceanogr. 22.
Acid dissolution with previous formalin preservation allows virtually total recovery of the infaunal community in coral rock, making quantitative studies possible. Most groups remain readily identifiable following this treatment. Coral rock samples from gradients of sewage and stream stress suggest a decrease in numbers and biomass with distance from the perturbation.

Brock, R. E., C. Lewis et al. (1979). "Stability and structure of a coral patch reef fish community in a stressed Hawaiian ecosystem." Mar. Biol. 54: 281-292.
Two collections of the fishes residing on an isolated coral patch reef (ca. 1500 m2) in Kane`ohe Bay were made 11 years apart. Of the 112 species of fishes in both collections, only 40% were in common, but these made up more than 85% of the wet biomass in each collection. The two assemblages of fishes were similar in trophic structure and standing crop. Many coral reef fish communities are dominated by carnivorous forms. In the present study planktonivorous fishes were the most important trophic group in the community; this was related to abundant zooplankton resources.

Brock, R. E. and S. V. Smith (1983). "Response of coral reef cryptofauna communities to food and space." Coral Reefs 1: 179-183.
Components of benthic communities in a coral reef system subjected to elevated particulate organic

loading show differential biomass responses to this food resources. Th macrofaunal biomass of the hard bottom cryptofaunal community was elevated under such loading ; termination of the nutrient input resulted in a rapid decline in hard bottom cryptofaunal biomass. In contrast, adjacent soft substratum communities showed minor variation in macrofaunal biomass.

Brock, V. E. (1952). "A history of the introduction of certain aquatic animals to Hawai`i." Rept. Bd. Agric. Forestry: 114-123.
Summary of established aquatic introductions in Hawai`i.

Brock, V. E. (1960). "The introduction of aquatic animals into Hawaiian waters." Int. Rev. Ges. Hydrobiol 45(4): 463-480.
The present account of Hawaiian aquatic introductions is not an analysis of ecological alterations of the fauna of Hawaiian waters. It is rather an attempt to simply record such introductions and additions that have occurred insofar as available documentation permits and to describe, in general, the Hawaiian environment. Many of the less conspicuous aquatic invertebrates which have been fortuitously introduced are not listed. Like insect immigrants, they will quietly continue to establish themselves. Their recognition as immigrants often depends on their ultimate collection and proper identification.

Brock, V. E. (1962). The experimental introduction of certain marine fishes from the Society Islands to the Hawaiian Islands. Honolulu, Hawai`i Economic Planning and Coordination Authority.
A final report of a study to selectively introduce some species of fish from the Society Islands into the Hawaiian Islands. This report deals with the preliminary studies of fish selection, transportation to the Hawaiian Islands, their release and finally cases of their recapture.
Records concerning Kane`ohe Bay:

October 10, 1956.	(Tarao) Epinephelus merra - 469 released from Coconut Island
October 10, 1956.	(Toau) Lutrianus vaigiensis - 239 released from Tide House, Coconut Island
October 10, 1956.	(Aaravi) Lethrinus meriatus - 3 released from Tide House, Coconut Island.

Brostoff, W. N. (1985). "Seaweed grazing and attachment by the nereid polychaete *Playtynereis dumerilii*." Proc. 5th Intern. Coral Reef Congr., Tahiti 4: 3-8.
Certain seaweeds able to form adventitious holdfasts appear to propogate in response to grazing by the herbivorous polychaete *Platynereis dumerilii*. While *Platynereis* is found on and grazes ten common species of seaweeds in Kane`ohe Bay, O`ahu, it attaches a lesser number to the substratum and causes permanent attachment and regrowth in only the red algae *Acanthophora spicifera, Ceramium fimbriatum* and *Griffithsia tenuis*. Holdfasts of *Acanthophora* can be classified into polychaete-induced or naturally developed based on the presence of conspicuous bite marks and orientation of the attached axes. In back-reef areas where the predominant substratum is sand and coral rubble, polychaete-attached *Acanthophora* constitutes 85% of the population, although 100% of thalli show evidence of grazing. At sites where *Acanthophora* grows on solid rock substrata, there is less evidence of polychaete-induced attachment and grazing.

Brownscombe, A. K. (1965). An Ethological Study of the Shore Crab, *Metapograpsus messor* (Forsskal) in O`ahu, Hawaiian Islands. Depart. Zoology. Honolulu, University of Hawai`i**:** 100.
The behavior of the crab, *M. messor,* was studied from an ethological viewpoint, both in the laboratory and in the field. Cyclic effects of the environment on the crab behavior were investigated. Various areas around O`ahu were studied, but the area of the concentrated population study was at Coconut Island in Kane`ohe Bay where the population reaches its greatest density found on O`ahu. The behavioral repertoire of the crab appeared to consist of 28 discrete behavioral units--the feeding and locomotion behaviors are remarkably complex considering the simplicity of the central nervous system. Dominance hierarchies were not apparent in the field, but dominance according to sex and size was established in the laboratory under enforced crowding conditions. Cyclic fluctuations in environmental light intensity, tides, and temperature have a profound effect on producing periodic behavioral patterns in the crab. A diurnal rhythm was revealed from population numbers, feeding rate, number and percentage of animals feeding at hourly intervals and the distribution of activities. Melanophore expansion had a rhythm corresponding to the diurnal activity rhythm. Territorial behavior was not present, and there was no tendency toward social cooperation.

Bryan, W. A. (1915). Natural History of Hawai`i. Honolulu, Hawaiian Gazette Co. Ltd.
A general history of the Hawaiian people, the geology and geography of the islands, the native and introduced plants and the animals of the islands. There are two chapters on the flora and fauna of coral reefs in which is mentioned finding *Dendrophyllia manni* growing on the edge of a small coral

island in Kane`ohe Bay. *Opheodesoma spectabilis* was found to be common in Pearl Harbor and Kane`ohe Bay.

Burdick, J. K. (1969). The feeding habits of nehu (Hawaiian anchovy) larvae. Dept. Of Oceanography. Honolulu, Univ. Of Hawai`i**:** 54 pp.
Nehu larva from S.E. Kane`ohe Bay were collected with a 1-m net and a plankton purse seine. The food of the larvae was mostly small copepods. Newly feeding larvae ate mostly nauplii, but changed their diet to copepods as they grew larger. Copepods were the selected food items. Nehu larvae do not have the very low feeding incidence often ascribed to these fishes.

Burgess, P. (1995). "Strangers in Hawai`i." Hawaiian Shell News 43: 12.
Description of *Bulla vernicosa* Gould 1859 abundant on sand bar in mid-Kane`ohe Bay, 1954; probably arriving from Guam.

Burns, D., C. Andrews et al. (1984). "Microbial biomass, rates of DNA synthesis and estimated carbon production in Kane`ohe Bay, Hawai`i." Bull. Mar. Sci. 34: 346-357.
Estimates were made of microbial biomass and production in the water column and unconsolidated sediments in a transect across the barrier reef of Kane`ohe Bay, O`ahu, Hawai`i over a 5-week period. Cell-associated parameters measured were chlorophyll alpha and adenosine-5'-triphosphate (ATP). The total biomass of microorganisms in the water column and coral sands ranged from11.5 to 99.8 mu g C liter-1 and 281 to 941 mu g C cms-3, respectively. Total microbial community production ranged from 3.3 to 17.4 mu g C liter-1 h-1 in the water column, and from 11.3 to 58.2 mu g C g-1 (dry wt) h-1in the sediments. Total depth integrated microbial production in the sediments exceeded that in the overlying water by a factor of 100 when expressed on an areal basis. Estimates for microbial carbon production in coral reef rubble are equivalent to, or exceed previous estimates for, the total coral reef.

Byrne, J. E. (1962). Observations on the behavior of parrotfishes with particular attention to the mucous envelope. Department of Zoology . Honolulu, Univ. of Hawai`i.
A study summarizing the literature published on the mucous envelope formation in the parrotfish and giving observations on the fish in Kane`ohe Bay. Observations included the effect of light, day/night cycles, and natural over unnatural (lab) environments on the mucous envelope formation. Studies were also done on the predator-prey relationship of the parrotfish to *Mulloidichthyes samoensis, Parupeneus porphyreus, Acanthurus sandvicensis, Parupeneus multifasciatus, Chaetodon miliaris* and *Kuhlia sandvicensis.* Species of parrotfish used: *Scarus dubius, Scarus perspicillatus*.

Byrne, J. E. (1970). "Mucous envelope formation in two species of Hawaiian parrotfishes (genus *Scarus*)." Pac. Sci. 24: 490-493.
Some parrotfishes have developed a unique capacity to form a mucous envelope at night. *Scarus dubius* and *S. perspicillatus* are two Hawaiian species that exhibit envelope-building behavior. Laboratory experiments indicate that envelope formation is promoted by darkness, and is inhibited by constant light. The completed envelope is a transparent, mucous cocoon surrounding the fish. A mass of glandular tissue was found in the buccal cavity of *S. dubius* and *S. perspicillatus*. It is suggested that this tissue is the envelope-producing gland

Campbell, L., P. et al. (1994). "Immunochemical characterization of eukaryotic ultraplankton from the Atlantic and Pacific oceans." J. Plankton Res. 16: 35-51.
The eukaryotic algae are an important component of the ultraplankton (<5 mu-m diameter cells) and contribute substantially to the photosynthetic biomass of the oceans. Because of their small size, individual species cannot be easily distinguished by traditional or epifluorescence microscopy. To examine the composition of the eukaryotic ultraplankton assemblage, immunofluorescence probes produced to strains thought to be representative of the ultraplankton (*Emiliania huxleyi* clone BT-6; *Pycnococcus provasolii* clone OMEGA-48-23; *Pelagococcus subviridis* clone PELA CL2; *Thalassiosira oceanica* clone 13-1; unidentified chlorophyte clone B6125) were used to identify and enumerate individual cell types in samples from the North Atlantic (Gulf of Maine and adjacent slope) and the subtropical North Pacific (Station ALOHA and Kane`ohe Bay). *Emiliania huxleyi* was the most frequently recognized cell type at all sample locations throughout the euphoric zone, varying from 1 to 7% of the total eukaryotic algae. Counts include both lith-bearing and naked forms, so are the first recorded total counts for *E. huxleyi. Pycnococcus provasolii* was also observed at all sampling locations, although it appeared to be more important at offshore stations than coastal or Kane`ohe Bay. In surface waters, where the prasinophyte marker pigment prasinoxanthin is below the level of detection by HPLC analysis (e.g. station ALOHA), an immunofluorescence assay provides an alternative means to quantify this cell type. *Pelagococcus subviridis* was observed throughout the Gulf

of Maine and at Station ALOHA, but was rarer (generally <1% of total counts), and it was absent or below the limit of detection at Kane`ohe Bay. *Thalassiosira oceanica* was also rare in the Gulf of Maine, where it occurred mainly in the mixed layer. The chlorophyte B6125, a subtropical isolate, was more abundant in Kane`ohe Bay than in the Gulf of Maine. In all, only a small proportion of the total eukaryotic algae (of which >60% were cells <3 mu-m diameter) could be accounted for by immunofluorescently labeled cells, which suggests the presence of numerous other species and a diverse assemblage. Moreover, the presence of cell types such as *E. huxleyi i*n a variety of geographic regions demonstrates the cosmopolitan nature of these ultraplankton species.

Canu, F. and R. S. Bassler (1927). "Bryozaires des Iles Hawai`i." Bull. Soc. des Sci. Nat. de Siene et Oise ser. 2. Fasc. 8 (suppl: 1-56.
A systematic study of the bryozoans collected by the Albatross expedition from the region of the Hawaiian Islands. Species collected in the Kane`ohe Bay area include: Fam. Escharellidae *Schizoporella crassomuralis* nov. sp. Albatross Stn. 4158-36-55 m., Moku Manu; Fam. Reteporidae - *Rhynchozoan nudum* nov. sp. Albatross stn. 4168-36-38 m., Moku Manu

Caperon, J. (1967). "Population growth in microorganisms limited by food supply." Ecology 48: 715-22.
The author suggests that the model for a number of different bacterial populations using a variety of both energetic and substantive food as the growth-limiting factor, is widely applicable as a density-dependent growth model. Data are presented to show that it is also applicable to the unicellular alga *Isochrysis galbana,* growing under limiting nitrate concentrations, and to several species of phytoplankton growing under limiting light intensity.

Caperon, J. (1968). "Population growth response of *Isochrysis galbana* to nitrate variation at limiting concentrations." Ecology 49: 866-872.
Initial uptake of nitrate by *Isochrysis galbana* is very rapid compared to the next synthesis step, thus the concentration of some form of internal rather than environmental nitrogen controls growth rate when the nitrogen supply is limiting. Under this assumption the steady-state growth rates are shown to fit a hyperbolic curve relating growth rate to the inferred internal nitrogen concentration.

Caperon, J., S. A. Cattell et al. (1971). "Phytoplankton kinetics in a subtropical estuary: eutrophication." Limnol. Oceanogr. 16(4): 599-607.
Kane`ohe Bay measurements of chlorophyll-a, primary productivity (14C), and nutrients (nitrate and phosphates) were taken over a four-month period to compare with data collected a decade earlier. The intent of this study was to investigate the enrichment effects of increased waste discharges over this period. The south sector was found to be highest in all parameters measured. The productivity index, however, showed no difference between sectors.

Caperon, J., W. A. Harvey et al. (1976). "Particulate organic carbon, nitrogen, and chlorophyll as measures of phytoplankton and detritus standing crops in Kane`ohe Bay, O`ahu, Hawaiian Islands." Pac. Sci. 30: 317-327.
Data are presented to show that the Kane`ohe municipal waste discharge into the southeastern corner of Kane`ohe Bay gives rise to high concentrations of particulate organic matter and chlorophyll-a. The data cover a period of 4.5 yr and show a continuing increase in particulate organic matter and chlorophyll-a and a significant increase in the particulate organic N:C ratio. It is shown that regression analyses of particulate organic C and N on chlorophyll-a can be used to estimate the phytoplankton and the detritus C and N concentrations in surface water samples from the eutrophic southeastern section of the bay. The differences in regression analyses results on samples from eutrophic waters as opposed to those from oligotrophic waters are discussed.

Caperon, J. and J. Meyer (1972a). "Nitrogen-limited growth of marine phytoplankton. I. changes in population characteristics with steady-state growth rate." Deep Sea Res. 19: 601-18.
Steady-state growth of phytoplankton in nitrate and ammonia limiting media was examined in continuous culture experiments. Growth rate cannot be directly related to observed nutrient concentration in a chemostat environment except perhaps in a long-term average sense. The results are consistent with an internal reservoir nutritional mechanism. Steady-state ammonium limited growth takes place without evidence of an internal reservoir, and nitrogen per cell remains constant over all growth rates studied. The relative variability of population carbon, nitrogen, chlorophyll-a, cell volume, and cell concentration with steady-state growth rate is examined in the context of using these indicators of the physiological state of the population, rather than environmental parameters, to determine steady-state nutrient-limited growth rate.

Caperon, J. and J. Meyer (1972b). "Nitrogen-limited growth of marine phytoplankton. II. uptake kinetics and their role in nutrient limited growth of phytoplankton." Deep Sea Res. 19: 619-632.
The kinetics of nutrient uptake for nitrate ions and ammonium ions is developed for several species of phytoplankton. A derived linear function correlating the maximum uptake rate parameter and the preconditioning growth rate of the population, combined with the findings of part I of this study, provides a model that relates steady-state growth rate to environmental substrate concentration.

Caperon, J., D. Schell et al. (1979). "Ammonium excretion rates in Kane`ohe Bay, Hawai`i measured by a ^{15}N isotope dilution technique." Mar. Biol. 54: 33-40.
Ammonium ion uptake and excretion rates were measured in water samples taken from Kane`ohe Bay, O`ahu, Hawai`i, by monitoring the ^{15}N/(^{15}N +^{14}N) isotope ratio in dissolved ammonium ion in incubated samples which had been spiked with ^{15}N-labeled ammonium ion. High excretion rates appeared to be associated with high standing crops of microzooplankton organisms passing a 0.333 mm mesh gauze), but the actual excretion was due primarily to smaller organisms (less than 0.035 mm in nominal diameter). Preliminary results indicate that excretion rates were substantially higher during the night than during the day, and that on the average daily uptake and excretion of ammonium ion were roughly in balance.

Carayannis, G. P. (1967). The barium content in the calcareous skeletal materials of some recent and fossil corals of the Hawaiian Islands. Honolulu, Univ. of Hawai`i.
A study involving ion concentrations of the skeletal materials of some corals. Aragonite-calcite ratios of living and fossil corals (Madreporaria) were determined with a Temp-Pres D-1, X-ray diffraction unit. Barium content was measured with a Perkin Elmer 303 atomic absorption spectrophotometer. Calcium determinations were made with a Beckman DU flame photometer. The corals were collected from the western side of Coconut Island, Kane`ohe Bay.

Caspers, H. (1980). "Fauna adapted to inhabiting the sponge Damiriana Hawaiiana in Kane`ohe Bay, Hawai`i (Abstr.)." Int. Symp. Biol. and Manag. Mangroves and Trop. Shallow Wat. Commun. 2: 20.

Caspers, H. (1985). "The brittle star, Ophiactis savignyi (Muller & Troschel), an inhabitant of a Pacific sponge, Damiriana Hawaiiana de Laubenfels." Echinoderms 1984-1985: 603-607.

Cass, P. H. (1967). Some aspects of the biology of the gastropod genus *Hipponix* on O`ahu, Hawai`i. Depart. of Zoology. Honolulu, Univ. of Hawai`i,**:** 62.
A study examining the differences among the three subtidal, rock dwelling species of *Hipponix* occurring on O`ahu, using taxonomic as well as biochemical means. Their modes of feeding and reproduction are compared with other closely related genera. Analysis of amino acids by paper chromatography suggested that the three species are distinct. The other methods used by the author came to this same conclusion. The specimens were collected in Kane`ohe Bay as well as in other areas of O`ahu.

Castro, P. (1966). Checklist of the commensal decapod crustacea of the Hawaiian Islands. Depart. Zoology. Honolulu, Univ. of Hawai`i**:** 64.
A complete review of the commensal decapods of the Hawaiian Islands. In addition to the material collected in the field, those commensal association decapods which have been reported in the literature are also included. A total of 31 commensal is listed: 17 natantian decapods and 14 brachyurans. The commensal nature of some of these forms is in question. Madreporian corals serve as hosts for the largest number of species. Other hosts are Echinoidea, Porifera, Asteroidea, Pelecypoda, Antipatharia, Polycheata, Holothuroidea and Gastropoda.

Castro, P. (1969). Symbiosis between *Echinoecus pentagonus* (Crustacea, Brachyura) and its host in Hawai`i, *Echinothrix calamaris* (Echinodea). Dept. of Zoology. Honolulu, Univ. of Hawai`i**:** 173 pp.
The symbiosis between *Echinoecus pentagonus* and its host in Hawai`i, the diademitid sea urchin *Echinothrix calamaris* , was studied from specimens collected in Kane`ohe Bay to show how physiological, behavioral and morphological adaptations are involved in the establishment of a dynamic equilibrium between the partners. Male and juvenile females live on the host's peristome, while adult females are confined to the host's rectum, where calcification of the periproct produces a gall-like structure. The feeding habits, nutrition, physiological mechanisms, energy budget and reproduction of the symbiotic crab are discussed in terms of the relationship to the sea urchin host.

Castro, P. (1978). "Settlement and habitat selection in the larvae of *Echinoecus pentagonus* (A. Milne Edwards) a brachyuran crab symbiotic with sea urchins." J. exp mar. Biol. Ecol. 34: 259-270.

Habitat selection by the settling larval stage of *Echinoecus pentagonus* (A. Milne Edwards) collected from Kane`ohe Bay, a crab inhabiting the rectum and peristome of sea urchins, was investigated by analyzing orientation to the host and the factors eliciting metamorphosis in the laboratory reared larvae. Results suggest a positive orientation to gravity and a negative response to light coupled with a chemical reaction to host material which provide the behavioral mechanism which enables the megalopa to find a host and establish the association.

Chadwick, N. E. (1986). Aggressive interactions of the solitary coral, *Fungia scutaria* (Lamarck). Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 350-360.

The solitary free-living coral *Fungia scutaria* caused unilateral tissue damage to colonial corals in over 93% of 277 natural contacts in Hawai`i. Macroalgae overgrew and smothered *F. scutaria* in all 52 natural cases observed. 41% of a population of *F. scutaria* occurred in contact with other species of live coral or algae with no significant difference between reefs. Th remainder of the population occurred in the midst of monospecefic aggregations or singly on reef flats. Large *F. scutaria* induced local tissue necrosis on corals in over 80% of field experimental contacts, while smaller individuals moved away and caused significantly less damage.

Chadwick, N. E. (1988). "Competition and locomotion in a free-living fungiid coral." J. Exp. Mar. Biol. Ecol. 123: 189-200.

This study examined the ecological importance and mechanisms of interspecific competitive damage and movement by the solitary free-living coral *Fungia scutaria* in Kane`ohe Bay. in Hawai`i. Over 40% of a population of *F. scutaria* occurred in contact with other species of live coral or algae, and *F. scutaria* caused unilateral tissue damage to colonial corals in >94% of 277 natural contacts. In contrast macroalgae overgrew and smothered *F. scutaria* in all cases observed. with no significant difference between reefs. Large *F. scutaria* induced local tissue necrosis on corals in over 80% of field experimental contacts, while smaller individuals moved away and caused significantly less damage. Laboratory and field experiments suggest that long distance movement may be via passive transport by water motion. The ability of some free living corals to actively damage or move away from encroaching corals may be important to their survival on reefs dominated by colonial species

Chase, R. G. (1969). Some aspects of the life history of the Iao, *Pranesus insularum insularum*, an Hawaiian atherinid. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 58 pp.

Description of general characteristics of the iao populations sampled in 1968-69 in the vicinity of Coconut Island and Lilipuna dock in Kane`ohe Bay. After March 1969 most of the iao in the sampling area disappeared, probably as result of spawning migrations.

Chave, E. H. and J. E. Maragos (1973). A history of the Kane`ohe Bay region. Atlas of Kane`ohe Bay. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Seagrant.

Chavez, E. M. (1986). Gametogenesis and origin of planulae in the hermatypic coral *Pocillopora damicornis*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 193-205.

Three colonies of *Pocillopora damicornis* were tagged on the reef flat of a fringing reef in Kane`ohe Bay, sampled every 2-3 days in summer 1983 and prepared for histological study. The ability of single colonies and single polyps to produce larvae over a period of two consecutive monthly cycles is described.

Cheroske, A. G., S. L. Williams et al. (1996). "The effects of physical disturbance on Hawaiian algal turf communities (Abstr.)." Ann. Benthic Ecology Meeting, 7-10 Mar 1996: 26.

Biological disturbance (herbivory) commonly controls coral reef algal communities. However, in coral reef environments that are, for example, high-energy or overfished, physical disturbance may also control algal communities. On a reef flat (Kane`ohe Bay, HI), algae growing on rubble were subjected to 3 levels of experimental tumbling (0, ambient, 3x), a disturbance that clearly is evident in the bay. After 3 months, algal biomass was significantly reduced by 16% between the non-tumbling and ambient treatments and disturbance-tolerant turfs and crusts were more prevalent on less disturbed rubble. Turfs were also the most abundant algal functional form in Kane`ohe Bay. Water flow measurements over the reef flat correlated positively with rubble tumbling rates, linking large-scale, oceanic processes with small-scale disturbance patterns. This study is one of the first demonstrating that chronic physical disturbance can control coral reef algal communities.

Chiappa, C. X., C. M. Gallardo et al. (1996). "Feeding behavior of the Hawaiian anchovy *Encrasicholina purpurea* Fowler (Pisces: Engraulidae) in Kane`ohe Bay, Hawai`i." Ciencias Marinas 22: 73-89.

In this paper, data on growth of the encephalon, sense organs and other feeding-related structures in *Encrasicholina purpurea* are analyzed. Allometric indexes of length of the different parts of the encephalon in relation to standard length (SL) were obtained. Growth of ocular lenses is isometric in organisms less than 25 mm SL, whereas positive allometric values were obtained for individuals 25+ mm SL. Growth of pectoral fins showed a similar pattern. During the life history of this species, visual perception is more important than olfactory sense for prey detection. Only larvae display filter-feeding, while adults feed through deglutition and biting.

Chu, G. W. T. C. (1952). "First report of the presence of a dermatitis-producing marine larval schistosome in Hawai`i." Science 115: 151-153.

A description of a larval schistosome tentatively identified as *Cercaria littorinalinae* from marine snails, *Littorina pintado* Wood collected from Moku Manu (Bird Island) near Kane`ohe, O`ahu.

Clark, A. H. (1949). "Ophiuroidea of the Hawaiian Islands." Bishop Mus. Bull. 195: 1-133.

A taxonomic study of the ophiuroids from the Hawaiian Islands based primarily upon the collections by the Albatross in 1902. Records of collections from Kane`ohe Bay (with date of collection): *Ophiactis savigny*i (Muller and Troschel) (1933 and 1942) *Ophiactis modesta* Brock (1933). The author includes a list of species taken in shore collecting but rather than listing the species from the various localities, they are all presented as the Hawaiian collection.

Clark, H. L. (1925). "Echinoderms other than sea stars." Bishop Mus. Bull. 27: 89-111.

A report on the echinoderms other than sea stars collected by the *Tanager* Expedition. The collection is now housed in the Bishop Museum.

Clarke, T. A. (1971). "The ecology of the scalloped hammerhead shark, *Sphyrna lewin*i in Hawai`i." Pac. Sci. 25: :133-44.

Kane`ohe Bay is a pupping ground for the scalloped hammerhead shark. This investigation found the pups to be most abundant between April and October. While in the bay for a maximum of three to four months, the pups stay in the most turbid areas by day and move out at night to reef areas where they feed on reef fishes and crustaceans. As many as 10,000 pups per year pass through Kane`ohe Bay. Except during the delivery and breeding season -April to October- stomach contents indicate that adult hammerheads are pelagic.

Clarke, T. A. (1973). Fishes of the open water. Atlas of Kane`ohe Bay: A Reef System Under Stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i, Sea Grant. UNIHI-SEAGRANT-TR-72-01**:** 99-100.

Brief description of the common pelagic fish species found in Kane`ohe Bay, based on observations and anecdotal reports.

Clarke, T. A. (1976). Fishes of the open waters of Kane`ohe Bay, App. 2.6 Kane`ohe Bay Water Resources Data Evaluation**:** 207-234.

Clarke, T. A. (1989). "Seasonal differences in spawning, egg size and early development time of the Hawaiian anchovy or nehu, *Encrasicholina pupurea*." Fish. Bull.

Detailed information is given on the factors affecting spawning and development success for the Hawaiian anchovy, *Encrasicholina pupurea.* All material was collected form Kane`ohe Bay in ca. 1988.

Clarke, T. A. (1992). "Egg abundance and spawning biomass of the Hawaiian anchovy or Nehu, *Encrasicholina purpurea*, during 1984-1988 in Kane`ohe Bay, Hawai`i." Pac. Sci. 46: 325-343.

In Kane`ohe Bay, Hawai`i (USA), nehu (Hawaiian anchovy, *Encrasicholina purpurea*) eggs were found primarily in areas where water depth was greater than 10-12 m and were infrequently encountered near reefs, shorelines, or other shallow areas. Eggs were usually most abundant near the centers of one or both of the two large basins; the more enclosed southern basin usually accounted for the majority of the total eggs present. Nehu eggs were present throughout the year, but abundance was usually higher between July and February or March. There was considerable shorter time-scale variation in egg abundance, but there was no apparent underlying periodicity other than the annual cycle. Egg abundance was poorly correlated with measured environmental factors; the only potential relationship was that abundance tended to be low during the season of strong northeast trade winds. Egg abundance in Kane`ohe Bay was poorly correlated with abundance in Pearl Harbor, Hawai`i, the other major area where nehu are found. Total numbers of eggs present in Kane`ohe Bay reached about 10-9 during peaks.

Clarke, T. A. (1996). "Reproductive biology and egg abundance of the yellowtail scad or Omaka, *Atule mate* (Carangidae), in Kane`ohe Bay, Hawai`i." Pac. Sci. 50: 93-107.
Yellowtail scad or 'omaka, *Atule mate* (Cuvier & Valenciennes), spawn mostly between March and September or October, but there is considerable interannual variation in length of the season and egg density in Kane'ohe Bay. Spawning occurs principally in open areas of the bay, with highest egg abundances in the southern section. Almost all adult 'omaka taken in the bay were reproductively active. More than two-thirds were males, which also routinely reached sizes larger than the largest female. Sex ratio and proportion of impending or recent spawners among females differed between day and night samples; all females in day samples were actively spawning. Adults probably move into the bay only for spawning and thus represent a biased sample of the sex ratio and spawning frequency of the population associated with the bay at any given time. Batch fecundity of females 188-232 mm standard length ranged from 63,000 to 161,000; mean relative fecundity was 741 eggs per gram. The standing stock of 'omaka associated with the bay during the peak spawning season is probably at least 800-1600 kg or 5000-10,000 adults. Current annual catch of 'omaka in the bay is a large fraction of the estimated standing stock, but the latter could be much higher if spawning frequency were underestimated or individual fish did not spawn throughout the entire season.

Clarke, T. A. (1987). "Fecundity and spawning frequency of the Hawaiian anchovy or nehu, *Encrasicholina purpurea*." U.S. Fish Wild. Serv. Fish. Bull 85: 127-138.
Female nehu (*E. purpurea*) can begin spawning at 35 mm standard length; almost all fish over 40 mm SL from Kane`ohe Bay were mature and in spawning condition. Mature females were found in all months of the year. Females from summer (May-October) had higher fecundity and relative cost per batch than fish from winter (November-April). In nehu and most other anchovies, fecundity appears to increase exponentially with weight. Nehu appear to be distinguished from other species by a higher exponent and consequently greater increase in relative fecundity over the reproductive size range. Nehu spawn during a short period 1 or 2 hours after sunset and begin hydrating ova only a few hours before spawning. Data on presence or absence of hydrated ova or postovulatory follicles along with differences in oocyte size in fish collected from throughout the diel cycle indicated that, after spawning, nehu can ripen a new batch of oocytes in 2 days and that most females spawn every other day.

Clausen, C. D. (1971). Effects of temperature on the rate of ^{45}calcium uptake by *Pocillopora damicornis*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 246-59.
Most of the data obtained was from samples taken at the end of three- and six-hour incubation periods at Kane`ohe Bay and Eniwetok Atoll. The amount of ^{45}Ca incorporated per hour was calculated and these rates were plotted against temperature. Rates based on samples taken after a three hour incubation were consistently higher at all temperatures than those taken after six hours, indicating an apparent decrease in the rate of ^{45}Ca incorporated with increasing incubation. The patterns of the curves, however, were similar for both incubation periods. The rate at which ^{45}Ca was incorporated increased exponentially with temperature from 12 deg whereas at 30 deg C it was again lower.

Clausen, C. D. (1972). Factors affecting calcification process in the hermatypic corals *Pocillopora damicornis and Porites compressa*. Dept. of Biology. Los Angeles, Loma Linda Univ.**:** 95 pp.
The effects of temperature and temperature acclimation on calcification in two coral species, *Pocillopora damicornis* and *Porites compressa,* were studied. *P. damicornis* showed both a 27°C and a 31°C temperature optimum, one or the other being dominant depending on the natural water temperature to which the coral was adapted. *P. compressa* may also have two optima, but the data are inconclusive. The optimum temperatures may indicate two isoenzymes or two alternative metabolic pathways for the calcification process.

Clausen, C. D. and A. A. Roth (1975). "Effect of temperature and temperature adaptation on calcification rate in the hermatypic coral *Pocillopora damicornis*." Mar. Bio. 33: 93-100.
Using ^{45}Ca incorporation into the coral skeleton as a measure of calcification rate, the effect of temperature on calcification rate was studied in the hermatypic coral *Pocillopora damicornis*. Temperature has a marked effect on rate - an effect that varies depending on the temperature history of the coral. *P. damicornis* showed both 27 and 31C temperature optima, one or the other being dominant depending on the natural water temperature to which the coral was adapted. The two optimum temperatures may indicate two isoenzymes or two alternate metabolic pathways involved in the calcification process. This research was conducted in Kane`ohe Bay, O`ahu, Hawai`i and at

Eniwetok Atoll, Marshall Islands.

Clutter, R. I. (1973). Plankton ecology. Estuarine pollution in the State of Hawai`i, Vol. 2: Kane`ohe Bay study, final report. D. C. e. a. Cox. Honolulu, Univ. of Hawai`i, Water Resources Research Center. 2**:** 187-213.
This study includes density, distribution, and diversity data for Kane`ohe Bay phytoplankton, microplankton, and macroplankton during the period of July 1968 to May 1969. These data are used to define similarities and differences in plankton populations in the various sectors of Kane`ohe Bay and to determine whether pollution has measurably affected the plankton community. Stressed conditions in the southern sector are evidenced by decreasing diversity, altered ecosystem structure, and decreasing plankton population stability.

Coles, S. L. (1973). Some effects of temperature and related physical factors on Hawaiian reef corals. Dept. of Zoology. Honolulu, Univ. of Hawai`i**:** 33 pp.
The effects of temperature on photosynthesis and respiration on four species of corals and of the combined effects of temperature, salinity and light on various physiological functions of *Montipora verrucosa* were investigated. Corals were collected from reefs in Kane`ohe Bay in 1970-71. Photosynthesis:respiration ratios showed significant decreases with increasing temperature for all four species, and coral growth and physiological functions were optimal was optimum at temperature approximating annual summer ambient maxima.

Coles, S. L. (1992). "Experimental comparison of salinity tolerances of reef corals from the Arabian gulf and Hawai`i. Evidence for hyperhaline adaptation." Proc. 7th Int. Coral Reef Symp. 1: 227-238.
The world-wide salinity tolerance of reef corals ranges considerably above and below the average salinity of open ocean seawater. Experiments in the Arabian Gulf and Hawai`i (specimens collected from Kane`ohe Bay, O`ahu) determined whether salinity tolerances of corals are altered by their salinity history. The lowest salinity tolerated by Gulf corals was 23$^{\square}$□□, which produced bleaching and partial mortality, compared to survival in good condition in Hawai`i at 20$^{\square}$□□ for *P. compressa* and at 25$^{\square}$□□ for Hawai`i *P. damicornis* and *M. verrucosa*. Acclimation experiments did not elevate the upper salinity tolerance of Gulf *P. compressa* above 49$^{\square}$□□, but lower tolerance could be altered to a level comparable to *Porites* in Hawai`i.

Coles, S. L. and P. L. Jokiel (1977). "Effects of temperature on photosynthesis and respiration in hermatypic corals." Mar. Biol. 43(3): 209-216.
Photosynthesis and respiration rates of the reef corals *Pocillopora damicornis* (Linn.), *Montipora verrucosa* (Lamarck) *Porites compressa* Dana and *Fungia scutaria* Lamarck were measured under controlled temperature conditions for specimens collected from Kane`ohe Bay and Enewetak in 1970-71 . Results indicate that coral metabolism is closely adapted to ambient temperature conditions. Tropical corals measured at Enewetak showed greater primary production compared to maintenance requirements at elevated temperatures than did subtropical varieties of the same species in Hawai`i. P:R ratios were significantly and negatively related with temperature between 18 and 31^{o}C for all Hawaiian corals, whereas at Enewetak this ratio generally showed a curvilinear relationship for this temperature range. Extrapolation of P:R ratios for Enewetak specimens at temperatures above 25^{o}C suggests lethal temperature for these corals to be 2-5^{o}C higher than for Hawaiian corals, in good agreement with experimental findings for temperature tolerance.

Coles, S. L. and P. L. Jokiel (1978). "Synergistic effects of temperature, salinity and light on the hermatypic coral *Montipora verrucosa*." Mar. Biol. 49: 187-195.
Temperature tolerance in a number of light and salinity regimes was measured for the reef coral *Montipora verrucosa* (Lamarck) collected from Kane`ohe Bay in 1972. Results indicate that tolerance is affected by salinity and light. Low salinity reduces the ability of the corals to survive short term exposure to elevated temperature, and high natural light intensity aggravates damage sustained by corals at high and low temperature. In long term growth experiments high light intensity caused substantial loss of zooxanthellar pigment, higher mortality rates, reduced carbon fixation and lowered growth rates at optimal temperatures at both upper and lower sublethal temperatures. Interactions between physical environmental factors appears to be most important near the limits of tolerance for a given factor. Acclimation capability was indicated, and was influenced by both thermal history and pigmentation state of stressed corals.

Coles, S. L., P. L. Jokiel et al. (1976). "Thermal tolerance in tropical versus subtropical Pacific reef corals." Pac. Sc. 30: 159-166.
Upper lethal temperature tolerances of reef corals collected in 1974 in Kane`ohe Bay and at Enewetak,

Marshall Islands were determined in the field and under controlled laboratory conditions. Enewetak corals survived in situ temperatures of nearly 34^{o}C, whereas 32^{o}C was lethal to Hawaiian corals for similar short term exposures. Laboratory determinations indicate the upper thermal limits of Hawaiian corals are approximately 2^{o}C less than congeners from the tropical Pacific, corresponding to differences in the ambient temperatures between the geographic areas.

Coles, S. L. and L. Ruddy (1995). "A comparison of water quality and reef coral mortality and growth in southeast Kane`ohe Bay, O`ahu, Hawai`i, 1990 to 1992 with pre-sewage diversion conditions." Pac. Sci. 49(3): 247-265.
Growth and mortality of the three dominant coral species occurring in Kane'ohe Bay were determined for four periods from November 1991 to January 1993 at four stations in the bay's southeast basin. Twelve water quality parameters were monitored biweekly to monthly at these stations from November 1991 to August 1992. Both water quality measurements and coral survival and growth indicated considerable improvement to conditions that prevailed when treated sewage was discharged into this area of Kane'ohe Bay. Mean concentrations for orthophosphate, nitrite + nitrate, ammonia, and chlorophyll a, and mean values for light extinction and sedimentation were significantly less than those measured during time of sewage discharge in 1976-1977. Means of all of these except orthophosphate were not significantly different from means measured in 1978-1979 during the first year after sewage diversion. Mean orthophosphate concentration was approximately double the mean of the first year after diversion, and this increase may relate to increased abundances of the green macroalgae *Dictyosphaeria cavernosa* (Forskal) Boergesen that have been observed in this section of the bay in recent years. *Montipora verrucosa* (Lamarck) survived and grew well throughout the study period at all four stations, including stations in areas where rapid mortality and minimal growth occurred for this species in 1969-1971. The other two species, *Porites compressa* Dana and *Pocillopora damicornis* (Linnaeus), showed different survival and growth patterns according to station location. Most rapid mortality and lowest growth generally occurred for *P. compressa* at the station most affected by land runoff in the southernmost section of the bay. However, the major cause of early mortality and poor growth of *Porites compressa* at that location was the nudibranch *Phestilla sibogae* (Bergh), which rapidly consumed tissues of corals transplanted to that station, suggesting that predators that control *P. sibogae* parasitism elsewhere in the bay are absent from that area. *Pocillopora damicornis* survival and growth declined at all stations throughout the study, and this species may have been affected by fish predation. Growth of *M. verrucosa* and *P. damicornis* showed significant positive relationships with water turbidity values within a range of up to ca. 1.0 NTU.

Coles, S. L. and R. Strathmann (1973). "Observations on coral mucus "flocs" and their potential trophic significance." Limnol. Oceanog. 18(4): 673-678.
Suspended mucus "flocs" were sampled selectively at Hawai`i and Eniwetok and analyzed for particulate carbon and nitrogen. Visible mucus flocs contain significant quantities of organic matter compared to microscopic suspended particle concentrations in the surrounding water. C:N ratios suggest that suspended mucus "flocs" are enriched with nitrogen compared to more recently secreted coral mucus or microscopic particulate organic matter.

Cook, C. B. (1971). Transfer of ^{35}S-Labeled material from food ingested by *Aiptasia* sp. to it's endosymbiotic zooxanthellae. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 218-224.
This report contains my preliminary results, a discussion of the pitfalls in this type of research, and suggestions regarding other approaches to problems of animal-to-alga transfer of materials. Specimens of *Aiptasia* sp. were collected from masses of the siphonaceous green alga *Dictyosphaeria intermedia* growing on reefs in Kane`ohe Bay, O`ahu.

Cook, S. B. (1969). "Experiments on homing in the limpet *Siphonaria normalis*." Anim. Behav. 17(4): 679-682.
In this paper I describe the homing cycle of *Siphonaria normalis*, the common pulmonate limpet found in the Hawaiian Islands. Given are the results of rock rotation experiments which tested the role of navigation by distant clues in homing and the results of displacement experiments performed to determine if dead-reckoning is necessary for limpet homing. The animals used in this study live on rocks in the intertidal zone of the outer shore of Coconut Island in Kane`ohe Bay, O`ahu, Hawai`i.

Cooke, W. J. (1976). Reproduction, growth and some tolerances of *Zoanthus pacificus* and *Palythoa vestitus* in Kane`ohe Bay, Hawai`i. Coelentrate Ecology and Behavior. G. O. Mackie. New York, Plenum.
Study of the reproductive biology of *Zoanthus pacificus* and *Palythoa vestitus* collected in Kane`ohe

Bay from the reef on the northeast side of Coconut Island in ca. 1975.

Cooke, W. J. (1977). Cnidaria (Colenterata) Class Hydrozoa. Reef and Shore Fauna of Hawai`i. Section 1: Protozoa through Ctenophora. D. M. Devaney and L. G. Eldredge. Honolulu, Bishop Museum press. B. P. Museum Spec. Publ. 64(1)**:** 70-104.
Description and taxonomic revision of hydrozoans for Hawai`i, including those collected by author in early 1970s in Kane`ohe Bay.

Cooke, W. J. (1984). "New scyphozoan record for Hawai`i: *Anomalorhiza shawi* Light, 1921, and *Thysanostoma loriferum* (Ehrenberg, 1835); with notes on several other rhizostomes." Proc. Biol. Soc. Wash. 97: 583-588.

Cooke, W. J., J. G. Grovhoug et al. (1980). A survey of marine borer activity in Hawaiian nearshore waters: Effects of environmental conditions and epifauna. 5th Int. Cong. Mar. Corrosion & Fouling, Graficas Orbe, Madrid.
Test exposures were conducted at various locations around the island of O`ahu, Hawai`i, to investigate the relationship of wood boring activity to environmental factors and surface epifaunal fouling. Data were collected from various field sites, exposures in a flow-through seawater microcosm facility, and drift wood borer communities. All test exposures were unpainted blocks of Douglas fir exposed for periods of 3-6 months in the field, and for one year in the experimental facility. Wide variation was found in borer activity between the various sites, even those less than 3000 meters apart in the same bay. Densities of teredinid borers ranged from 0 per block to about 6000/block (1 per 0.2 cm^3). At locations in Pearl Harbor and Kane`ohe Bay, reductions in borer activity were associated with epifaunal communities consisting of compound tunicates and tubicolous polychaetes. The results of this study show that borer and surface epifaunal populations do interact with each other, and the amount and kind of surface fouling can reduce borer activity.

Cooney, T. D. (1973). Yolk sac stage energetics of the larvae of three Hawaiian fishes. Dept. Of Oceanography. Honolulu, Univ. Of Hawai`i**:** 57 pp.
The energetics of yolk sac stage larvae of *Caranx mate, Etrumeus micropus* and *Abudefduf abdominalis* sampled from Kane`ohe bay were investigated under laboratory rearing conditions at 24^{o}C. Although the results do not support the existence of a physiological "critical period" at the time of yolk depletion, there exists a possibility of high mortality resulting from the switch from endogenous to exogenous food sources in the period following yolk depletion.

Cordover, R. D. (1975). Aspects of the natural history of the Hawaiian marine shrimp, *Penaeus marginatus*. Dept. Of Oceanography. Honolulu, Univ. of Hawai`i**:** 36 pp.
Adult and juvenile *P. marginatus* were studied in their deep water and nearshore environments at O`ahu, Hawai`i. General ecology and life history data are reported. Weekly sampling with a seine were taken at several study sites along the perimeter of Kane`ohe Bay.

Corn, C. (1967). Interim Report (as of January 1967) on the distribution and ecology of the family Ostreidae, in Kane`ohe Bay. Honolulu, KB Collection**:** 23.
A progress report and proposal for research concerning oysters in Kane`ohe Bay. Included is a taxonomic key for identification of species as well as a summary of the distribution of each species in the bay.

Cox, D. C., P. F. Fan et al. (1974). Estuarine pollution in the State of Hawai'i. Volume 2: Kane`ohe Bay Study, University of Hawai`i, Water Resources Research Center, Manoa**:** 444.

Cox, E. F. (1983). Aspects of corallivory by *Chaetodon unimaculatus* in Kane`ohe Bay, O`ahu. Dept. of Zoology. Honolulu, Univ. Of Hawai`i**:** 60.
Interactions between a corallivore, *Chaetodon unimaculatus*, and the two dominant coral species in Kane`ohe Bay were investigated. Because of its selective feeding, *C. unimaculatus* appears to have a significant effect on the growth and distribution of its preferred coral species, *M. verrucosa*.

Cox, E. F. (1986). The effects of predation on growth and competition in the corals *Montipora verrucosa* and *Porites compressa*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, Univ. of Hawai`i, Haw. Institute of Marine Biology. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 321-329.
Experiments evaluated the effects of predation by a selective corallivore (the one spot butterflyfish *Chaetodon unimaculatus*) on *Porites compressa*. Caged colonies of *M. verrucosa* had a vertical growth

rate of $9.71x10^{-3}$ cm d^{-1}. Uncaged colonies of this species that were exposed to predation had a vertical growth rate of only $3.92x10^{-3}$ cm d^{-1}. In the caged treatments *M. verrucosa* killed and overgrew *P. compressa* tissue, as predicted from laboratory experiments. In the uncaged pairs however, several colonies showed a reversal of dominance, with *P. compressa* killing branches of *M. verrucosa*.

Cox, E. F. (1986). "The effects of a selective corallivore on growth rates and competition for space between two species of Hawaiian corals." J. Exp. Mar. Biol. Ecol. 101: 161-174.

Cox, E. F. (1991). Interactions between trophic levels on coral reefs: scleractinian corals and corallivorous butterflyfishes in Hawai`i. Dept. of Biology. Albuquerque, Univ. Of New Mexico**:** 123 pp.
Resource use by coral-feeding butterflyfishes was studied at six sites in the Hawaiian islands, including one site in Kane`ohe Bay. There was little diet overlap between the specialist species *Chaetodon unimaculatus* and the generalist species *Chaeatodon multicinctus, C. ornatissimus* and *C. trifasciatus*. Although there was high diet overlap between the generalist species, *C. multicinctus* showed a strong feeding preference for the coral *Pocillopora meandrina*. *C. ornatissimus* fed on corals roughly in proportion to their abundance, and *C. trifasciatus*, contrary to laboratory feeding preferences shown for pocilloporid and montiporid corals, fed on *Porites* in the field. The specialist *C. unimaculatus*, preferred *Montipora* spp. at all sites, and there was no correlation between overall butterflyfish densities and coral cover at these sites.

Cox, E. F. (1992). "Fragmentation in the Hawaiian coral *Montipora verrucosa*." Proc. Seventh Intern. Coral Reef Symp, Guam 1: 513-516.

Cox, E. F. and S. W. Ward (1998). Effects of ammonium enrichment on reproduction in two Hawaiian corals, *Montipora verrucosa* and *Pocillopora damicornis*. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 61.
Colonies of *Montipora verrucosa* and *Pocillopora damicornis* were collected in early March 1997 from the perimeter of Checker Reef in Kane`ohe Bay. Colonies were distributed among 6 microcosm tanks, with 3 tanks randomly assigned to an ammonium enrichment treatment. Ammonium sulfate was dripped into tanks beginning in April 1997 and spawning of *M. verrucosa* was monitored during June, July, and August. There were no differences in the number of eggs per bundle or fertilization success between control and treated colonies. There was a significant decrease in mean egg size (control: 429 □m, SD=16, n=12 colonies; treatment: 408 □m, SD=14, n=8 colonies) and a trend towards increased chlorophyll per egg. Total fecundity was highly variable. With removal of one outlier colony in the nutrient treatment, there was a trend towards reduced fecundity in the treated colonies. Planulation in *P. damicornis* was assessed following the full moon in July. Controls released significant numbers of planulae, but nutrient treated colonies did not release any planulae. Planulae collected from control colonies settled equally well in aquaria containing seawater enriched with ammonium sulfate as in aquaria with just seawater. There were no differences in short term survival of planula with or without nutrient enrichment. Nutrient enrichment was ended 15 November 1997, and planulation monitored on the following full moon periods. No planulation in nutrient treated colonies was observed until the full moon of March 1998 when 5 of 6 previously nutrient enriched colonies released small numbers of viable planulae.

Cox, W. W. (1971). The relation of temperature to calcification in *Montipora verrucosa*. Dept. of Biology. Los Angeles, Loma Linda Univ.**:** 29 pp.
Various test indicate that inorganic exchange between labeled Ca^{45} and unlabeled calcium is not a significant factor affecting experiments using this isotope in measurements of coral calcification. Tests run at temperatures from $17^{o}C$ to $34^{o}C$ indicate that the optimum temperature for this species sampled from Kane`ohe Bay is around $30^{o}C$.

Cross, R. R. (1968). "Introduced shells not to be collected." Hawaiian Shell News 16: 7.

Cuttress, C. E. (1977). Subclass Zoantharia. Reef and Shore Fauna of Hawai`i. Section 1: Protozoa through Ctenophora. D. M. Devaney and L. G. Eldredge. Honolulu, Bishop Museum press. B. P. Museum Spec. Publ. 64(1)**:** 130-147.
Description and taxonomic revision of zoantharians for Hawai`i, including those collected or observed by author in Kane`ohe Bay.

Dade, W. and B. T. Honkalehto (1986). Bryozoan assemblages in modern coral reefs of Kane`ohe Bay. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, Univ. of

Hawai`i, Haw. Institute of Marine Biology. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 35-51.

Environmental preferences of the 57 bryozoan species collected in Kane`ohe Bay indicate three distinct assemblages. Observed species distributions reflect not only availability of substrate but also changes in environmental factors with depth and distance from shore. Centers of abundance and diversity are limited to coral and bedrock dominated habitats of reef environments, and bryozoans are virtually absent from sand dominated environments.

Dade, W. and B. T. Honkalehto (1986). Common ectoproct bryozoans of Kane`ohe Bay, O`ahu. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, Univ. of Hawai`i, Haw. Institute of Marine Biology. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 52-65.

A catalog of short descriptions and illustrations of 57 species of bryozoans collected during summer 1983 in Kane`ohe Bay. Classification is based on colony form, degree of calcification and shape of zooecial aperature.

Dall, W. H., P. Bartsch et al. (1938). "A manual of the recent and fossil marine pelecypod mollusks of the Hawaiian Islands." Bishop Mus. Bull. 153.

A study of recent and fossil marine pelecypods including a taxonomic discussion and a discussion of the two theories of organism establishment on the Hawaiian Islands: the drift theory versus the larval swimming theory.

Danforth, C. G. (1970). "Epicaridea (Isopoda) of Hawai`i." Bull. Southern Calif. Acad. Sci. 69: 27-31.

A description of a new form of the Bopyrid *Ionella murchisoni* n. sp. This is the sixth species of parasitic isopod in the Epicaridea suborder to be reported from the State of Hawai`i and is the first of this genus to be found outside of Chile. The isopod was found in Kane`ohe Bay on Sand Island in the right gill chamber of the host shrimp *Callianassa* sp.

Danilowicz, B. S. (1995). The origin of recruitment pulses in the Hawaiian damselfish *Dascyllus albisella* (Abstr.). Twenty Third Benthic Ecology Meeting, New Brunswick, NJ, Rutgers Inst. Marine Coastal Sciences.

The distance reef fish larvae before recruitment is under debate: do larvae recruit to their natal reefs, or do they disperse and recruit to distant reefs? The degree of localized recruitment in *D. albisella* was tested by monitoring spawning and recruitment daily and weekly in Kane`ohe Bay, O`ahu, in 1992. Spawning dates of recruits were back-calculated using otolith rings. No evidence for localized recruitment was found, as spawning and back-calculated spawning of recruits did not overlap on a daily or seasonal basis. Recruitment occurred in distinct pulses from January through July, and these events were highly correlated with peaks in water temperature. Given the seasonal changes in oceanic currents in the islands, recruitment pulses in this species were likely to originate from distinct spawning episodes occurring at upcurrent.

Danilowicz, B. S. (1997). "The effects of age and size on habitat selection during settlement of a damselfish." Environ. Biol. Fishes 50: 257-265.

The adults of many coral reef fish species are site-attached, and their habitat is selected at the time of settlement by their larvae. The length of the planktonic larval period varies both intra- and interspecifically, and it is unknown how the age and size of larvae may affect their selection of habitat. To investigate the influence of age and size on habitat selection, I collected newly settled Hawaiian domino damselfish, *Dascyllus albisella*, daily from grids containing three coral species at four locations in Kane`ohe Bay, O`ahu, Hawai`i. I recorded the coral species each fish was collected on, and measured and aged (by otoliths) the collected fish. The results indicate that the coral *Pocillopora meandrina* was selected by settling fish significantly more than the other two coral species. Younger and smaller larvae selected this coral species more frequently than older/larger larvae. In addition, younger/smaller individuals were found more commonly inside the bay than older/larger settling larvae. Differences in the choice of coral species and location of settlement may be partly due to ontogenetic differences in the sensory capacities of larvae to detect corals, conspecifics, and predators, or to a larval competency period.

Danilowicz-Bret, S. (1997.). "A potential mechanism for episodic recruitment of a coral reef fish." Ecology 78: 1415-1423.

Most marine animals have complex life histories with dispersive larvae. Recruitment to marine populations should then result from larval production external to each population (i.e., an open population). However, it has been suggested that self-recruitment to these populations may also be important (i.e., a closed system). The contribution of these two sources of larval supply to recruitment were explored using the Hawaiian domino damselfish, *Dascyllus albisella*. Spawning and recruitment were monitored daily and weekly in the southeast section of Kane`ohe Bay, O`ahu, Hawai`i, during 1992. Daily increment formation in the otoliths of this species was validated, and the spawning dates of arriving recruits were back-calculated using otolith rings. Since this section of Kane`ohe Bay is sheltered, with a water exchange rate of only 26% per day, I predicted larvae would be retained (passively and behaviorally) after hatching; therefore recruitment from locally spawned larvae would be important. Contrary to my prediction, no self-recruitment was evident. Spawning times and back-calculated production of recruits did not overlap on a daily or seasonal basis. During the first half of the year, recruitment pulses were large and associated with rises in water temperature. During the latter half of the year, recruitment rates were lower and recruitment events were not associated with water temperature. Given the apparent absence of self recruitment and the seasonal pattern of oceanographic currents in the Hawaiian Islands, recruitment episodes in the, first half of the year may have originated from distinct reproductive episodes at upcurrent islands. Recruitment episodes in the latter half of the year may have resulted from a general increase in *D. albisella* spawning external to Kane`ohe Bay.

Davis, K. K. (1971). The levels of residual chlorine in Kane`ohe Bay, O`ahu, Hawai`i and the effects of residual chlorine on coral planulae. Dept. of Zoology. Honolulu, Univ. of Hawai`i: 62.
The purpose of this study was to determine the level of chlorine present in the field and the effects of chlorine on coral planulae. The field studies consisted of measuring the chlorine concentration of seawater from the vicinity of two sewer outfalls in southern Kane`ohe Bay. Water samples were collected from the surface boils in dark glass bottles. Subsurface samples were collected with a Van Doren water sampler. Laboratory studies involved determining the lethal and sublethal effects of different concentrations of hypochlorite solutions for various time periods on the planulae.

Davis, L. V. (1967). "The suppression of autotomy in *Linckia multiflora* (Lamarck) by a parasitic gastropod, *Stylifer linckiae* Sarasin." Veliger 9: 343-346.
A study conducted at the Hawai`i Marine Laboratory, Kane`ohe Bay, with specimens collected in Kane`ohe Bay, investigating the host-parasite relationship of *L. multiflora* and *S. linckiae*. In this relationship, the gastropod reduces the high rate of spontaneous autotomy of the arms of the starfish.

de Laubenfels, M. W. (1950). "The sponges of Kane`ohe Bay, O`ahu." Pac. Sci. 4(1): 3-36.
A taxonomic study of the sponges in Kane`ohe Bay especially in the vicinity of Coconut Island. About a dozen species were common, another dozen were rare. The more common species of sponges of Kane`ohe Bay are described and a key is provided for their identification.

de Laubenfels, M. W. (1957). "New species and records of Hawaiian sponges." Pac. Sci. 11: 1-236.
A paper based oh three years of taxonomic study of the Hawaiian sponges. *Myxilla rosacea* (Lieberkuhn) Schmidt found in Kane`ohe Bay was previously described in de Laubenfels, 1950.

Deardorff, T. L. (1987). " Redescription of *Pulchrascaris chiloscyllii* (Johnston and Mawson, 1951) (Nematoda: Anisakidae), with comments on species in *Pulchrascaris* and *Terranova*." Proc. Helmintholog. Soc. Wash 54: 28-39.

Deardorff, T. L. a. S., F. G. (1983). "Nematode-induced abdominal distention in the Hawaiian puffer fish, *Canthigaster jactator* (Jenkins)." Pac. Sci. 37: 45-48.
A heavy infection in the body cavity of two sharp-nosed puffer fish, *C. jactator* , by a nematode, *Philometra* sp., is reported. The large number and size of the nematodes caused a conspicuous protrusion of the abdomen in both fish. Other infected specimens of *C. jactator* were observed in the waters of Kane`ohe Bay, O`ahu, Hawai`i.

D'Elia, C. F. (1977). "Uptake and release of dissolved phosphorus by reef corals." Limnol. Oceanog. 22(2): 301-315.
The fluxes of dissolved reactive, organic, and total phosphorus into and out of non-feeding corals were measured by chemical and radiochemical techniques. A net uptake of reactive phosphorus from seawater by corals containing zooxanthellae was not, at typical ambient phosphorus levels, sufficient to offset simultaneous losses of organic P. Although the symbiotic corals tested cannot obtain all of the phosphorus they require by means of reactive phosphorus uptake at typical environmental concentrations, the ability of corals to obtain part of it in this manner, and the presence of mechanisms for efficient recycling of phosphorus within the symbiotic association, may help enable corals to flourish in waters low in phosphorus sources.

Demartini, E. E., F. A. Parrish et al. (1996). "Barotrauma-associated regurgitation of food: Implications for diet studies of Hawaiian pink snapper, *Pristipomoides filamentosus* (family Lutjanidae)." USNMFS Bull. 94: 250-256.

Juvenile (128-244 mm fork length) pink snapper, *Pristipomoides filamentosus*, were caught by hook and line from 60-90 m depths offshore of Kane`ohe Bay, windward O`ahu, Hawai`i, during February-August 1994. About one-half of the 180 specimens were intercepted by scuba divers 15-18 m below the sea surface and individually "bagged" live before they were retrieved for the remaining distance to the surface. The other half were retrieved directly by fishing line to the surface ("unbagged"); these latter fish thus remained at a continual risk of prey loss from regurgitation while they were stressed by the full extent of pressure change. The retained stomach contents of bagged and unbagged fish were compared on the basis of volume and type of food -and on the size of individual prey items. Bagged samples of juvenile snapper on average retained a 116% (95% CI=70-157%) greater volume of prey than unbagged snapper; bagged snapper also had more types and greater maximum body sizes of prey than did unbagged fish. These results are discussed in terms of designing quantitative diet studies for juvenile snapper and other deep-water physoclistous fishes.

Devaney, D. M. (1967). "An ectocommensal polynoid associated with Indo-Pacific echinoderms, primarily ophiuroids." Occ. Pap. Bernice P. Bishop Mus. 23: 287-304.

A commensal polynoid from Hawai`i and other Pacific localities is described and identified as *Hololepidella nigropunctata*. The generic status of *Hololepidella* is reviewed and two additional morphological features are considered as possible criteria for separating this genus from other polynoid genera. The polynoid is very commonly associated with the brittlestar *Ophiocoma dentata* and less frequently with *O. brevipes* and *O. erinaceus* in Hawaiian waters. Biological observations indicates the following: Only single individuals are found on ophiuroid hosts, but more than one have been recovered from the asteroid, *Acanthaster planci.*

Devaney, D. M. (1968). The systematics and post-larval growth changes in ophiocomid brittlestars. Depart. Zoology. Honolulu, University of Hawai`i**:** 292.

A comprehensive review of the subfamily Ophiocominae in terms of its systematic structure. This study involved: (a) determining the extent and the limitations of genera and species concept and (b) analyzing the phylogenetic relationships more thoroughly. These two points are realized through new interpretation of taxonomic criteria, some presented for the first time, according to the author. Numerous collections were made on O`ahu - *Ophiocoma pica* Muller and Troschel was found in Kane`ohe Bay. A representative series of specimens were given by the author to the Hawai`i Institute of Marine Biology, Coconut Island.

Devaney, D. M. and L. G. Eldredge (1977). Class Scyphozoa. Reef and Shore Fauna of Hawai`i. Section 1: Protozoa through Ctenophora. D. M. Devaney and L. G. Eldredge. Honolulu, Bishop Museum press. B. P. Museum Spec. Publ. 64(1)**:** 108-118.

Description and taxonomic revision of hydrozoans for Hawai`i, including those collected by author in early 1970s in Kane`ohe Bay.

Devaney, D. M., M. Kelly et al. (1976). Kane`ohe: a history of change (1778-1950). Honolulu, U. Army Corps of Engineers, Pacific Ocean Division**:** 271.

Comprehensive and richly illustrated compendium of historical information for the Kane`ohe Bay watershed, including changes in Kane`ohe Bay water quality, dominant biotopes and summary of species introduced into Kane`ohe Bay up through 1958

Disalvo, L. H. (1969a). Regeneration functions and microbial ecology of coral reefs. Dept. Of Zoology. Chapel Hill, Univ. Of North Carolina**:** 289 pp.

This study attempted to characterize mechanisms and rates of regenerative functioning in coral reefs in Kane`ohe Bay and Eniwetok Atoll, Marshall Islands. Emphasis was placed on the study of bacteria and other microorganisms based on their typically important regenerative roles in other ecosystems. Ten dead coral heads were collected from 3 study sites within indicated study area.

DiSalvo, L. H. (1969b). "Isolation of bacteria from the corallum of *Porites lobata* (Vaughn) and its possible-significance." Am. Zool. 9: 735-40.

This paper discusses the results of a survey conducted to determine the number, distribution, and activities of bacteria in selected coral reef environments, including Kane`ohe Bay. Some of the isolated bacteria were capable of digesting chitin *in vitro*, suggesting that the mechanism for skeletal weakening might be bacterial breakdown of the organic matrix. Absence of change from aragonitic to calcitic crystals from a discolored region supported the contention that skeletal weakening was due to the breakdown of organic matrix rather than direct solution of carbonate.

DiSalvo, L. H. (1971a). Ingestion and assimilation of bacteria by two scleractinian coral species. Experimental Coelenterate Biology,. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 129-36.
The author attempted to determine the degree of bacterial fouling of living and dead coral surfaces and to observe some general aspects of particle feeding by these corals. He also attempted to determine if the ingested ^{35}S-labeled bacteria were assimilated by the polyps of two coral species collected on a mid-Kane`ohe Bay patch reef.

DiSalvo, L. H. (1971b). "Regenerative functions and microbial ecology of coral reefs: labeled bacteria in a coral reef microcosm." J. Exp. Mar. Biol. Ecol. 7: 123-36.
Representative coral reef organisms and substrata assembled in a lab microcosm removed radioactively labeled bacteria from water circulated over them. Biochemical fractionation of selected organisms in these experiments suggested digestion and possible assimilation of bacterial proteins. In view of previous results concerning microbial ecology, it is suggested that coral reef infaunal metazoa are adapted to utilize internal sedimentary processes and regenerative functioning through suspension (and deposit) feeding mechanisms. A model ecosystem is presented to suggest the possible feedback of these mechanisms as they operate within a reef.

DiSalvo, L. H. (1971d). "Regenerative functions and microbial ecology of coral reefs. II. Oxygen metabolism in the-regenerative system." Can. J. Microbiol. 17:: 1091-11.
Measurements were made relevant to the oxygen metabolism of the internal zone of coral reefs. Antibiotics significantly lowered oxygen demands and bacterial counts, suggesting the important respiratory role of anaerobic bacteria. Measurements of total oxygen consumption by two intact coral "deadheads" were compared to oxygen demands by their internal sediments, resulting in oxygen consumption of these sediments in suspension being about ten percent of the total oxygen consumption of intact heads. Water samples collected from within regenerative spaces in situ generally showed oxygen debts when compared to ambient reef waters, with oxygen debts of internal water's of (stressed) inshore reefs higher than those of an offshore reef.

DiSalvo, L. H. (1972). "Stressed coral reef crabs in Hawai`i." Mar. Poll. Bull. 3: 90-91.
Destruction of coral reefs in Hawai`i eliminates the associated fauna by loss of its habitat, but evidence is produced of damage to reef crabs, which may be a more direct consequence of pollution. Carapaces showing distress were recovered from living crabs collected in Kane`ohe Bay.

DiSalvo, L. H. (1974). "Soluble phosphorus and amino nitrogen released to seawater during recoveries of coral reef regenerative sediments." Proc. 2nd Intern. Coral Reef Symp. Brisbane 1: 11-19.
The amounts of recovered nutrients at Kane`ohe Bay were calculated in relation to the total sediment and sediment organic matter derived from each coral head. The results of these calculations were comparable on a per-station basis with previous data on bacteria per unit sediment and oxygen consumption per unit sediment. The bacterial count per gram sediment was directly related to the amounts of soluble nutrients when calculated on a per-gram-sediment basis.

DiSalvo, L. H. and K. Gundersen (1971c). "Regenerative functions and microbial ecology of coral reefs. I. Assays for microbial population." Can. J. Microbiol. 17: 1081-89.
This paper discusses the results of analyses performed on sediments obtained from complex internal reef spaces at Kane`ohe Bay and Eniwetok Atoll. Attention is focused on assaying the microbial populations. Arguments are made for the existence of an efficient system of mineralization based on the unique biogenic structure and high organismic diversity of coral reefs.

Domotor, S. L. and C. F. D'Elia (1986). "Cell-size distributions of zooxanthellae in culture and symbiosis." Biol. Bull. 170: 519-525.

Doty, M. S. (1961). "*Acanthophora*, a possible invader of the marine flora of Hawai`i." Pac. Sci, 15: 547-552.
A paper dealing with the genus *Acanthophora*, its discovery in Hawai`i and a subsequent literature and herbaria search to find previous Pacific records of this genus. The author mentions Kohn (1959) recording *Acanthophora* in Kane`ohe Bay found on the egg cases of *Conus quercinus*.

Doty, M. S. and B. C. Stone (1966). "Two new species of *Halophila* (Hydrocharitaceae)." Brittonia 18: 303-306.

A taxonomic paper describing two new species in the genus *Halophila*, one from the Hawaiian Islands, *Halophila Hawaiiana* Doty and Stone sp. nov., and the other from Australia, *Halophila australis* Doty and Stone sp. nov. *H. Hawaiiana* was found in four areas in Kane`ohe Bay: in the salty mud at minus 2 feet below MSL off the NW corner of Moku 0 Loe Island, 3 Oct. 1950 Doty 8110; in a colony in about 15 feet water on bottom of channel dug in 1943, east of U. H. Marine Laboratory, 28 March, 1952, Doty 9930; in sand on shoal, submerged 2 feet, about 1 mile NW of Kapapa, 17 January 1948, Webster 1189 and near Mokuawa, off Makaekahana, 19 August 1915

DPED, H. S. (1967). Hawai`i State Research Inventory. 1967. Honolulu, Hawai`i Dep. of Planning and Econ. Dev.**:** 199.
Bibliography of all research reports completed and/or published by or for the State of Hawai`i between January 1, 1967 and December 31, 1967, or in progress as of January 1, 1968. Listings are by administrative departments and includes all such research by HIMB researchers.

DPED, H. S. (1968). Hawai`i State Research Inventory. 1961-1966. Honolulu, Hawai`i Dep. of Planning and Econ. Dev.**:** 199.
Bibliography of all research reports completed and/or published by or for the State of Hawai`i between July 1,1961 and December 31, 1966, or in progress as of January 1, 1967. Listings include all such research by HIMB researchers. - companion volume #123.

Dunham, D. W. (1978). "Effect of chela white on agonistic success in a diogenid hermit crab (*Calcinus laevimanus*)." Mar. Behav. Physiol. 5: 137-144.
An intertidal Hawaiian diogenid hermit crab, *Calcinus laevimanus*, has an enlarged left chela, bearing a large white patch on its outer surface. The chela is used in agonistic display and in fighting. In fights between opponents closely matched in size, the crab bearing the larger white patch is more likely to win. An experiment in which the white was concealed by black paint showed that it is the white patch *per se* that confers an agonistic advantage on the bearer. Possible modes of effect are discussed. Specimens were collected from Coconut island and Rubble Island in Kane`ohe Bay in 1972-73.

Dunham, D. W. (1978). "On contrast and communication efficiency in hermit crabs." Crustaceana 35(1).
Three common Hawaiian intertidal hermit crabs differ in the appearance of their chelae. [*Calcinus laevimanus* (Randall, 1840), *Calcinus swurati* (Forest, 1951), *Clibanarius zebra* (Dana, 1852).] Since the chelae are conspicuously important in fighting, one might expect the fighting efficiency of these three species to differ significantly. Their agonistic behaviour was compared by observing intraspecific fighting in the laboratory, in order to determine whether there were any differences in the overall efficiency of terminating agonistic bouts.

Dunham, D. W. (1981). "Chela efficiency in display and feeding by hermit crabs (Decapoda, Paguridea)." Crustaceana 41(1).
Three common Hawaiian intertidal hermit crabs differ in the appearance of their chelae. [*Calcinus laevimanus* (Randall, 1840), *Calcinus seurati* (Forest, 1951), *Clibanarius zebra* (Dana, 1852).] The present paper examines the use of leg displays, responses to these displays, and the use of chelae in feeding in these three species, in order to investigate some of the advantages and disadvantages of chela specialization for fighting. Animals were collected from Kane`ohe Bay and Waimanalo Bay in 1972-73.

Dunn, D. F. (1974). "*Aciniogeton sesere* (Coelenterata, Actiniaria) in Hawai`i." Pac. Sci. 28: 181-188.

Edmondson, C. H. (1921). "Stomatopoda in the Bernice P. Bishop Museum." B. P. Bishop Museum Occ. Pap. 7(13): 279-302.
A taxonomic study of the stomatopod collection in the B., P. Bishop Museum. The collection comprises 53 specimens grouped under six genera and nine species, one of which is new. Of the 53 specimens, 10 are recorded from Guam, 4 from Tahiti and 2 from the Marquesas, the other 37 are from Hawai`i.

Edmondson, C. H. (1928). "The ecology of an Hawaiian coral reef." Bishop Museum Bull. 45: 64 pp.
Description of Kane`ohe Bay as "one of the most favorable localities for the development of shallow water corals. Nearly all the reef-forming general known in the Hawaiian Islands are represented in certain areas of this bay and many species grow luxuriantly."

Edmondson, C. H. (1930). "New Hawaiian Medusae." B. P. Bishop Museum Occ. Pap. 9(6): 1-16.
A taxonomic description of several forms of creeping and sessile medusae previously unrecorded from

the Hawaiian Islands. The type specimen of the Stauromedusae, *Kishinouyea hawaiiensis* n. sp. was found in Kahana Bay on seaweed in shallow water; type specimen is now in Bishop Museum.

Edmondson, C. H. (1930). "New Hawaiian Crustacea." B. P. Bishop Museum Occ. Pap. 9(10): 1-18.
A taxonomic description of new species of the genera *Processa, Jousseaumea. Axiopsis,* and *Palicus* and of the family Portunidae. Kane`ohe Bay is the type locality of a new species, *Processa paucirostis* n. sp.

Edmondson, C. H. (1933a). Reef and Shore Fauna of Hawai`i. Honolulu, Bishop Museum Special Publ. no. 22, 1st ed.
A general descriptive study of the fauna found in the reefs and shores of the Hawaiian Islands.

Edmondson, C. H. (1933b). "Quantitative studies of copepods about the shores of O`ahu." Fifth Pacific Science Congress 3: 1997-2001.
A study in which the copepods around O`ahu were sampled quantitatively to determine the amount of food available to other organisms in the shoal areas. It was hoped that this abundance or paucity of such a potential food source might be correlated with the relative growth of other organisms. Kane`ohe Bay was the center for sampling on the windward shore of O`ahu. Sampling was carried over a period of one year (September 22, 1931 to September 21, 1932).

Edmondson, C. H. (1933c). "*Cryptochirus* of the Central Pacific." B. P. Bishop Museum Occ. Pap. 10(5): 1-23.
A taxonomic study of the members of the genus *Cryptochirus* (Crustacea) collected in the Central Pacific. This genus includes the crabs which as larvae settle in the calyces of coral, causing the death of the polyp. The crabs remain there passively as the coral continues to grow around it. *Cryptochirus minutus* n. sp. is less plentiful in Kane`ohe Bay than at other localities on O`ahu. It may be found in species of *Cyphastrea ocellina* and *Lepastrea purpurea*.

Edmondson, C. H. (1935). "New and rare Polynesian crustacea." B. P. Bishop Museum Occ. Pap. 10(24): 1-40.
A taxonomic account of the new and rarely observed decapod crustaceans collected by various field workers in widely separated parts of Polynesia ranging from Hawai`i through the equatorial islands to Fiji, including the Lau Archipelago and Tongatabu. A new species of *Periclimenes* was found living on *Linckia multiflora* in Kane`ohe Bay called *Periclimenes bicolor* n. sp. Kane`ohe Bay is listed as the type locality for this species (Bishop Museum Collection no. 3756). Another species, *Hymenocera elegans* Heller was first collected in Hawai`i in 1934 from a Porites coral head in Kane`ohe Bay.
A hydroid apparently identical with *Pennaria tiarella* McCrady from the Atlantic coast flourishes in Kane`ohe Bay - a possible introduction.

Edmondson, C. H. (1935-1936). "Autotomy and regeneration in Hawaiian starfishes." B. P. Bishop Museum Occ. Pap. 11(8): 1-20.
An investigation to determine the extent of the phenomenon of autotomy among Hawaiian starfishes and to follow the processes involved in the regeneration after natural or artificial injury. This investigation covered a period of approximately three years and was conducted on *Linckia multiflora, Linckia diplax* and *Coscinasterias acutispina* from Kane`ohe Bay as well as *Pentaceros hawaiiensis* Fisher from Maile Point and *Dactyloaster cvlindricus pacificus* Fisher and *Nepanthia sp*. from Black Point.

Edmondson, C. H. (1937). "Quantitative studies of copepods in, Hawai`i with brief surveys in Fiji and Tahiti." B. P. Bishop Museum Occ. Pap. 13(12): 131-146.
A one-year investigation (Sept. 22, 1931 - Sept. 21, 1932) on the determination of the amount of potential food available at certain localities in the shoal waters about O`ahu as expressed in the numerical quantity of marine free swimming copepods. The correlation of the amount of growth of the invertebrates and the amount of the copepods was also considered. Kane`ohe Bay was the center for all investigations, stations also being run at Waikiki, Pearl Harbor and other areas of O`ahu.

Edmondson, C. H. (1940). "A recent shipworm survey in Hawai`i." Proc. 6th Pacific Science Congress 3: 245-250.
A continuation of previous work on shipworms in Hawai`i with emphasis on wood borers of the genera *Teredo* and *Bankia*. The history of shipworms on the island is reviewed and this paper presents the results of a re-survey of shipworms which might reveal additions to or shifts in the previously known population of shipworms on the island. Two of the survey areas were in Kane`ohe Bay. Test blocks of

various woods were submerged and lifted at intervals to determine species present, their distribution, rate of growth, periods of spawning, seasonal variation in behavior, larval and postlarval development, their behavior under normal and abnormal conditions, their preference for certain woods and other information.

Edmondson, C. H. (1944). "Teredinidae of Hawai`i." B. P. Bishop Museum Occ. Pap. 17(10): 97.

A report dealing with a record of studies and observations of shipworm on the island of O`ahu. Shipworms from 14 stations on O`ahu were collected and systematically described. The material from Canton Island and Western Samoa is discussed. Collections in Kane`ohe Bay included:

Station J., pier of Territorial Fish and Game Farm
- *Teredo parksi*
- *T. bartschi*
- *T. diagensis*

Station K., near the middle of Kane`ohe Bay on the reef
- *T. parksi*
- *T. bartschii*
- *T. millen*
- *T. gregoryi*

Station L., shore of Mokapu Peninsula
- *T. millen*
- *T. medilobata*

Edmondson, C. H. (1946). Reef and Shore Fauna of Hawai`i. Honolulu, Bishop Museum Spec. Publ. 22, 2nd ed.

A revised edition of the earlier 1933 edition. More complete data, new figures and keys was added to several sections and the nomenclature was brought up to date to conform with intervening investigations.

Edmondson, C. H. (1954). "Hawaiian Portunidae." B. P. Bishop Museum Occ. Pap. 21(2): 217-274.

A critical study of the portunid crabs in the Bishop Museum collection and in other collections including descriptions of new forms. Keys and illustrations are included.

Edmondson, C. H. (1962). "Hawaiian Crustacea: Goneplacidae, Pinnotheridaelp Cymopoliidae, Ocypodidae and Gecarcinidae." B. P. Bishop Museum Occ. Pap. 23(l): 1-27.

The fourth and the last in a series of revised records of brachyuran crabs recorded in Hawaiian waters. This report deals with five families, lists only sixteen species, four of which were thought not to exist in the Hawaiian fauna at the time of publication.

Edmondson, C. H., W. K. Fisher et al. (1925). "Marine Zoology of Tropical Central Pacific ." Bishop Mus. Bull. 27: 148.

The collective reports of the Tanager expedition 1923-24, including reports on Crustacea, sea stars, echinoderms other than sea stars, polychaetous annelids and foraminifers. Reference is made to Kane`ohe Bay in the paper by Clark and many specimens are mentioned as being very common about the reefs of Hawai`i.

Edmondson, C. H. and W. M. Ingram (1939). "Fouling organisms in Hawai`i." B. P. Bishop Museum Occ. Pap. 14(14): 251-300.

A report on the fouling organisms found in Kane`ohe Bay and in Pearl Harbor over a period of years, 1935-1939. Attention was given to species, their seasonal succession and ecology. Early developmental stages in some cases are described and the rate of growth under varied conditions is recorded. Consideration was also given to surface type of attachment. The majority of experiments were done with larval and adult barnacles.

Edmondson, C. H. and G. S. Mansfield (1948). "Hawaiian Caprellidae." B. P. Bishop Museum Occ. Pap. 19(10): 201-218.

A taxonomic report dealing with a small collection of caprellids at the Bishop Museum. Specimens of *Caprella acutifrons* Latreille are reported to be very abundant in Kane`ohe Bay.

Edmondson, C. H. and I. Wilson (1940). "The shellfish resources of Hawai`i." Proc. 6th Pacific Science Congress 3: 241-243.

A review of the shellfish industry in Hawai`i including the number of species occurring in the islands, species of commercial value and the successes and failures of various transplanting operations. In

1920, *Tapia philippinarum* from Japan, were planted in Kalihi Basin, Pearl Harbor and Kane`ohe Bay. They grew and reproduced in all areas except Kane`ohe Bay. In February 1939,, a shipment of 20,000 young specimens of *Cytherea* were received from Japan and planted in Kane`ohe Bay where rapid growth has taken place (to date in 1940). In 1927, a small shipment of abalones were planted in Kane`ohe Bay where they seemed to do well and then disappeared. Quantities of the American oyster, *Ostrea cucullata* have been planted in Kane`ohe Bay (no date given). They died within 6 months. During March 1939, more than one million spat of the Japanese oyster, *Ostrea gigas* were planted in Kane`ohe Bay. Exceptional growth took place and it is hoped that this species may become permanently established in Hawai`i. *Pteria nebulosa* is a small native oyster growing luxuriantly in Kane`ohe Bay. The commercial value of the Hawaiian invertebrates such as squid, gastropods, crabs and shrimps are discussed but with no reference to Kane`ohe Bay.

Eger, W. H. (1963). An exotoxin produced by the puffer, *Arothron hispidus*, with notes on the toxicity of other plectognath fishes. Depart of Zoology. Honolulu, University of Hawai`i**:** 88.
A study of *Arothron hispidus* to confirm the presence of a toxic substance in the skin secretions and to establish the site of its production. The author also investigated the character of this exotoxin and compared it with the endotoxin of the internal organs on a biological, physical and chemical basis. All of the specimens used in this study were caught either with traps or with a hook and line in Kane`ohe Bay. It was found that the exotoxin was being secreted by specialized serous glands associated with the integumentary spines. It is essentially similar to the endotoxin on a biological, chemical, physical and pharmacological basis.

Eldredge, L. G., III. (1965). The taxonomy of the Diademnidae (Ascidiacea). Depart. of Zoology. Honolulu, Univ. of Hawai`i.
A descriptive taxonomic study of the 23 diademnid ascidian specie in the central Pacific area.

Eldredge, L. G., III (1966). "A taxonomic review of the Indo-Pacific didemnid ascidians and descriptions of twenty-three Central Pacific species." Micronesica 2: 161-261.
A systematic description of twenty-three didemnid ascidians species, eight of them new, from the Central Pacific waters. The taxonomic position of each is considered with reference to other related Indo-Pacific species and the basis for generic and specific determinations are reviewed and evaluated. The author provides an appendix with information concerning the distribution of identified species and a summary of pertinent Indo-Pacific records. A key to the didemnid ascidian species of O`ahu is also included. Kane`ohe Bay and Moku Manu were among 16 collection sites on O`ahu.
Data for Kane`ohe Bay:

Trididemnum roundup (Sluiter) leeward Sand Island; 1-8-63; 1 colony Coconut Island; 30-7-64; 2 colonies in coral and calcareous algae

Trididemnum savignii (Herdman) Coconut Island; 2-8-61, 29-11-61, 13-12-611, 21-9-629 1-8-63; 20 colonies on wood, glass, sabellid worm tubes, barnacles and solitary ascidians

Didemnum elikapekae n. sp. Coconut Island; 21-11-62; 1 colony on wood

Didemnum edmondsoni n. sp. Coconut Island; 21-6-61, 9-8-61, 29-11-61, 3-12-63, 1-8-63, 16-11-63; 50 colonies Buoy No. 8; 29-11-61; 7 colonies Sand Island; 1-8-63; 1 colony on wood, glass, serpulid wormtubes, solitary ascidians, molluscs, sponges and calcareous algae

Didemnum moseleyi (Herdman) Coconut Island; 14-10-61, 13-12-61; 6 colonies

Didemnum candidum Savigny Coconut Island; 41-10-61, 15-11-61, 29-11-61, 13-12-619 11-5-63@ 1-8-63, 26-10-63, 16-11-63; 60 colonies on wood, sabellid and serpulid worm tubes, barnacles, solitary ascidians, bivalve molluscs, sponges, cal. algae

Leptoclinides rufus (Sluiter) Moku Manu; ?-11-62; 2 colonies collected 45 m. on coral and black coral

Diplosoma (Diplosoma) virens (Hartmeyer) Checker Reef; 10-11-61, 30-7-64; in colonies on coral and calcareous algae

Diplosoma (Diplosoma) macdonaldi Herdman (nomen conservandum) Coconut Island; 9-8-61, 4-10-61, 11-10-61, 11-9-61, 29-11-61, 21-11-62, 11-5-63, 1-7-63, 30-7-64; 100 colonies on wood, sabellid and serpulid worm tubes, barnacle, coral, mollusks, sponges, green algae, calcareous algae, solitary ascidians

Diplosoma (Lissoclinum)'fragile (Van Name) Coconut Island; 21-11-62, 26-10-63; 6 colonies on wood, coral and calcareous algae

Eldredge, L. G. (1994). Perspectives in aquatic exotic species management in the Pacific Islands. Introductions of commercially significant aquatic organisms to the Pacific Islands. Noumea, New Caledonia, South Pacific Commission. 1**:** 1-127.
The purpose of this review is to record the intentional and accidental introduction of aquatic plants and

animals to the Pacific Islands (the area encompassed by the South Pacific Commission). Plants and animals are distributed either intentionally or accidentally.

Eldredge, L. G., III (1995). "First record of the blue crab *Callinectes sapidus* in Hawai`i (Decapoda: Brachyura)." Occ. Pap. B. P. Bishop Museum 42: 55-58.
Six female specimens of the Atlantic blue crab *C. sapidus* were trapped in Kane`ohe Bay in 1985-92.

Eley, M. A. (1960). Some visual aspects of behavior in *Gonodactylus glabrous* Brooks (Crustacea: Stomatopoda). Zoology. Honolulu, University of Hawai`i**:** 62.
A study of *Gonodactylus glabrous* to determine whether this species has form vision and if so, to discover some of the kinds of forms that it can distinguish and to consider the significance of this ability on the animals' behavior in nature. All of the animals examined were taken from the north shore of Coconut Island in Kane`ohe Bay. Results showed that the animals displayed a spontaneous preference for certain form patterns. Sexual differences were noted in some of the form patterns. The author discusses the possible importance of this ability of visual discrimination.

Ely, C. A. (1942). "Shallow water Asteroidea and Ophiuroidea of Hawai`i." Bishop Museum Bull 176: 1-63.
A systematic paper dealing with 40 species of Asteroids, 25 of which are starfishes and 15 are brittle stars. Among the brittle stars, 3 species were new to science at the time of publication and one of these was the type of a new genus. *Linckia multiflora* (Lamarck) is found only in Kane`ohe Bay on O`ahu.

Emig, C. C. (1981). "Observations sur l'ecologie de *Lingula reevei* (Davidson) (Brachiopoda: Inarticulata)." J. Exp. Mar. Biol. Ecol 52: 47-61.
In Kane`ohe Bay (O`ahu, Hawai`i), *Lingula reevei* Davidson inhabits infralittoral sandy bottoms. Its distribution appears to be related mainly to the nature of substratum, the presence of predators and diggers, and the food supply. The meiofauna is studied and compared between the stations in which *L. reevei* occurs. The stomach and intestinal contents are analysed, for the first time in *Lingula*: the nutrients arise mainly from the superficial fauna and flora. *L. reevei* filters continuously; the arrangement of the anterior mantle ciliation forming the three characteristic siphons is described more precisely. No preferential orientation to prevailing currents could be established; however, this cannot be excluded. The depth of the burial and anchorage conditions depend on the nature of the substratum. *L. reevei*, if removed from the substratum, is unable to re-establish itself or to change its burrow. But this species is capable of upward burrowing through a sediment layer, even if the animal has to automize the pedicle (a new one then regenerates). A growth rate curve for estimating the age length in relation to the shell length is proposed and compared to that of *L. anatina. L. reevei* does not survive more than a few days exposure to adverse environmental conditions: in extremely diluted salinities (<15%), after several days, *Lingula* emerging from the sediment dies, and after body putrefaction the valves dislocate and fall onto the substratum. In high salinities (>40%) or after substratum emersion, the animal dies within the burrow. Tolerance to desiccation does not ever reach 3 days.

Environmental Consultants Inc. (1973). Impact studies on the marine environment at Heeia Meadows. Kane`ohe, Gentry-Hawai`i, Inc.**:** 1-94.
Environmental surveys of nearshore areas related to potential development of Heeia Meadow area in Kane`ohe Bay, includes species lists of organisms sighted and sampled.

Environmental Consultants Inc. (1975). Observations on the marine environment at Coconut Island, Kane`ohe Bay, O`ahu, Environmental Consultants, Inc., Kane`ohe**:** 23.

Environmental Consultants Inc. (1977). Marine environmental reconnaissance survey for Kualoa beach shore protection project. Honolulu, U. S. Army Corps of Engineers**:** 47.
A qualitative marine survey was conducted.

Erseus, C. and D. Davis (1989). "The marine Tubificidae (Oligochaeta) of Hawai`i." Asian Marine Biology 6: 73-100.

Esquivel, I. (1986a). Short term copper bioassay on the planula of the reef coral *Pocillopora damicornis*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 465-472.
A short term copper bioassay was done on the planulae of *Pocillopora damicornis* and the 24 h, 48 h

and 96 h median lethal concentrations (LC50) were determined. Concentrations of copper (added as CuCl) ranged from 10-1000 ug l-1 (ppb). Comparisons with previous studies show the planulae of *P. damicornis* to be more resistant than adults to heavy metal toxicity, surviving in higher concentrations for longer periods.

Esquivel, I. F. (1986b). Direct retrospective analysis of the reef coral *Porites compressa*: evidence for sexual versus asexual origins of reef coral populations. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 234-239.
Determination of relative importance of asexual reproduction in the reef coral *Porites compressa* in two different physical environments on the same reef, reef flat vs reef slope. Radiographic studies of coral heads revealed a greater percentage of sexually derived colonies on the reef slope, while colonies formed from asexual fragmentation formed a greater percentage of young colonies on the reef flat.

Evans, C., J. T. Maragos et al. (1986). Reef corals in Kane`ohe Bay. Six years before and after termination of Sewage discharges (O`ahu, Hawaiian Archipelago). Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 76-90.
Resurvey of lagoon and coral transects previously conducted in 1971 revealed a remarkable recovery of corals, especially *Porites compressa* and *Montipora verrucosa* in the southern and middle lagoon, and continued abundance in the northern lagoon. Minor coral species *Pocillopora damicornis* and *Cyphastrea ocellina* also were more abundant in the lagoon. In contrast, *Dictyosphaeria cavernosa* algae declined greatly except for a minor increase in the northern lagoon.

Evans, C. W. (1991). Patterns of recovery and change of coral reef communities in Kane`ohe Bay, Hawai`i. 17th Pacific Science Congr., Coral Reefs and Environmental Change -- the Next 100 Years, Honolulu, Pacific Science Assoc.
Kane`ohe Bay offers an excellent example of a large coral reef ecosystem disturbed by factors associated with urbanization. Early research in the 1970s showed that eutrophication and sedimentation caused declines in coral reef communities and an explosive growth of the green alga Dictyosphaeria cavernosa . In 1983, 6 yr after major sewage discharges were diverted from the bay, surveys showed a significant decrease in the *Dictyosphaeria* algal cover and a remarkable recovery of coral reef communities. Researchers hoped that this pattern of recovery would continue; however, re-surveys in 1990 indicate that algal populations may once again be increasing and coral recovery rates may have slowed or, in some places, reversed. Periodic sewage bypasses and overflows from the old sewage-treatment facilities in combination with non-point source sewage discharges may be the cause. Alternatively, natural fluctuations and/or other environmental factors may explain these changes.

Evans, C. W. (1995). Sewage diversion and the coral reef community of Kane'ohe Bay, Hawai'i: 1970-1990. Geography, University of Hawai`i**:** 175.

Evans, C. W. and C. L. Hunter (1992). "Kane`ohe Bay: An update on coral reef recovery and trends to the contrary." Proc. 7th Intern. Coral Reef Symp., Guam.

Everson, A. (1994). Fishery data collection system for fishery utilization study of Kane`ohe Bay, two-year interim report. Honolulu, State of Hawai`i, Dept. Land and Natural Resources, Div. Aquatic Resources.

Fan, P. (1973). Sedimentation. Estuarine pollution in the State of Hawai`i, Vol. 2: Kane`ohe Bay study. Honolulu, University of Hawai`i, Water Resources Research Center**:** 229-266.

Fee, J. H. (1967). Studies of the direction-finding behavior of the beach hopper, *Orchestia platensis* (Kroyer) (Crustacea-Amphipoda). Department of Zoology. Honolulu, University of Hawai`i**:** 57.
A report beach hopper is compared with that of other species. The effect of the northward position of the sun in the late spring and early summer in the Hawaiian Islands on the direction-finding behavior is also investigated. Kane`ohe Bay was one of the collecting areas on a beach near the middle of the bay shore. The amphipod appeared to move vertically up and down the beach as the tide ebbed and flowed. The amphipods examined in Kane`ohe Bay demonstrated rhythmic behavior, the change of the angle of orientation with respect to a stationary light source correlated with the daily motion of the sun. These amphipods were noted to be physically different from *0. platensis* and so they may be another species; the author was not sure.

Fellows, D. P. (1966). Zonation and burrowing behavior of the ghost crabs *Ocypode ceratophthalmus* (Pallas) and *Ocypode laevis* Dana in Hawai`i. Department of Zoology. Honolulu, University of Hawai`i**:** 78.

A study representing the first behavioral study of *Ocypode ceratophthalmus* in the eastern portion of its distributional range as well as the first such study for *Ocypode laevis*. The primary objective was to determine whether the disparity among the previous reports on the digging behavior of *0. ceratophthalmus* is related merely to habitat diversity, or is, in fact, the result of behavioral differences among isolated populations of this species. *0. laevis* was found to inhabit only one type of burrow. In contrast, *0. ceratophthalmus* was found to dig 4 types of burrows, the structure being dependent upon the age and sex of the crab. No differences in digging behavior were noticed between the two species. Sand Island, Kane`ohe Bay, was one area of collection.

Fiedler, G. C. (1990). "Observations on the social behavior of a small population of the butterflyfish *Chaetodon ornatissimus* in Kane`ohe Bay, Hawai`i." Pac. Sci. 44: 184.

Since May 1988, the population of *Chaetodon ornatissimus* on a patch reef in Kane`ohe Bay has been monitored. These fish are territorial corallivores and live in heterosexual pairs. Monogamy in fish is rare, but among chaetodontids, this seems to be the rule. Observations of *C. ornatissimus* in groups larger than two provides an interesting comparison. The work presented here is a portion of an ongoing project to study this butterflyfish.

Field, S. (1998). Settlement biology of larvae of *Montipora verrucosa* and *Porites lobata* in Hawai'i. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 117-125.

This study investigated the early life histories of *Porites lobata* and *Montipora verrucosa* including determination of substrate preferences for settlement. Following settlement the processes of survivorship under unfavorable conditions was also examined. The duration of larval viability shows that *M. verrucosa* and *P. lobata* are both capable of lasting extended periods in the water column prior to discovering a suitable substrate. The metamorphosed larvae showed no substrate testing behavior. Colonies of *M. verrucosa* were collected from three sites within Kane`ohe Bay to ensure genetic diversity: Checker Reef, Kane`ohe Bay Yacht Club and Coconut Island boat channel.

Fisher, W. K. (1906). "The starfishes of the Hawaiian Islands." U. S. Fish Commission Bull. 1903 (3): 987-1130.

A taxonomic description of specimens collected by the U. S. Fisheries steamer Albatross from the Hawaiian Islands during the spring and summer of 1902. Included also is a small collection taken by the *Albatross* in 1891 off the south coast of O`ahu. Specimens were taken from the shoreline to the thousand fathom line. A list of station positions and keys to the families plus a directory of technical terms is presented in the introduction.

Fisher, W. K. (1907). "The holothurians of the Hawaiian Islands." Proc. U. S. Nat. Mus. 32: 637-744.

A taxonomic description of the holothurians found in and around the Hawaiian Islands. The material for this study comes from the dredging stations of the Albatross expedition in 1902 and observations of reef and shallow water areas near land by the author.

Data for the Kane`ohe Bay areas:

Scotodeima vitreum n. sp. station 3979, vicinity of Bird Island in 222-387 f. on fine white sand, foraminifers, rocks. bottom temperature 540.

Fitzhardinge, R. (1985). Spatial and temporal variability in coral recruitment in Kane`ohe Bay (O`ahu, Hawai`i). Proc. 5th Intern. Coral Reef Congr., Tahiti.

Experiments to investigate coral colonization are underway in Kane`ohe Bay. Seven shallow sites (1-2m depth) were chosen on three patch reefs. Eight concrete blocks were placed at each site in the spring of 1983 and again in the spring of 1984. Each set of blocks was examined after 3 and 6 mo., and the 1983 blocks were also examined after 15 mo.. The number of recruits differed between sites each year, and recruitment rates at a given site were not necessarily similar each year. The amount or species of coral cover present at a site was not a good indicator of the number or species of coral recruits at that site. *Pocillopora damicornis* was the only species found on any of the 1983 blocks after 3 mo.. In 1984, *Cyphastrea ocellina* was also present on some of the blocks after 3 mo.. *Cullicia* sp., an ahermatypic coral was present on some blocks after 6 mo. in 1983 and 1984. Two common species, *Porites compressa* and *Montipora verrucosa* were detected as small colonies (1-5mm) on some blocks after 6 mo. in 1984. These two species were present on 1983 blocks after 15 mo.. Variation in recruitment may be the result of temporal variability in larval abundance. Spatial variability in recruitment between sites may be due to a variety of factors including differences in larval production and dispersal, grazing pressure and the composition of the co-occurring epiflora and epifauna.

Fitzhardinge, R. (1986). Spatial variability in the recruitment of corals and other organisms in Kane`ohe Bay, O`ahu. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 263-285.

Colonization by corals and other organisms on concrete blocks and dead heads of the branching coral *Porites compressa* was investigated at seven different shallow water sites in Kane`ohe Bay. *Pocillopora damicornis* was the only coral to recruit to either the blocks or the coral heads after three months. Coral recruitment was highest on the windward edge of a patch reef where territories of damselfish *Stegastes fasciolatus* are common. After six months, two other species of coral, *Cyphastrea ocellina* and ?*Culicia* sp. had also colonized the blocks. No recruitment by the two commonest corals in the bay, *Porites compressa* or *Montipora verrucosa*, was detected. At most sites most individuals of *P. damicornis* were found on the inside uppermost surface of the blocks. Grazing fish were most abundant near the margins of reefs except where excluded by *S. fasciolatus*. At most sites xanthid crabs were the most common motile invertebrates colonizing the dead coral surfaces. At one site hermit crabs were very abundant. *Trochus intertextus* was the only motile invertebrate found on the outside of concrete blocks. Sessile invertebrates such as tunicates, bryozoans and oysters were most common on the inner and bottom surfaces of the blocks

Fitzhardinge, R. C. (1988). Coral recruitment: the importance of interspecific differences in juvenile growth and mortality. Proc. 6th Intern. Coral Reef Symp., Townsville, Australia.

If mortality decreases with increasing size, interspecific differences in growth rate could result in differential mortality between species. Recruitment, juvenile growth and survival of three Hawaiian corals were investigated in Kane`ohe Bay, O`ahu, Hawai`i. Two species, *Porites compressa* and *Montipora verrucosa* are broadcast spawners; *Pocillopora damicornis* is a brooder. Interspecific differences in growth e.g. in the rate at which skeleton and new polyps form, were observed. Many features of the reproductive, larval and juvenile ecology of brooding species such as *Pocillopora damicornis* may promote rapid juvenile growth and permit higher juvenile survival than occurs in broadcast spawning species.

Fitzhardinge, R. C. (1993). The ecology of juvenile Hawaiian corals. Department of Zoology. Honolulu, University of Hawai`i.

A study of coral recruitment, growth and community development at seven sites for three consecutive years in Kane`ohe Bay. Variability in recruitment was observed both between sites and between surfaces of the blocks. Temporal variability in recruitment patterns between years also occurred. After 3 mo. immersion, *Pocillopora damicornis*, a brooding species, was the most abundant coral. Another brooding species, *Cyphastrea ocellina*, and the ahermatype *Culicia* cf. *tenella* were also detected. Two spawning species *Montipora verrucosa* and *Porites compressa* were not detected until after 6 mo. immersion. Over 3 yr., the relative abundance of *P. damicornis* declined at most sites and the relative abundance of *P. compressa* increased. *M. verrucosa* recruits remained uncommon.

Fitzhardinge, R. C. and J. H. Bailey-Brock (1989). "Colonization of artificial reef materials by corals and other sessile organisms." Bull. Mar. Sci. 44: 567-579.

Benthic community development was compared on coral and materials used to construct artificial reefs at two sites off O`ahu, Hawai`i, Kane`ohe Bay, and Kahala. The materials tested were concrete, car tires and metal (painted steel). In Kane`ohe Bay, one series of plates was immersed in winter, another in summer. At both sites plates were oriented horizontally, and upper and lower surfaces were examined for corals which were counted, measured, and the number of polyps recorded. Cover of sessile organisms on the Kane`ohe Bay plates was estimated, and counts of sessile species were made on some Kahala plates. Highest coral recruitment in Kane`ohe Bay was on metal and least on tires. A few coral recruits, mostly *Porites lobata* were found on the Kahala plates. Concrete is recommended for artificial reef construction because community development was most similar to coral, it is durable in seawater and it can be shaped to specification. Metal structures which disintegrate slowly would also be appropriate.

Foster, M. A. (1975). The comparative behavior of several pomacentrid fishes to tropical sea anemones. Department of Zoology. Honolulu, University of Hawai`i**:** 112.

The heterospecific associations between the fishes of the genera *Amphiprion* and *Dascyllus* and the anemones of the genera *Stoichactis* and *Radianthus* were investigated. *Dascyllus albisella* and *Radianthus papillosa* were collected from Kane`ohe Bay along the north side of Sampan Channel and from the sand bar in midbay. The mucus of unacclimated, deacclimated and acclimated fishes and the mucus of the symbiotic anemones was analyzed by cellulose acetate electrophoresis. During the acclimation sequence a chemical change occurs in the mucus of fishes which may be caused by the discharge of nematocysts that carry toxin into the fishes. The acclimated fishes possess a protective substance within their mucus that inhibits nematocyst discharge. A fish with its mucus coating removed does elicit nematocyst discharge. The acclimation of anemone fishes to anemones is species specific and is temporarily limited and can be lost through isolation or mucus removal.

Fowler, H. W. (1928). "The fishes of Oceania." Mem. Bernice P. Bishop Museum 10.

A description of the fishes stored in the Bernice P. Bishop Museum embracing some 14,000 specimens. These include the large Hawaiian collections (the local accessions of the museum since its inception); the collections made by Mr. Alvin Seale in the South Pacific (1900-1903) and in Guam (1900); those made by Hans G. Hernbostel in Guam (1923); by the Tanager Expedition (1923); and by the *Whippoorwill* Expedition in 1924.

Reference to the Kane`ohe Bay areas:

Echidnidae - *Gymnothorax laysanus* Jenkins - from Coconut Island by Jordan and Evermann, U. S. Fish Comm. Bull. v. 23, p. 93. 1903. (Synonymous with *Lycodontis melaegris* (Shaw and Nodder)).

Atherinidae - *Hepsetia insularum* (Jordan and Evermann) - from Koolau Bay, Nov. 1922.

Kyphosidae - *Sectator azureus* Jordan and Evermann - type loc. is Heeia, O`ahu. Synonymous with *Sectator azureus* Jordan and Evermann, U. S. Fish Comm. Bull. 22, only one specimen from Heeia known in the museum.

Gobiidae - *Sicyopterus stimpsoni* (Gill) - synonymous with *Sicydium stimpsoni* Jordan and Evermann U. S. Fish Comm. Bull. 23 pt. 19 from Hilo, Heeia and Kailua.

Franzisket, L. (1969). "The ratio of photosynthesis to respiration of reef building corals during a 24-hour period." Forma et Functio 1: 153-58.

The diurnal ratio of apparent photosynthesis to respiration of four dominant Kane`ohe Bay reef-building corals was measured. Oxygen release during the day by the corals ranged from 2.9 to 4.3 times their oxygen consumption during the night. The photosynthetic activity of the coral-algal was found to be-of the same order of magnitude as that of common free-living algae in the same environment.

Franzisket, L. (1969). "Riffkorallen konnen autotroph leben." Die Naturwissenschaften 56(3): 144-145.

(English translation). A significant decision as to the autotrophic or heterotrophic nature of reef corals could be reached by holding reef corals in a laboratory under well controlled conditions. However, until now such experiments could not be executed satisfactorily, since the reef corals die relatively soon when they are kept in running seawater pumped by metal equipment. The Hawai`i Institute of Marine Biology has installed a seawater supply with non-toxic plastic pumps, pipes and glass fiber tanks. Collected corals were kept in this system for six months in good condition.

Franzisket, L. (1970). "The atrophy of hermatypic reef corals maintained in darkness and their subsequent regeneration in light." Int. Revue Ges. Hydrobiol. 55: 1-12.

Four specimens of each of four principal reef building corals, collected in Kane`ohe Bay, were placed in two fiberglass tanks (one light, one dark) to study the roles of zooxanthellae and plankton in coral nutrition. Results showed that some hermatypic corals are able to live from the photosynthetic products of their symbiotic algae.

Franzisket, L. (1970). "The effect of mucus on respirometry of coral reefs." Int. Revue Ges. Hydrobiol. 55: 409-412.

The author measured the oxygen consumption of freshly collected mucus from reef corals-in Kane`ohe Bay. The experimental data cast doubt on the previously published conclusion that mucus respiration is primarily responsible for oxygen consumption in respirometry experiments with corals.

Franzisket, L. (1973). "Uptake and accumulation of nitrate and nitrite by coral reefs." Die Naturwissenschaften 60: 552.

The author has shown significant uptake of nitrate by reef corals from Kane`ohe Bay independent of light. In these waters nitrite was not measurable, but the fact that nitrite is extracted from coral and algal tissue suggests that the nitrate consumed is possibly reduced by metabolic processes of the zooxanthellae. It was also found that both the amount of nitrogen compounds and the nitrate/nitrite ratio in the coral and algal tissues change in the course of the day.

Franzisket, L. (1974). "Nitrate uptake by reef corals." Int. Revue Ges. Hydrobiol. 59: 1-7.

In specimens of hermatypic coral species and in alga of Kane`ohe Bay, nitrate uptake was measured under light and dark conditions with a flow-through apparatus. The nitrate uptake was measurable in high-nitrate Kane`ohe Bay water and in low-nitrate open ocean water. The nitrate consumption rates of both were independent of light. Neither the coral nor the alga showed measurable immediate uptake in open water of low nitrate concentration after being held previously in the bay water. In the ocean fixation was dependent on photosynthesis.

Freeman, P. J. (1966). "Observations on osmotic relationships in the holothurian, *Opheodesoma spectabilis*." Pac. Sci. 20(1): 60-69.
A study conducted at the Hawai`i Marine Laboratory in Kane`ohe Bay, with specimens collected from the Coconut Island reef, to establish by what means the holothurians were able to function in such an environment where the seawater underwent marked fluctuations in dilution. The easy tolerance of *Opheodesoma* to dilute seawater remains puzzling, there are no particular structures devoted to osmoregulation; there appears to be no adaptive significance in tolerance extending *Opheodesoma's* environmental range. It is suggested that tolerance to fresh waters is incidental and is derived from the slow "turnover" of the comparatively large volume of coelomic fluid with environmental water and to the habit of steadily ingesting variable quantities of organic material which results in oscillating levels of digestive end products in the coelomic fluid.

Freeman, W. (1993). Revised total maximum daily load estimates for six water quality limited segments of O`ahu, Hawai`i. Honolulu, State of Hawai`i, Depart. of Health, Env. Planning Office.

Fujimura, T. (1957-58). Introduction of marine game fishes from areas in the Pacific. Honolulu.
A report dealing with the release of lutjanids and serranids from the Marquesas Islands to O`ahu. The groupers were released from Brown's Camp O`ahu, and the snappers were released off Coconut Island, Kane`ohe Bay. Underwater surveys were made to determine the distribution of the released fish.

Galtsoff, P. (1933). "Pearl and Hermes Reef, Hawai`i; hydrological and biological observations." Bishop Mus. Bull. 107: 1-49.
An account of the discovery in 1927 of a large pearl oyster bed in the Pearl and Hermes Reef and the resultant hydrological and biological survey of the area, legislation to regulate exploitation and development of the resource and the possible introduction of the oysters into the waters near Honolulu. To test the possibility of propagating the oysters on a commercial scale in waters close to Honolulu, 320 oysters were transported into the area west and south of the southern end of Mokuloe Island in Kane`ohe Bay. The oysters were examined at yearly intervals afterward and in 1931, 150 oysters remained which indicated that the project was successful.

Gilbert, W. J. (1962). "Contribution to the marine Chlorophyta of Hawai`i I." Pac. Sci. 16: 135-144.
An annotated list of new and previously recorded green algae of the Hawaiian Islands. Kane`ohe Bay collection: *Caulerpa ambigua* Okamura Gilbert collection No. 9797 found on Coconut Island and Doty collection Nos. 8117 and 10100 both found on Coconut Island. This algae appears only among the Kane`ohe Bay collection from the Hawaiian Islands.

Gilbert, W. J. (1965). "Contribution to the marine Chlorophyta of Hawai`i II. Additional records." Pac. Sci. 19: 482-492.
An annotated list of new or previously recorded marine green algae from the Hawaiian Islands. *Monostroma oxyspermum* (Kutzing): Doty, 1947 Gilbert collection no. 97859 was found on Coconut Island in 1959.

Glenn, E. P. and M. S. Doty (1981). "Photosynthesis and respiration of the tropical red seaweeds, *Eucheuma striatum* (Tambalang and Elkhorn varieties) and *E. denticulatum*." Aquat. Bot. 10: 353-364.
Rates of photosynthesis for 3 Central Pacific forms of *Eucheuma* ranged from 2031-2685 l O_2 /h/g dry wt. tissue under the conditions used when measured by manometric techniques in the laboratory (24 C, 1600 ft-candles light). Respiration ranged from 471-630 l O_2/h/g dry wt. Photosynthesis and respiration of Tambalang showed diurnal variations and also varied with the position of the tissue along a branch. Light saturation of photosynthesis (24 C) occurred at 1200 ft-candles for all 3 forms. Inhibition by light intensity for Tambalang was 18% at 5000 ft-candles compared to the rate at 1000 ft-candles, which was measured in air by the infrared gas analyzer technique. The photosynthetic capacity of Tambalang was found to decrease with increasing water depth, at a site in Kane`ohe Bay, Hawai`i. Maximum rates of photosynthesis for all 3 forms occurred at 30 C with Q_{10} values of ca. 3.0 between 20 and 30 C at 1600 ft-candles of illumination. Inhibition of photosynthesis occurred above 32 C. The response of respiration to temperature showed 2 peaks of activity at 25 C and 40 C for all 3

Eucheuma species. Tambalang had a carbon dioxide compensation point of 29-32 ppm when measured in recirculated air at 25 C and 1000 ft-candles illumination by the infrared gas analyzer technique.

Glenn, E. P. and M. S. Doty (1990). "Growth of the seaweeds *Kappaphycus alvarezii, Kappaphycus st*riatum and *Eucheuma denticulatum* as affected by environment in Hawai`i (USA)." Aquaculture 84: 245-256.

Three commercial gel-producing seaweed species native to the Philippines were grown experimentally in pens on an algal reef-flat in Kane`ohe Bay, O`ahu, Hawai`i. Growth rates and environmental conditions were measured for 55 consecutive weeks. The normal northeast trade winds created a flow of water through the 272-m-2 farm, one side of which faced northeast. Upstream thalli of *Kappaphycus alvarezii* grew at an average relative growth rate of 5.06%/day, whereas *K. striatum* and *Eucheuma denticulatum* grew at 3.50%/day. These growth rates and the overall productivity of 20.8 tonnes dry wt/ha per year, similar to those obtained on Philippine reef-flat farms. Growth rates tended to be independent of season, and correlations between growth rates and environmental variables were low. The study suggested a range of conditions under which these eucheumatoids can be productive in a farm setting: temperature maxima of 24-30 degree C and minima of 21-22 degree C; nitrogen levels of 2-4 mu-g-atm/l; phosphate levels of 0.5-1.0 mu-g-atm/l; and high solar energy levels. *The pH and s*alinity were near 8.0 and 32 ppt, respectively, throughout the study period. The degree of water motion per se was not correlated with growth rate but the direction of wind across the farm was important. Downstream thalli generally appeared unhealthy and grew at half the rate of upstream thalli. When the normal trade winds reversed, the (formerly) upstream thalli grew poorly. None of the measured environmental factors was correlated with the downstream growth reduction, and its cause remains unknown.

Glenn, E. P. and M. S. Doty (1992). "Water motion affects the growth rates of *Kappaphycus alvarez*ii and related red seaweeds." Aquaculture 108: 233-246.

Tagged thalli of three eucheumatoid seaweed species were grown in five locations comprising a natural gradient of water motion on a reef flat in Kane`ohe Bay, O`ahu. The gradient of water motion was related to the wind-shadow effect of a small island on the reef which sheltered part of the reef from the prevailing trade winds. Three experiments were conducted at different times of year in which growth rates, water motion, and other environmental factors were measured weekly in the pens for 8 to 12 weeks. In all three experiments significant ($P<0.05$) correlations were found between the growth rates of the seaweeds and the amount of water motion measured by the dissolution rate of calcium sulfate clod cards placed in the pens. Growth rates increased up to the highest water motion velocities measured in the pens, 15 cm s^{-1}. It was concluded that culture of these species requires high levels of water motion provided by strong and consistent trade winds under reef farming conditions. The results support the mulfifactorial hypothesis of seaweed growth regulation.

Glynn, P. W., L. S. Howard et al. (1986). Preliminary investigations into the occurrence and toxicity of commercial herbicide formulations in reef building corals. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 473-485.

Controlled tolerance experiments testing herbicides 2,4-D phenoxy acid, MCPP and Tergitol (a dispersent) on *Pocillopora damicornis* demonstrated dramatic effects of tissue sloughing and death on corals at 2, 4-D in concentrations near those in affected field specimens (0.02 ppm).

Glynn, P. W. and D. A. Krupp (1986a). Feeding biology of a Hawaiian sea star corallivore, *Culcita novaeguineae* Muller and Troschel. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 330-349.

The sea star *Culcita novaeguinae* preferentially fed on pocilloporid corals (*Pocillopora damicornis* and *P. meandrina*) over the nonpocilloporid species *Porites compressa, Montipora verrucosa* and *Fungia scutaria* in both laboratory experiments and in the field. Field studies suggested that *C. novaeguinae* is not present in sufficient abundance to exert a significant effect on reef growth in Hawai`i.

Glynn, P. W. and D. A. Krupp (1986b). "Feeding biology of a Hawaiian sea star corallivore, *Culcita novaeguineae* Muller & Troschel." J. Exp. Mar. Biol. Ecol. 96: 75-96.

Several traits were examined in four potential coral prey species (colony form, organic matter content, caloric density, tissue accessibility, mucus release, cnidocyst composition, toxicity, and colony defense by crustacean coral guards) to help understand the feeding preference of the Hawaiian asteroid corallivore *Culcita novaeguineae* Muller & Troschel.

Gochfeld, D. J. and G. S. Aeby (1997). "Control of populations of the coral-feeding nudibranch *Phestilla sibogae* by fish and crustacean predators." 130: 63-69.

The aeolid nudibranch *Phestilla sibogae* (Bergh) is a specialist predator on corals of the genus *Porites*. Predation by this gregarious nudibranch causes extensive damage, ultimately mortal, to colonies of *Porites compressa* (Dana) kept in laboratory tanks at the Hawai`i Institute of Marine Biology. In contrast, individuals of *Phestilla sibogae* are seldom found on Hawaiian reefs, even in areas of high coral cover by *Porites* spp., and evidence of predation by *Phestilla sibogae*, such as feeding scars on corals, is rarely encountered. We tested the hypothesis that predation by coral reef fishes and crustaceans on *P. sibogae* is an important factor controlling populations of this nudibranch under natural reef conditions. Survival of nudibranchs was determined in the presence and absence of two species of reef fishes, a carnivorous wrasse, *Thalassoma duperrey* (Quoy and Gaimard), and an omnivorous butterflyfish, *Chaetodon auriga* (Forsskal). Both species significantly reduced survival of *P. sibogae*. *T. duperrey* was a more efficient predator on large (1.5 to 3.0 cm length) than on small (0.7 to 1.4 cm length) nudibranchs, while *C. auriga* fed equally effectively on both size classes. These differences may be related to foraging behavior of the fish. Four species of crustaceans were found in abundance within colonies of *Porites compressa*, and fed readily on small nudibranchs. The largest and most abundant of these species, the xanthid crab *Phymodius monticulosus*, also consumed large nudibranchs. This combination of predation by fishes outside the coral colony and by crustaceans inside the coral colony may control populations of *Phestilla sibogae*. At low population densities, *P. sibogae* does not inflict excessive damage on its coral prey. In the absence of predators, *P. sibogae* populations have the potential to explode, resulting in extensive damage and mortality of coral colonies.

Goh, B. P. L. (1991). "Mortality and settlement success of *Pocillopora damicornis* planula larvae during recovery from low levels of nickel." Pac. Sci. 45: 276-286.

Gordon, J. A. and P. Helfrich (1970a). An annotated bibliography of Kane`ohe Bay. Hawai`i. Kane`ohe, Hawai`i Institute of Marine Biology**:** 260 pp.

This publication is an extensive annotated bibliography of research and related activities conducted in and around Kane`ohe Bay. A companion listing of species is recommended as a cross-reference (Gordon and Helfrich, 1970, HIMB Tech. Rep. No. 21).

Gordon, J. A. and P. Helfrich (1970b). Bibliographic species list for the biota of Kane`ohe Bay. Kane`ohe, Hawai`i Institute of Marine Biology,**:** 70.

This publication contains a bibliographic list of the species found in the Bay as recorded in the papers and reports listed in the accompanying Bibliography of Kane`ohe Bay (Gordon and Helfrich, 1970, HIMB Tech. Rep. No. 20).

Gordon, M. S. and H. M. Kelly (1962). "Primary productivity of an Hawaiian coral reef: a critique of flow respirometry in turbulent waters." Ecology 43(3): 473-480.

This study describes the results of a new study of coral reef productivity as estimated by changes in oxygen content in the water flowing over an Hawaiian coral reef. The reef studied is demonstrated not to be autotrophic. A comparison of the results obtained by both calculation methods, also limitations apparent in the present data, demonstrate that estimation of productivity of benthic communities covered by turbulent flowing water is more difficult than had been realized. The reef investigated was a small fringing reef on the southeast side of Coconut Island in Kane`ohe Bay, O`ahu.

Gorlick, D. L. (1978). Cleaning symbiosis: factors controlling host species preference and preference change in *Labroides phthirophagus* Randall. Department of Zoology. Honolulu, University of Hawai`i**:** 197.

This study investigated the mechanisms for preference behavior between the cleaner wrasse *Labroides phthirophagus* and various host fishes at three stations observed in Kane`ohe Bay in 1973. Radio tracer studies indicated that *L. phthirophagus* ingests considerable amounts of mucus from the surfaces of its host. Analysis of the quantity and gross chemical composition of host mucus revealed species specific differences. Host mucus probably serves as a reliable energy source for *L. phthirophagus* and may be important in determining preference under conditions of low ectoparasite availability. Cleaners also fed more frequently on parasite infected host fish. Ectoparasites may provide most of the cleaner's protein and are probably the preferred food of *L. phthirophagus* when they are available. There was evidence the the presence of ectoparasites led to increased posing by certain host species.

Gorlick, D. L. (1980). "Ingestion of host fish surface mucus by the Hawaiian Cleaning Wrasse, *Labroides* *phthirophagus* (Labridae), and its effect on host species preference." Copeia 80: 863-868.

Gorlick, D. L. (1984). "Preference for ectoparasite-infected host fishes by the Hawaiian cleaning wrasse, *Labroides phthirophagus* (Labridae)." Copeia 3: 758-762.
Experiments demonstrated that the Hawaiian cleaning wrasse *Labroides phthirophagus* showed a distinct preference for host fishes with crustacean and trematode ectoparasites compared to those that were ectoparasite free. Cleaners spent more time with, and fed more frequently on, ectoparasite-infected host fishes. Cleaners also changed preference from one host species to another when the host carrying ectoparasites was changed to one without ectoparasites. These results suggest that ectoparasites are an important factor determining preference among host fish species by *L. phthirophagus*. Ectoparasites may not be a reliable food source, however, in comparison to host-fish surface mucus.

Gosline, J. M. (1971). Kinetics of incorporation of ^{14}C-Proline into mesogleal protocollagen and collagen of the sea anemone *Aiptasia*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 146-156.
By taking advantage of two unique aspects of collagen, it is possible to investigate the kinetics of mesogleal collagen formation in the sea anemone *Aiptasia*. Anemones of *Aiptasia* sp. were collected from Kane`ohe Bay, O`ahu. Data showed that the presence of disulfide linkages may be common to many coelenterate nematocysts and tend to support previous findings that the capsule wall of coelenterate nematocysts is composed of disulfide-linked collagens.

Gosline, J. M. and H. M. Lenhoff (1968). "Kinetics of incorporation of ^{14}C-proline into mesogleal protocollagen and collagen of the sea anemone *Aiptasia*." Comp. Biochem. Physiol. 26: 1031-1039.
By taking advantage of two unique aspects of collagen, it is possible to investigate the kinetics of mesogleal collagen formation in the sea anemone *Aiptasia*. Anemones of *Aiptasia* sp. were collected from Kane`ohe Bay, O`ahu. Data showed that the presence of disulfide linkages may be common to many coelenterate nematocysts and tend to support previous findings that the capsule wall of coelenterate nematocysts is composed of disulfide-linked collagens.

Gosline, W. A. (1953). "Hawaiian shallow-water description of a new fishes of the family Brotulidae with a genus and notes on brotulid anatomy." Copeia 4: 215-225.
A review of the shallow-water brotulids known from the Hawaiian Islands with notes on their anatomy. *Microbrotula rubra* sp. nov. Holotype; U. S. N. M. No. 162710, a male, 38.3 mm in standard lengths taken in a rotenone station in about three feet of water over an area of mixed coral and sand in Kane`ohe Bay on the north coast of O`ahu, October 2. 1948 by Gosline and class.

Gosline, W. A. (1965). "Vertical zonation of inshore fishes in the upper water layers of the Hawaiian Islands." Ecology 46: 823-831.
A summary of information regarding the vertical distribution of fishes in Hawaiian waters making reference to the reef in Kane`ohe Bay. The pools in the splash zone contain very few but well differentiated species of fish. On exposed rocky shores just above sea level,, the herbivorous blenny is the only fish found among the seaweed. Six meters below sea level are found the herbivores grazing on the short algal stubble. In the quiet water offshore in the coral zone, there is a greater diversity of species. Data on the zonation of the fishes below this point is scarce. Preliminary information suggests that the differentiation of the species at deeper levels is far more gradual and that there is still a considerable number of species found to at least half a mile in depth.

Gosline, W. A. (1968). "Considerations regarding the evolution of Hawaiian animals." Pac. Sci. 22: 267-273.
A discussion of some aspects of the evolution of oceanic animals. The author explains the occurrence of insular evolution on oceanic islands and the possibility that this might be a small-scale model of what has happened on the continents. The details of insular evolution are somewhat unclear and so the author attempts to explain some of them. With the rapid decimation of many native insular habitats, soon many of them will be impossible to study. Reference is made to the introduction of the Marquesan sardine into the waters of Kane`ohe Bay.

Gosliner, T. M. (1980). "The systematics of the Aeolidae (Nudibranchia: Mollusca) of the Hawaiian Islands, with descriptions of two new species." Pac. Sci. 33: 37-76.

Greenfield, D. W. and J. E. Randall (1999). "Two new *Eviota* species from the Hawaiian Islands (Teleostei: Gobiidae)." Copeia 199: 439-446.
Eviota epiphanes has been the only *Eviota* species known from the Hawaiian Islands, but two

additional undescribed species have been discovered. *Eviota susanae* n. sp. is described from shallow, sheltered habitats within Kane`ohe Bay, O`ahu, and *Eviota rubra* n. sp. from deeper spur and groove or ledge habitats outside Kane`ohe Bay. Both species share a possible synapomorphy, rugose genital papillae in both males and females. Both species also differ from *E. epiphanes* by having a short, unbranched fifth ray on the pelvic fins and the absence of the IT pore.

Grigg, R. W. (1995). "Coral reefs in an urban embayment in Hawai`i: a complex case history controlled by natural and anthropogenic stress." Coral Reefs 14: 253-266.

Grottoli, A. G. (1999). "Variability of stable isotopes and maximum linear extension in reef-coral skeletons at Kane`ohe Bay, Hawai`i." Mar. Biol. 135: 437-449.
Stable-isotope and growth records of coral skeletons are often used to reconstruct tropical paleoclimate, yet few surveys have systematically examined the natural variability in coral skeletal ^{13}C, ^{18}O and maximum linear skeletal extension (MLSE) across depth. Here, interspecific, intraspecific, and geographical variations in coral skeletal ^{13}C, ^{18}O, and MLSE were examined in the corals P*orites compressa, P. lobata,* and *Montipora verrucosa* grown at 1.7, 5.0, and 8.3 m depth from August 1996 to March 1997 at The Point Reef and Patch Reef #41 field sites in Kane`ohe Bay, Hawai`i.

Coral skeletal ^{13}C values significantly decreased with depth and differed between species, but did not vary between field sites. ^{18}O values were not significantly different across depth within a species, but did differ among species and field sites. High-resolution analysis of the intra-annual variation in skeletal ^{13}C and ^{18}O in *P. compressa* at 2.0 m depth confirms that these isotopes reflect changes in solar irradiance and temperature, respectively. Changes in MLSE across depth were consistent within, but highly variable among, species. Peak MLSE occurred at 1.7, 5.0, and 8.3 m for *P. lobata, P. compressa, and M. verrucosa*, respectively. Such interspecific variation in MLSE patterns may be attributable to one or more of the following: increases in zooplankton in the diet, changes in metabolic processes, or changes in growth form with depth. Overall, these results imply that natural inter- and intraspecific variability in coral skeletal ^{13}C, ^{18}O, and MLSE should be considered when interpreting and comparing coral-based tropical paleoclimate data from various coral species, depths, and field sites.

Grovhoug, J. G. (1976). A preliminary evaluation of environmental indicator systems in Hawai`i. San Diego, Ca.

Grovhoug, J. G. and E. R. Rastetter (1980). Marine fouling dynamics in Hawaiian nearshore ecosystems. A suggested technique for comparison and evaluation. 5th Int. Cong. on Mar. Corrosion and Fouling, Graficas Orbe, Madrid.
Study of fouling assemblages performed in Pearl Harbor and Kane`ohe Bay, O`ahu.

Guinther, E. B. (1970). Biology of some Hawaiian Epitoniidae. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology.
A study of four species of *Epitonium* in Kane`ohe Bay and their associated coelenterates: *E. fucatum* Pease (with *Maracanthea cookei*); *E. hyalinamokulensis* Pilsbry (with *Boloceroides lilae*); *E. ulu* Pilsbry (with *Fungia scutaria*); and a species resembling *E. costulatum* Sowerby (also with *F. scutaria*). *E. fucatum* maintains one large population in Kane`ohe Bay associated with the anemone on which they feed. Individuals collected in Kealakekua Bay were not in association with any anemone although they will eat *M. cookei, E. hyalina* is rare in Kane`ohe Bay although its associated anemone is quite abundant. *E. ulu* is the most common species of this genus in the bay. Only three individuals of *E. costulatum* were found during the study.

Guinther, E. B. and M. L. Bartlett (1986). A note on comparative quadrat sampling for infaunal and epifaunal invertebrates, 1968-71 and 1983 Coconut Island reef flat, Kane`ohe Bay. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Honolulu, University of Hawai`i Institute Marine Biology Technical Report No. 37/U. H. Sea Grant Cooperative Report UNIHI-SG-CR-86-01**:** 111-122.
Lists invertebrates and densities (number/square meter) found in 1968-71 and 1983 surveys of Coconut Island reef flat. Dramatic changes occurred in infauna and epifauna following termination of sewage disposal in the bay in 1978, shown by a sharp reduction in numbers of crabs, bivalves and various filter feeding invertebrates. Sewage abatement apparently reduced the amount of food available to these species.

Guinther, E. B. and R. Bowers (1976). Kane`ohe Bay urban water resources study: Benthic Biota. Kane`ohe

Bay Water Resources Data Evaluation Appendices I and II. Honolulu, U.S. Army Corps. of Engineers., Pacific Ocean Division.

Gundersen, K. R. (1973). Microbiology. Estuarine pollution in the State of Hawai`i, Vol. 2: Kane`ohe Bay study. D. C. e. a. Cox. Honolulu, University of Hawai`i, Water Resources Research Center**:** 327-341.
The bacterial distribution in Kane`ohe Bay is covered in this study. Ten stations in the bay were monitored weekly and biweekly in 1968-1969. Fairly complete data are available for the distribution of total bacteria, fecal coliforms, and enterococci. Nitrification in Kane`ohe Bay was also investigated.

Gundersen, K. R. and D. B. Stroupe (1967). Bacterial Pollution of Kane`ohe Bay, O`ahu (June through August 1967). Honolulu, University of Hawai`i, Water Resources Research Center, Manoa**:** 12 pp.
From June through August 1967, a thorough investigation was made presence and numbers of coliform bacteria, fecal streptococci), and bacteria capable of growing on peptone-seawater agar. In contrast to the low count of fecal bacteria in most parts of Kane`ohe Bay, rather high counts of coliforms, and especially enterococci, were found at several stations in shallow water in the middle sector. In addition to the study of bacterial pollution of Kane`ohe Bay, data were collected from the sea south of the island of Maui and surrounding the island of Kauai.

Gupta, K. C. (1967). Marine Sterols. Chemistry. Honolulu, University of Hawai`i**:** 185.
A systematic investigation of the sterols of marine invertebrates chiefly the sterols of members of the family Zoanthidae, phylum Coelenterata, and those of members of the phylum Echinodermata. Zoanthids for the study were collected during 1964-1967 from various locations including the islands of O`ahu (Coconut Island), Tahiti, Maui, Eniwetok Atoll and the Marshall Islands.

Gust, G. and J. T. Harrison (1981). "Biological pumps at the sediment-water interface: mechanistic evaluation of the alpheid shrimp *Alpheus mackayi* and its irrigation pattern." Mar. Bio. 64: 71-78.
Deep-burrowing crustaceans are common on all coasts. In a series of model experiments conducted at the Hawai`i Institute of Marine Biology from March to October 1977 on specimens collected from Kane`ohe Bay, the effect of the alpheid shrimp *Alpheus mackayi* Banner and Banner, on material fluxes across the sediment-water interface has been determined. Viewed as a "biological pump," the shrimp's irrigation pattern was not random, but intermittent, with a mean period of 6 min activity and 16 min resting. In microcosm experiments with 177 cm^2 burrow-system surface, the pumping of one shrimp enhanced the release of silica from the pore water by an average factor of 5 compared to concentration gradient-driven flux across the sediment-water interface in a control core with the same dimensions but without a shrimp. Data suggest that "real-world models" of interfacial fluxes without inclusion of the macro-infauna as biological pumps will be unrealistic.

Hadfield, M. G., E. A. Kay et al. (1972). "The Vermetidae (Mollusca: Gastropoda) of the Hawaiian Islands." Mar. Biol. 12: 81-98.
The Hawaiian vermetid fauna comprises 8 species, 7 of which are here described as new. The generic distribution includes 5 species of *Dendropoma* and 1 each of *Petaloconchus, Vermetus* and *Serpulorbis*. The species descriptions rely little on conchology, stressing instead descriptions of animals, habitats and reproductive and developmental characteristics. Feeding is accomplished in all species by a combination of mucous nets and detrital collection by ctenidial cilia. Only in the single species of *Vermetus*, an inhabitant of quiet waters, does ciliary feeding predominate. The Hawaiian vermetids are very abundant in some localities, with densities ranging from up to 60,000/m2 in one species of *Dendropoma*. Reproduction is continuous in all Hawaiian vermetids, most of which produce small hatching juveniles rather than swimming veligers. Larval or juvenile size is correlated with available nurse yolk, not with egg size.

Haley, S. R. (1982). "Zonation by size of the Pacific mole crab, *Hippa pacifica* Dana (Crustacea: Anomura: Hippidae), in Hawai`i." J. Exp. Mar. Biol. Ecol. 58: 221-231.

Hanson, R. B. (1974). Biological nitrogen fixation in a subtropical eutrophic estuary of Kane`ohe Bay, O`ahu, Hawai`i. Dept. of Microbiology. Honolulu, Univ. Of Hawai`i**:** 127 pp.
Biological nitrogen fixation was investigated in Kane`ohe Bay. Nitrogen fixation was measured by the acetylene reduction method which was confirmed by the 15-N2 method. The south sector receives primary and secondary sewage from two treatment plants. A great deal of the sewage-enriched water escapes to the ocean through the Southeast Channel, some of it reaches the middle sector and mixes with open ocean water. The north sector water receives nutrient-enriched freshwater run-off from streams and land drainage. Three major communities were measured for nitrogen fixation: the estuarine water, the periphytic and the benthic communities. Nitrogen fixation was not found in the free

water community. The periphytic algal community showed higher fixation activity in the middle sector; the benthic bacterial community showed higher rates in the south and north sectors. Nitrogen fixation in dead coral communities was about 1000 times greater than in live coral.

Haramaty, L. (1991). "Reproduction effort in the nudibranch *Phestilla sibogae*: Calorimetric analysis of food and eggs." Pac. Sci. 45: 257-262.
Phestilla sibogae, a nudibranch living on corals of the genus *Porites*, is rarely found on the reef at Kane`ohe Bay, Hawai`i, although *Porites compressa* is a dominant coral there. This is probably due to massive predation on juveniles and adults. Such predation pressure would force this species to put high effort into reproduction. In this work I found that *P. sibogae* laid eggs amounting to up to 17% of their body weight each day. Furthermore, based on a 100% conversion efficiency for ingested coral tissue, 51-78% of the calories each individual ate daily were channeled into egg production. Photosynthetic activity of zooxanthellae in the nudibranch's tissue suggests that the algae may provide some of the energy required by the animal's metabolism.

Harrigan, J. F. (1972). The planula larva of *Pocillopora damicornis*: lunar periodicity of swarming and substratum selection behavior. Dept. of Zoology. Honolulu, University of Hawai`i.
Swarming of the planulae was analyzed according to five physical environmental factors: moon phase, temperature, tides, photoperiod, and rainfall. Measurements were also made to determine if there is any relationship between the number of planulae released and the size of the coral head to determine the distribution of planulae on a coral head.

Harrington, M. E. and G. S. Losey (1990). "The importance of species identification and location on interspecific territorial defense by the damselfish, *Stegastes fasciolatus*." Exp. Bio. of Fishes 27: 139-145.
The Hawaiian damselfish, *Stegastes fasciolatus*, defends an all-purpose territory on shallow-water reefs. By conceptually dividing each territory into 3 horizontal and 2 vertical zones, each intruder into the territory was recorded by species, zones violated, and reaction of the resident. Species of the intruder and their position in the territory had an additive effect on the chase response, with position in the territory as the less important factor. The ecological implications of these results are discussed.

Harrison, J. T. (1981). The influence of *Alpheus mackayi* on ecosystem dynamics in Kane`ohe Bay. Dept. Of Zoology. Honolulu, Univ. Of Hawai`i**:** 112 pp.
Field and laboratory studies of lagoon floor sedimentary infauna were performed in Kane`ohe Bay. In particular, the role of the *Alpheus mackayi* in the cycling of dissolved nutrients between the sediments and the water column was examined. Material fluxes from in situ incubations, substratum manipulations, sediment traps, and specific laboratory experiments were considered in the context of extant data on ecosystem dynamic processes. Samples were collected from the bottom sediment throughout the bay.

Hartman (1966). "Polychaetous annelids of the Hawaiian Islands." Bishop Museum Occ. Papers 23: 163-25.
A report assembling all published records of polychaetous annelids named from the Hawaiian Islands. Some unpublished records are included based on collections from littoral regions. Descriptions are given of two new species and one new genus.

Harvey, W. A. (1974). The utilization of urea, ammonium and nitrate by natural populations of marine phytoplankton in a eutrophic environment. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 61 pp.
The utilization rates of urea, ammonium and nitrate have been determined for natural populations of marine phytoplankton in the South sector of Kane`ohe Bay. The uptake rate of ammonium and nitrate, in addition to urea, were monitored by time series nutrient analysis. The distribution of phytoplankton biomass appears to result from the mixing processes associated with wind stress and the tidal prism. The C/N ratio indicates that the phytoplankton community is less nitrogen deficient than previous studies reported and therefore may not be nitrogen limited. Based on the relative nutrient uptake rates, the order of preference was found to be ammonium > urea > nitrate. Mass balance calculations indicate that the sewage effluent and stream run-off into the South sector contribute only 2.6% of the total mean uptake rate, but provide the primary nutrient source for maintaining the phytoplankton concentration.

Harvey, W. A. and J. Caperon (1976). "The rate of utilization of urea, ammonium, and nitrate by natural populations of marine phytoplankton in a eutrophic environment." Pac. Sci. 30: 329-340.
The utilization rates of ammonium, nitrate ion, and urea were determined for 18 samples of water from the southern sector of Kane`ohe Bay, O`ahu, Hawaiian Islands. The samples were collected from 14

May through 23 Aug 1974. The mean daytime uptake rates for this period were 0 . 040, 0 . 033, and 0 . 013$^{h\ -1}$ for ammonium, urea, and nitrate, respectively. Dark uptake rates for ammonium, urea, and nitrate from 2 samples were approx 50, 30, and 0% of the daytime uptake rates. The uptake data indicate that the phytoplankton growth rate is not limited by the availability of fixed N. This conclusion is supported by the data on the C:N ratio of the phytoplankton, which show that the plants were more heavily enriched in nitrogen than they had been during previous studies of this part of the bay. Mass balance calculations show that the supply of fixed N to the nutrient pool from stream runoff and municipal waste discharge was only 3.5% of the total uptake rate by phytoplankton, and, therefore, suggest that the in situ regeneration of nutrients is far larger than the new nutrients added to the bay from these sources

Hawai`i Institute of Marine Biology (1978). Kane`ohe Bay sewage relaxation experiment, pre-diversion report. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 166 pp.

Hazlett, B. A. (1970). "Interspecific shell fighting in three sympatric species of hermit crabs in Hawai`i." Pac. Sci 24(4): 472-482.
Interspecific competition is often difficult to measure due to lack of a definitive limiting factor for two (or more) species. The gastropod shell inhabited by a hermit crab gives protection to the soft abdomen but also elicits ritualized shell fighting behavior patterns of hermit crabs. This study was designed to measure the extent of interspecific competition and investigate the behavioral basis of the results obtained. Using data from this and other studies, several competition coefficient values based upon shell inhabitation are obtained and compared. All the individuals used were collected from the northeast side of a small sandbar, Gravel Island, in Kane`ohe Bay, O`ahu.

Hazlett, B. A. (1971). "Interspecific fighting in three species of brachyuran crabs from Hawai`i." Crustaceana 20(3): 308-314.
Interspecific agonistic interactions can serve as a direct means of ecological competition. Such direct competition may result in physical injury, but can also result in a spacing out of individuals as a consequence of exchanges of ritualized signals. Reports on agonistic interactions between crustacea of different species have not been common. While working on the sensory physiology of decapod crustacea in Hawai`i, it was noted that the aggressiveness of certain portunid crabs toward the experimenter varied greatly from species to species. Initial observations were designed to determine the relationships between size of interactions and outcome of interspecific aggressive interactions between three species of crabs obtained from Kane`ohe Bay, O`ahu. Agonistic interactions readily occurred between the crabs of different species, although they were usually brief and involved just a few behavioral acts.

Hazlett, B. A. (1972). "Shell Fighting and Sexual Behavior in the Hermit Crab Genera *Paguristes* and *Calcinus*, with Comments on *Pagurus*." Bull. Mar. Sci. 22: 806-823.
The behavioral patterns executed by hermit crabs during shell fights and during sexual behavior are described for eight species in the genus *Calcinus* and ten species in the genus *Paguristes*. The shell fighting patterns of eight species of *Pagurus* are also described. The variability in *Pagurus* is compared with the consistency seen in *Calcinus* and *Paguristes*.

Hazlett, B. A. (1989). "Mating success of male hermit crabs in shell generalist and shell specialist species." Behav. Ecol. Sociobiol. 25: 119-128.
The reproductive behavior of two species of diogenid hermit crabs was studied in Hawai`i. In the shell generalist, *Clibanarius zebra*, male reproductive success varied little with size, although the largest males were less successful in obtaining copulations than were medium-large males. Male and female size were positively correlated, in successful pairs, thus larger males had the potential to fertilize more eggs when they were successful in obtaining a copulation. In the shell specialist, *Calcinus seurati*, which is found primarily in *Nerita* shells as an adult, males in *Nerita* shells were quite successful.

Hazlett, B. A. (1990). "Disturbance pheromone in the hermit crab *Calcinus laevimanus* (Randall, 1840)." Crustaceana 58(3): 314-316.
The experiments were designed to test for the existence of analogous chemical communication systems in an unrelated marine crustacean. The intertidal hermit crab *Calcinus laevimanus* (Randall, 1840) was studied in Hawai`i using specimens collected from Kane`ohe Bay in 1988.

Helfrich, P. (1963). "Fish poisoning in Hawai`i." Hawai`i Medical Journal 22: 361-372.
A review of the categories of fish poisoning, their symptomology, treatment and other information of value to the public and to physicians. The review makes reference to investigations on the causes of

ciguatera being carried out at the Hawai`i Marine Lab, Kane`ohe Bay, and to investigations on tetradon poisoning using female specimens of *Arothron hispidus* collected in Kane`ohe Bay.

Helfrich, P. and A. H. Banner (1960). "Hallucinatory mullet poisoning - a preliminary report." J. Tropical Medicine and Hygiene April: 1-4.
Two species of mullet, *Mugil cephalus* L. and *Neomyxus chaptalli* (Eydoux and Souleyet) and two species of goatfish *Mulloidichthys samoensis* (Gunther) and *Upeneus arge* (Jordan and Evermann) have been reported in Hawai`i to cause a type of intoxication termed 'hallucinatory mullet poisoning' by the authors. Afflictions are sporadic rather than general which has led people to believe that quantities of the blue-green algae, *Lyngbya majuscula*, eaten by the fish causes poisoning. However, *Lyngbya* is found abundantly in areas where there has been no toxic reports, such as Kane`ohe Bay.

Helfrich, P. H. (1958). The early life history and reproductive behavior of the maomao, *Abudefduf abdominalis* (Quoy and Gaimard). Department of Zoology. Honolulu, University of Hawai`i.
A study of the embryonic, larval and adult stages of the maomao with respect to various elements in the environment which may affect the survival of each stage. Factors controlling the spawning cycle, fluctuations in abundance and fecundity are also reviewed to determine how they might influence the reproductive potential of this species. The reproductive activities of the maomao were observed in Southwest Point and Tuna Road, two shallow water spawning areas on Coconut Island, Kane`ohe Bay. Results showed the habitat of the maomao to be varied, extending over a considerable range of depth and substrate type with the exclusion of extensive muddy and sandy areas. The maomao is broadly omnivorous. Coloration includes two categories - normal adaptive coloration and nuptial coloration. The structure of the reproductive system is similar to other teleosts with external fertilization. The sex ratio noted in this study was 68.16% male and 31.4% female but there is evidence of selective sampling. The fecundity of female maomao was not determined although a single female was estimated to spawn an average of 21,400 eggs at one time spawning cycle continued throughout the year with increased spawning from mid-December to September and a peak in May or June. Eggs are described, mortality, development, rearing and adult rearing behavior as well as mating behavior .

Helfrich, P. H. and S. J. Townsley (1964-1968). Biology of *Palythoa* and related forms, U.S. Army Edgewood Arsenal Laboratories.
A study involving three annual reports, nine quarterly reports, and twenty four monthly reports on the biology of the *Palythoa* and related forms. Numerous references to collections of zoanthids from Kane`ohe Bay are made including a draft of a taxonomic revision of the family Zoanthidae from Hawai`i.
Data for Kane`ohe Bay:

Zoanthus nitidus	Goat Island
Zoanthus confertus	Coconut Island on the reef flat, boat channel, lagoon and edge of reef
Palythoa vestitus	Coconut Island on reef edge, lagoon and sand flat
Palythoa tuberculosa	Coconut Island in the lagoon
Edwardsia sp.	Coconut Island in the lagoon
Epizoanthus ?	Coconut Island on the reef flat
Zoanthus ?	Coconut Island on the reef flat
Palythoa ?	Turtle Island
Palythoa ?	Chinaman's Hat

Henderson, R. S. (1982). "*In situ* and microcosm studies of diel metabolism of reef flat communities." Proc. 4th Intern. Coral Reef Symp., Manila 1: 679-686.
Diel fluxes of dissolved nutrients and oxygen were determined for shallow benthic communities of coral rubble and sandy silt. Communities were monitored both in situ using plexiglass domes as enclosures on reef flat in Kane`ohe Bay, Hawai`i and in flow-through tank microcosms at two nearby research facilities. Gross production to respiration ratios (P/R's) were below 1.0 for all in situ communities, with rubble being nearly 30% less productive than silt. Microcosm P/R's were 1.5 to 2.7 times greater than the corresponding in situ values apparently because of thick algal mats that developed in the microcosms under reduced grazing pressure. In situ rubble communities released significant amounts of PO_4, NO_2 + NO_3 and NH_4

Henderson, R. S. (1992). A natural resources survey of the nearshore waters of Mokapu Peninsula, Kane`ohe Marine Corps Air Station. Kane`ohe, Naval Command, Control and Ocean Surveillance Center, Environmental Sciences Division, Hawai`i Lab: 47 pp.

Henderson, R. S. and S. M. Salazar (1996). Flowthrough bioassay studies on the effects of antifouling TBT leachates. Organotin: Environmental Fate and Effects. M. A. Champ and P. F. Seligman. London, Chapman & Hall**:** 281-303.

Henderson, R. S. and S. V. Smith (1978). Flow-through microcosms for simulation of marine ecosystems: Changes in biota and oxygen production of semi-tropical benthic communities in response to nutrient enrichments. Kane`ohe, NOSC
HIMB, UH**:** 39 pp.
A flow-through seawater system supplying a series of experimental tanks was constructed in 1974 to augment laboratory studies of joint marine biological investigations by the Naval Ocean Systems Center (NOSC) and the Hawai`i Institute of Marine Biology (HIMB). This facility draws near-oceanic seawater from the seaward side of Mokapu peninsula and complements a similar facility drawing water from the relatively higher-nutrient estuarine environs of Kane`ohe Bay.

Henderson, R. S., S. V. Smith et al. (1976). Flow-through microcosms for simulation of marine ecosystems: Development and intercomparison of open coast and bay facilities. Kane`ohe, Naval Undersea Center Technical Paper**:** 80 pp.
A low-nutrient flow-through seawater facility was constructed on the seaward side of Mokapu Peninsula (Ulupau Head), O`ahu, Hawai`i. This facility complements a system of similar design existing in the nearby high-nutrient environs of Kane`ohe Bay. The double-plumbing innovation introduced at the newer facility has been very successful in reducing antifouling maintenance. A calibration test was performed to determine interfacility differences in source water chemistry, organism recruitment, and growth of biota in the tanks. The bay source water generated a diverse, near-climax community within 60 days. At the oceanic facility succession was much slower and community productivity was significantly lower than in the bay microcosms. The principal difference in source water macronutrients between the two facilities was the PO^4 content, the bay values being about double those of the oceanic source. NH_3 and NO_3 contents were nearly the same, but showed large fluctuations which correlated with tide and surf conditions.

Herbert, D. A. (1986a). "The growth dynamics of *Halophila Hawaiiana*." Aq. Bot. 23: 351-360.

Herbert, D. A. (1986b). "Staminate flowers of *Halophila Hawaiiana*: Description and notes on its flowering ecology." Aq. Bot. 25: 97-102.
The staminate flowers of the Hawaiian endemic seagrass *Halophila Hawaiiana* Doty and Stone are reported from Kane`ohe Bay, O`ahu and described for the first time. These flowers are highly ephemeral and anthesis appears to occur only at night. The observation of staminate flowers for *Halophila Hawaiiana* leaves only *H. johnsonii* Eiseman with unreported staminate flowers.

Heyward, A. (1988). "Comparative coral karyology." Proc. 5th Intern. Coral Reef Conf., Tahiti 6: 47-51.
Scleractinian corals investigated in Australia and Hawai`i collected from Kane`ohe Bay all exhibited a similar pattern of external development. In all species, early cleavages occurred usually every 60 minutes or less. Such externally developing coral embryos provide a source of rapidly dividing cells which enabled good chromosome preparations to be made. The karyotype of 4 species, representing 3 families, is presented. Preliminary results suggest that karyptypic data will be useful for higher level systematics. The use of externally developing coral embryos has application to the majority of coral species and opens the way for extensive cytogenetic investigation of the Anthozoa.

Heyward, A. J. (1986). Sexual reproduction in five species of the coral *Montipora*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 170-178.
The timing and scale of sexual reproduction were investigated in five Hawaiian corals of the genus *Montipora*. All species were simultaneous hermaphrodites. *M. verrucosa* and *M. dilitata* were observed to shed gametes following the new and full moon, respectively, in July. Spawning was also inferred for *M. studeri* and *M. verrilli* following the July full moon.

Heyward, A. J. and J. A. Stoddard (1985). "Genetic structure of two species of *Montipora* on a patch reef: conflicting results from electrophoresis and histocompatibility." Mar. Biol. 85: 117-121.
Spatial patterns of graft acceptance and rejection were different for two species of the coral *Montipora* from Kane`ohe Bay, Hawai`i. Electrophoretically distinct tissues were capable of fusing, indicating that clonal identity is not necessarily inferred by acceptance of grafts. For *M. dilatata*, 18 of 40 cases of fusion were between dissimilar genotypes and for *M. verrucosa*, 3 of 7 cases. In one case, fusion

occurred between genotypes which shared no alleles. A greater understanding of the genetics of invertebrate immunology is required before histocompatibility criteria can be used independently to assess population genetic structure with confidence.

Hiatt, R. W. (1948). "Records of rare Hawaiian decapod crustacea." Pac. Sci. 2: 78-80.
A taxonomic study of some rare or previously unknown decapod crustacea from Hawai`i. *Hymenocera elegans* Heller was found in a *Porites* coral head in Kane`ohe Bay.

Hiatt, R. W. (1951). "Food and feeding habits of the nehu *Stolephorus purpureus* Fowler." Pac. Sci. 5: 347-358.
A study of the food and feeding habits of the nehu in an attempt to learn more of this important baitfish. Kane`ohe Bay, where the studies were done, provides more than 60% of the total commercial catch according to statistics of the Territorial Division of Fish and Game.

Results showed that copepods, barnacle nauplii and mysis larvae of shrimps were most important in the diet of the nehu taken in Kane`ohe Bay, while other animals were more important to nehu in other areas. The nehu are selective feeders in that they feed only on the crustacean elements in the plankton. The author concludes that further study on the relation of vigor to size and of size to food available may indicate the principles underlying the apparent differences in size and vigor of nehu in the various baiting grounds.

Hidaka, M. (1985). "Tissue compatibility between colonies and between newly settled larvae of *Pocillopora damicornis*." Coral Reefs 4: 111-116.
Grafting experiments with newly settled larvae and with adult colonies of *Pocillopora damicornis* were performed. Newly settled larvae pairs, when kept in contact fused to form an aggregate even if they were of different color morphs showing no sign of allogenic rejection. Fusion was observed only when branches derived from the same colony were paired. The present results suggest that juvenile corals lack the functional histocompatibility system as shown by adult colonies. Colonies of *P. damicornis* were collected from the reef in Kane`ohe Bay, O`ahu.

Hidaka, M. (1986). Tissue compatibility between colonies and between primary polyps of *Pocillopora damicornis*: a preliminary study. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 151-160.

Higa, G. (1967). A quantitative study of the fixed motor patterns of the shrimp, *Stenopus hispidus*, particularly those movements associated with self-grooming. Department of Zoology. Honolulu, University of Hawai`i.
A literature review of shrimp cleaning symbiosis and a quantitative analysis of the fixed motor patterns in the self-grooming behavior of *Stenopus hispidus*. To study the latter problems the grooming behavior of *S. hispidus* was compared to that of *Hippolysmata grabhami* to determine the fixed motor patterns of this behavior in each shrimp. Along with these studies, observations were made on *S. hispidus* when one member of the major pair of periopods had been amputated. The research was conducted on Coconut Island with shrimp from Kewalo Basin and Kane`ohe Bay. Mention is made of finding six possible new species of shrimp but no descriptions are given.

Higgins, J. H. (1969). Some aspects of the ecology of a bivalve mollusk in Kane`ohe Bay. O`ahu, Hawai`i. Department of Zoology. Honolulu, University of Hawai`i**:** 47 pp.
This study was made 1) to collect relevant ecological data particularly on the distribution and growth of clams in various parts of the bay in order to determine what limits distribution and any effects pollution may have on the clam beds; 2) to determine interaction of *Tapes* with other species, particularly predators and *Lingula reevi*, a co-occurring filter feeder; and 3) to study the effects of harvesting on abundance and population structure. These aspects of the ecology of *Tapes* were considered in the light of increasing onshore development in the shores of the southeastern bay and sewage discharge.
The author collected relevant ecological data with emphasis on the distribution and growth of clams (*Tapes philippinarum* Adams and Reeve, 1867) in various parts of the bay in order to determine what limits distribution and the effects (if any) which pollution may have on the clam beds. The author also determined the interaction of *Tapes* with other species, particularly predators and *L. reevi,* and he studied the effects of harvesting on abundance and population structure. The study was conducted in the southeastern section of Kane`ohe Bay. Clam distribution was shown to be possibly related to substratum, circulation, depth and salinity. The larvae settle in the spring, the peak time being between April and May. The growth rate of the clams varied with location in the bay which may be due to possible nutritional differences in various parts of the bay. The effects of clammers on the clam

population showed the biggest clams on the periphery of the beds were leaving the smaller clams in the centralized crowded areas. The average weight of the clams dropped 35% (1.7 - 1.1 gms) as virtually all the clams above the legal size limit (25 mm) were taken. Approximately 50% of the total clam population was reduced by clammers, 15% of this were clams above the legal size limit, indicating that smaller clams were being illegally harvested. Several regulations are suggested by the author to insure the continued harvest of clams.

Hildemann, W. H., C. H. Bigger et al. (1980). "Characteristics of transplantation immunity in the sponge, *Callyspongia diffusa*." Transplantation 30(5): 362-367.
Very extensive polymorphism of histocompatibility (H) molecules in the sponge *Callyspongia diffusa* was revealed by the incompatibility found among 480 different allogeneic pairings without exception. This represents some 960 clones utilized as alloparabionts or sources of fitted allografts. Maximal allosensitization indicated by accelerated second-set reactivity was gradually achieved, as a function of the interclonal combination, after 2 to 8 days of primary contact. Heightened transplantation immunity or memory persists for at least 2 to 3 weeks after contact sensitization.

Hildemann, W. H., I. S. Johnson et al. (1979). "Immunocompetence in the lowest metazoan phylum: transplantation immunity in sponges." Science 204: 420-422.
Isografts of *Callyspongia diffusa* fuse compatibly, but allografts are invariably incompatible. Extensive polymorphism of cell-surface histocompatibility markers is evident. The histocompatibility barriers range from strong to weak depending on the interclonal combination, but early rejection with conspicuous cytotoxic sequelae is typical. Reaction times of first-set, second-set, and third-party grafts indicate highly discriminating transplantation immunity with a specific memory component.

Hill, S. D. (1972). "Caudal regeneration in the absence of a brain in two species of sedentary polychaetes." J. Embryol. exp. Morph. 28(3): 667-680.
Evidence has been obtained showing that unlike the requirements of errant polychaetes studied by other investigators, at least two species of sedentary polychaetes, *Branchiomma nigromaculata* and *Chaetopterus variopedatus* can undergo caudal regeneration in the absence of a brain. These experiments suggest that the ventral ganglia rather than the brain are important posterior regeneration in these species. Polychaetes were collected from the waters around Coconut Island, O`ahu, Hawai`i.

Hilton, W. A. (1942). "Pycnogonids from Hawai`i." B. P. Bishop Museum Occ. Papers 17(3): :43-55.
A taxonomic description of the pycnogonids collected mainly by C. H. Edmondson. A number of new species and one new genus are described. All the specimens are presently in the Bishop Museum. Those species collected from Kane`ohe Bay include:
Endeis (Phoxichillus) nodosa n. sp. - collected 1924-1927 from hydroids by V. Pietschmann

Hiromi, J., S. Kadota et al. (1985). "Infestation of marine copepods with epizoic diatoms." Bull. Mar. Sci. 37: 766.
Several copepod species collected in coastal waters of Japan and Kane`ohe Bay of Hawai`i were heavily infested with epizoic diatoms. Investigation by SEM revealed that these diatoms were composed of three new species of Diatomaceae and two species of Protoraphidaceae. The authors report this infestation is more common than previously thought and discuss the ecological significance of such an association.

Hirota, J. and J. P. Szyper (1976). "Standing stocks of zooplankton size-classes and trophic levels in Kane`ohe Bay, O`ahu, Hawaiian Islands." Pac. Sci. 30(4): 341-361.
Data are presented for the estimated standing stocks of nanozooplankton, microzooplankton, and macrozooplankton in the southern sector of Kane`ohe Bay. There is evidence that a shift has occurred in the past decade in the size-composition of the macro- and microzooplankton; during this time the total amount of zooplankton particulate nitrogen has remained nearly unchanged. The same dominant species of macro- and microzooplankton still inhabit the bay. We speculate that the historical changes in the zooplankton of southern Kane`ohe Bay are the result of selection for nanophytoplankton feeders with rapid rates of metabolic turnover. The size-composition and trophic structure of the southern Kane`ohe Bay zooplankton and planktivorous nekton in the ecosystem are compared with available information from the northeastern Pacific Ocean. The major differences between these ecosystems are to be found in the ratio of macrozooplankton:microzooplankton, the predominant trophic level of zooplankton captured by 0.333-mm mesh nylon nets, and the size of the common epipelagic planktivorous nekton.

Hixon, M. A. and W. N. Brostoff (1983). "Damselfish as keystone species in reverse: intermediate

disturbance and diversity of reef algae." Science 220: 511-513.
Substrates located within the defended territories of Hawaiian damselfish for 1 year were subjected to intermediate grazing intensity and, as a result, showed greater diversity of algae than substrates either protected within fish-exclusion cages or exposed to intense fish grazing outside territories. Thus, this damselfish enhances local diversity on reefs through "intermediate disturbance" effects, and is a keystone species that decreases rather than increases overall predation intensity relative to areas where it is absent.

Hixon, M. A. and W. N. Brostoff (1985). " Substrate characteristics, fish grazing, and epibenthic reef assemblages off Hawai`i." Bull. Mar. Sci. 37: 200-213.

Hodgson, G. (1985a). "Vertical distribution of planktonic larvae of the reef coral *Pocillopora damicornis* in Kane`ohe Bay (O`ahu, Hawai`i)." Proc. 5th Intern. Coral Reef Congr., Tahiti 4: 349-354.
Preliminary work in Kane`ohe Bay, O`ahu, Hawai`i suggested that planktonic *Pocillopora damicornis* planulae more than one day old, may migrate vertically from near the surface to 3-5 m depth during the day and return toward the surface at night. Differences in planula abundance at the two depths in the daytime versus the night-time were predicted based on a hypothesis of diurnal vertical migration in response to light stimulation. Plankton tows were employed to quantify the diurnal, vertical distribution of *Pocillopora damicornis* larvae at 0-1 m and 3-5 m depth in Kane`ohe bay. When planulae were abundant, the average number recovered from the surface tows was significantly greater than the number recovered from tows taken at 3-5 m depth, both day and night. Predicted differences between day and night planula abundance at 0-1 m and 3-5 m depth were found on 30% and 55% of the sample dates respectively. But predicted abundance inversion between depths occurred on 26% of the days and 62% of the nights. The relatively high abundance at 0-1 m depth was attributed to the continuous inflow of new planulae released from a nearby reef. This inflow may have masked diurnal changes in abundance caused by vertical migration alone. A model of the processes affecting the abundance of coral planulae in the Kane`ohe Bay water column is presented.

Hodgson, G. (1985b). "Abundance and distribution of planktonic coral larvae in Kane`ohe Bay, O`ahu, Hawai`i." Mar. Ecol. Prog. Ser. 26: 61-71.
A plankton sampling program was designed for the capture of coral planulae. Twelve different types of cnidarian larvae were recognized. Six were identified as the planulae of the corals *Pocillopora damicornis*, *Porites compressa*, *Montipora verrucosa*, *M dilitata*, *Cyphastrea ocellina* and *Fungia scutaria*. Two appear to be the zoanthina larvae of the zoanthids *Palythoa vestitus* and *Zoanthus pacificus*. Limited data indicate that some coral planulae may undertake diurnal migration, residing near the surface at night and moving to several meters depth during the day. The potential for the export of large numbers of coral planulae from Kane`ohe Bay is considered high, but whether this export is significant to recruitment on reefs outside the bay remains to be determined.

Hodgson, G. (1986). Preliminary observations on the abundance and distribution of planktonic coral larvae in Kane`ohe Bay, O`ahu, Hawai`i. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 206-233.
A plankton sampling technique designed for capture of coral planulae collected more than 100,000 cnidarian larvae, most of which were scleractinian planulae. Twelve different types of cnidarian larvae were differentiated. Two appear to be the zoanthina larvae of the zoanthids *Palythoa vestitus* and *Zoanthus pacificus.* Six were identified as the planulae of the corals *Pocillopora damicornis, Porites compressa, Montipora verrucosa, M. dilitata, Cyphastrea ocellina* and *Fungia scutaria*. Peak recovery generally occurred 3-7 days after the onset of coral spawning or planulation.

Hoffman, K. S. (1987). Daytime changes in oocyte development and plasma estradiol 17□ with relation to the tidal cycle in the Hawaiian saddleback wrasse, *Thalassoma duperrey*. Department of Zoology. Honolulu, University of Hawai`i**:** 98 pp.
Hourly variations in oocyte stages and plasma estradio-17□ were measured in association with the daytime tidal cycle in the Hawaiian saddleback wrasse, *Thalassoma duperrey* during fall and summer months on fish sampled from Kane`ohe bay. The association of developmental changes with changes in tide heights of the rate of water movement points to the importance of the tidal cycle or its underlying lunar influence as a predominant reproductive cue for the wrasse.

Holland, K. N., C. G. Lowe et al. (1992). Growth and movements of the blue and white trevally (*Caranx melampygus* and *C. ignobilis*) in Kane`ohe Bay, Hawai`i. Honolulu, Hawai`i Division of Aquatic Resources, State Department of Land and Natural Resources.

Holland, K. N., C. G. Lowe et al. (1996). "Movements and dispersal patterns of blue trevally (*Caranx melampygus*) in a fisheries conservation zone." Fish. Res. 25: 279-292.
The short- and long-term movement patterns of blue trevally (*Caranx melampygus*) were monitored using a combination of sonic tracking and tag-and-release techniques. All fish were captured and released on the patch reef surrounding Coconut Island in Kane`ohe Bay, O`ahu, Hawai`i, which has been a no-fishing conservation zone for over 30 years. Sonic tracking produced fine-scale movement data from five fish for periods spanning up to 18 days. All fish displayed diel movement patterns within consistent home ranges, which encompassed different parts of the reef during the night than during the day. Movements were predominantly along the walls of the patch reef, with occasional forays to nearby sections of adjacent reefs. Four hundred and ten fish were tagged and released on the Coconut Island reef, and the recapture sites of 85 recaptured fish indicated that most did not move far from their point of release; 75.5% were recaptured within 0.5 km of their release points. Time at liberty ranged from 4 to 454 days, and distance between release and recapture sites was not related to time at liberty. Some fish were observed many times in the same areas over periods of several months. Both the tracking and recapture data indicate strong site fidelity in this species and low occurrence of long distance emigration. These behavioral traits suggest that successful husbandry of this species may be accomplished through the use of management practices such as establishing no-fishing zones.

Holland, K. N., J. D. Peterson et al. (1993). "Movements, distribution and growth rates of the white goatfish *Mulloides flavolineatus* in a fisheries conservation zone." Bull Mar. Sci. 52: 982-992.
The movements, growth rates and distribution of a population of white goatfish M*ulloides flavolineatus* were investigated in Kane`ohe Bay, O`ahu, Hawai`i, using a combination of tag-and-release and sonic tracking techniques. The study site was a 137 km super(2) patch reef which has been a no-fishing conservation zone for over 30 years. The population showed high site fidelity; 93% of recaptures occurred at the release site, with times at liberty of up to 531 days. Tracking revealed crepuscular movements away from daytime schooling sites to consistent nighttime foraging groups up to 600 m away. The route taken between daytime and nighttime habitats was the same each night. Surround-net quadrats were used to measure goatfish densities on the nighttime feeding grounds. The high site fidelity and limited range of diel movements of these fish indicate that quite small harvest refugia can serve to effectively protect populations of mature adults, and that for most of the year, emigration of adults into adjacent fisheries was minimal.

Holland, K. N., B. M. Wetherbee et al. (1993). "Movements and distribution of hammerhead shark pups *on* their natal *g*rounds." Copeia 1993: 495-502.
Ultrasonic telemetry was used to determine the movements and distribution of juvenile hammerhead sharks (*Sphyrna lewini*) on their natal grounds in Kane`ohe Bay, O`ahu, Hawai`i (USA). Transmitters were force fed to six pups which were tracked for periods of up to 12 days. All animals showed a high fidelity to a shared daytime core area to which they repeatedly returned after exhibiting wider ranging nocturnal movements. During daytime, the shark pups formed a loose school which moved about within the core area, hovering about 1.5 m off the bay floor. This daytime refuging behavior may serve an antipredation function. Nighttime movements covered the bay floor and bases of patch and fringing reefs and probably represented foraging excursions. Occasional forays away from the core area also occurred during daytime. The small size of the total activity space may indicate a healthy forage base for the sharks. Nocturnal swimming speeds were greater than diurnal swimming speeds.

Hollenberg, G. J. (1968). " An account of the species of *Polysiphonia* of the Central and Western tropical Pacific Ocean 1. *Oligosiphonia*." Pac. Sci. 22: 56-98.
A taxonomic account of the *Oligosiphonia* algae collected by Dr. M. S. Doty (1962) and by the author in 1948 of the Marshall Islands and in 1964-1965 by Doty of widely scattered central and western tropical islands in the Pacific Ocean.

Hollenberg, G. J. (1968). "An account of the species of the red alga *Herposiphonia* occurring in the Central and Western Pacific Ocean." Pac. Sci. 22: 536-560.
A taxonomic study of fourteen species in the genus *Herposiphonia* collected in the Central and Western tropical Pacific Ocean. The nature and arrangement of trichoblasts and of the sexual reproductive structures as features of taxonomic importance were emphasized. Specimens of *H. parca* Setchell were collected in Kane`ohe Bay.

Hollet, K. J. (1977). Shoaling of Kane`ohe Bay, O`ahu, Hawai`i, in the period 1927 to 1976 based on bathymetric, sedimentological, and geophysical studies, University of Hawai`i, Manoa**:** 145.

Holloran, M. K. (1986). The relationship between colony size and larva production in the reef coral *Pocillopora damicornis*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 167-169.
The planulation rates of *Pocillopora damicornis* colonies from throughout the size range in which they commonly occur in Kane`ohe Bay were experimentally determined. The planulation rate increased with colony size to a size of 8 cm radius was reached, after which planulation rate decreased with increasing size.

Holloran, M. K. and W. G. J. (1986). Diurnal periodicity in planula release by the reef coral *Pocillopora damicornis*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 161-166.
The hourly planula production rates of the common hermatypic coral *Pocillopora damicornis* in Kane`ohe Bay were measured for three 24 h periods in order to detect any ordered periodicity in the daily cycle. A single peak in daily production was found which occurred during periods of low tide and appeared to be independent of photoperiod.

Holly, M. (1935). "Polychaeta from Hawai`i." Bishop Mus. Bulletin 129.
A taxonomic study of the polychaeta collection which was part of a zoological collection made by Dr. Victor Pietschmann in Hawai`i in 1928. Kane`ohe Bay was one of the collecting sites. Most of the species described are the pelagic forms of nereids which were captured on the sea surface especially at night.

Holthus, P. F. (1986). Structural reefs of Kane`ohe Bay, Hawai`i: An overview. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology (HIMB) and Sea Grant College Program, Manoa. 37**:** 1-18.
Systematically describes and characterizes all parts of Kane`ohe Bay from a synthesis of existing literature.

Holthus, P. F. (1986). Coral reef communities of Kane`ohe Bay, Hawai`i: An overview. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, University of Hawai`i Institute Marine Biology Technical Report No. 37/U. H. Sea Grant Cooperative Report UNIHI-SG-CR-86-. 1**:** 19-34.
Describes coral reef communities in Kane`ohe Bay, including percent cover for different species and substrates at six sites throughout the bay.

Holthus, P. F., C. W. Evans et al. (1986). Coral reef recovery subsequent to the fresh water kill of 1965. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 66-75.
The recovery of the coral reef community on a patch reef near Kahaluu in Kane`ohe Bay from a "fresh water kill' in 1965 was studied by resurveying an a area previously surveyed in 1971. Results show large increases in the size and numbers of colonies and of coral coverage. Analysis of distribution reveals an extension of coral coverage further down the reef slope, but with highest abundance in the upper 5 m. Community diversity decreased slightly as the fast growing *Porites compressa* became more dominant.

Holthus, P. F., J. E. Maragos et al. (1989). "Coral reef recovery subsequent to the freshwater kill of 1965 in Kane`ohe Bay, O`ahu, Hawai`i." Pacific Science 43(2): 122-134.

Hoskins, G. P. (1968). The comparative biology and morphology of the parasitic prosobranchs *Mucronalia nitidula* Pease, 1860 and *Mucronalia* n. sp. Department of Zoology. Honolulu, University of Hawai`i**:** 117.
A microanatomical study of two species of Mucronalia in an attempt to **de**rive a more satisfactory description of these molluscs at the familial and subordinal level. Various aspects of the ecology, zoogeography behavior and physiology as related to nutrient uptake of these two species are also studied and compared. *M. nitidula* and its host *Holothuria atra*, are common in Kane`ohe Bay where some specimens for this study were collected. Other collection sites included Queens Surf, O`ahu and the southern coast of Kauai.

Houbrick, J. R. and F. V. (1969). "Some aspects of the functional anatomy and biology of *Cymatium* and *Bursa*." Proc. Malac. Soc. Lond. 38: 415-429.

A description of the external anatomy and alimentary canal of two species from the Mesogastropod superfamily Tonnacea, *Cymatium* and *Bursa* with consideration of their food and feeding habits. The reproductive system of both species is described and their reproductive activity is discussed. An egg mass with a structure similar to that of *Cymatium nicobaricum* and containing 400 eggs was dredged from a hard substratum in Kane`ohe Bay. Three species found in Kane`ohe Bay were studied: *Bursa granularis* (Roding, 1789), *Cymatium nicobaricum* (Roding, 1789) and *Cymatium pileare* (Linnaeus, 1758).

Houck, J. E., R. W. Buddemeier et al. (1977). "The response of coral growth rate and skeletal strontium content to light intensity and water temperature." Proc. 3rd Intern. Coral Reef Symp., Miami 2(425-431).

Five species of scleractinian corals were maintained in a series of experimental tanks under controlled conditions for up to eight months. Water temperatures and light intensities were controlled and monitored continuously. Growth rate was observed to be a function of both temperature and insolation. Skeletal strontium content decreased linearly with increasing temperature and appeared independent of insolation. A phylogenetic effect was observed, and separate strontium versus temperature regression lines for each species were calculated. Conditions of light and temperature stimulating optimum growth also differed with species.

Howard, L. S., D. G. Crosby et al. (1986). Evaluation of some methods for quantitatively assessing the toxicity of heavy metals to corals. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 452-464.

The effects of dissolved copper on respiration, nutrient uptake and release, pigments and zooxanthellae expulsion were investigated in *Montipora verrucosa*. The LC50 was determined to be 0.048 mg/L Cu (II). No significant change was detected in any other function after exposure to CU (II) between 0.01 and 1.0 mg/l, except that polyps were visibly bleached and zooxanthellae expelled in proportion to copper concentration.

Howe, M. A. (1934). "Hawaiian algae collected by Dr. Paul Galtsoff." Wash. Acad. Sci. 24: 32-42.

The taxonomic report of algae collected by Dr. P. Galtsoff during the summer of 1930 from Kane`ohe Bay, O`ahu and from Pearl and Hermes Reef, 1200 miles northwest of O`ahu.

Hsiao, S. C. (1965). "Kinetic Studies on alkaline phosphatase from echinoplutei." Limnol. Oceanogr. 10: R129-R136.

Using mass culture of the sea urchin *Tipineustes gratilla* eggs, a method was worked out for extracting fairly large quantities of the phosphomonoesterase alkaline phosphatase. The extracted enzyme showed a single ultraviolet absorbance band. It showed two characteristics bands in starch-gel electrophoresis. The optimal temperature for enzymatic action was 25-30C, coinciding with the range of fluctuations of the animal's ambient temperature.

Huber, M. E. and S. L. Coles (1986). "Resource utilization and competition among the five Hawaiian species of *Trapezia* (Crustacea, Brachyura)." Marine Ecol. Prog. Series 30: 21-31.

Crabs of the genus *Trapezia* and their hosts, the reef corals *Pocillopora* spp., were collected at 2 sites on the island of O`ahu, Hawai`i. At one site, Kahe Point, all 5 Hawaiian species of *Trapezia* were common, while at Kane`ohe Bay, the other site, only *T. intermedia* and *T. digitalis* were abundant. More than 90% of corals at both sites were inhabited by at least 1 species of *Trapezia* . Crabs usually occurred as heterosexual pairs, with a single pair of a given species per coral head. Up to 5 species were found to co-occur on single coral colonies. *T. intermedia* is abundant on coral colonies of all sizes, but the other species of *Trapezia* are largely restricted to colonies larger than 2000 to 4000 cm^3, probably as a result of their aggressive exclusion from small colonies by *T. intermedia.*

Hunt, J. W., R. Y. Ito et al. (1979). Cooperative *Gracilaria* Project: Environmental factors affecting the growth rate of *Gracilaria bursapstoris* and *Gracilaria coronopifolia* (Limu). Honolulu, University of Hawai`i Sea Grant College Program.

Hunter, C. L. (1985). "Assessment of clonal diversity and population structure of *Porites compressa* (Cnidaria, Scleractinia)." Proc. 5th Intern. Coral Reef Congr., Tahiti 6: 69-74.

Intraspecific variability is currently being assessed for a patch reef population of a dominant hermatypic coral, *Porites compressa*, in Kane`ohe Bay. Clonemates are distinguishable from allogenic colonies based on corallum morphology and color. Immunocompatibility testing by grafting, and preliminary electrophoretic analysis have provided corroboration of genetic identity for colonies representing seven morphotypes. In addition, each morphotype is unique in its total produced chromatographic signatures characteristic of their particular morphotypes. Variation in UV- absorbing compounds in this species provides a new method by which individual colonies can be assigned to different clonal groups. Single colonies tend to dominate large areas (up to 15 m 2), especially on the seaward side of the patch reef. Even in the most clonally diverse (leeward) areas of the reef, 40% of the total coral cover is comprised on only three morphotypes, represented by 91 separate colonies. Asexual (clonal) reproduction, followed by colonization and success due to temporal precedence or competitive superiority, seems to be an important aspect affecting the population structure of this species.

Hunter, C. L. (1988). Genotypic diversity and population structure of the Hawaiian reef coral *Porites compressa*. Department of Zoology. Honolulu, University of Hawai`i**:** 136.
The assessment of clonal diversity in populations of the endemic Hawaiian coral *Porites compressa* was undertaken using four independent assays of genotypic identity: colony morphology, immunocompatibility testing by tissue grafting, electrophoresis of soluble proteins and chromatography of ultra-violet absorbing compounds. Experimental specimens were collected from patch reef 43 in northern Kane`ohe Bay. All methods were corroborative, but electrophoresis of soluble proteins provided the single most efficacious assay of genotypic diversity, with a 7 locus (21 alleles) system which was estimated to sufficiently resolve approximately 95% of clonal samples.

Hunter, C. L. (1993). Living resources of Kane`ohe Bay: habitat evaluation section. Kane`ohe, O`ahu, Main Hawaiian Islands Marine Resource Inventory**:** 62.

Hunter, C. L. and C. W. Evans (1995). "Coral reefs in Kane`ohe Bay, Hawai`i: two centuries of western influence and two decades of data." Bull. Mar. Sci. 57: 501-515.
Impacts to Kane`ohe Bay coral reefs have resulted from various effects of natural processes such as freshwater flooding and erosional runoff. Additional impacts to the reef communities have resulted from anthropogenic activities concomitant with land use changes. One of the best documented anthropogenic changes in Kane`ohe Bay focused on physical and ecological responses during a one-year period following sewage diversion. After twenty-five years of discharge, two large sewage outfalls were diverted from the bay in 1977-1978, followed by rapid and dramatic decreases in nutrient levels, turbidity, and phytoplankton abundance in the previously affected areas. There was a corresponding change in community structure from one dominated by the green bubble alga, *Dictyosphaeria cavernosa*, and filter or deposit feeders, to one or more closely approaching the "coral gardens" described by Kane`ohe Bay visitors prior to W.W.II. By 1983, *D. cavernosa* had decreased to 1/4 of its previous (1970) abundance while coral cover had more than doubled. The last point-source sewage discharge into the bay was diverted in 1986. Recovery of coral-dominated reef communities in Kane`ohe Bay was expected to continue with a further decrease in algal cover and an increase in coral abundance. However, a 1990 survey indicated that, on a baywide basis, 1) algal cover had increased between 1983-1990 surveys, and 2) the rate of coral recovery established by surveys in 1970 and 1983 had slowed or, in some cases, reversed. Percent cover of *D. cavernosa* increased at 5 of 15 sites, while live coral showed slight to significant declines at nine sites compared to 1983 levels.

Hunter, C. L. and C. C. Kehoe (1986). Patchwork patchreefs: the clonal diversity of the coral *Porites compressa* in Kane`ohe Bay, O`ahu. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 124-132.
Morphological characteristics were used in conjunction with an immunocompatibility assay to determine the genetic diversity of a patch reef population of *Porites compressa*. Virtually identical colonies which exhibited tissue graft fusion were identified at distances of 0.2 to 100 m across the reef. In a 2 m X 10 m transect of the reef 49% of the 291 colonies of *P. compressa* were identified as belonging to 8 morphologically distinct and immunocompatible groups.

Hunter, C. L., M. D. Stephenson et al. (1995). "Contaminants in oysters in Kane`ohe Bay, Hawai`i." Mar. Poll. Bull. 30: 646-654.
Despite past and present concerns about the toxicity and persistence of various environmental contaminants (heavy metals and pesticides), relatively few studies have documented their concentrations in tropical or sub-tropical marine ecosystems. In this investigation, a 'mussel watch' approach was applied in Kane`ohe Bay, Hawai`i, to assess the present levels of potential contaminants in the Pacific oyster, *Crassostrea gigas*. Geographical gradients of these contaminants

were observed and related to what is known about past and present inputs. Concentrations of lead, copper, chromium and zinc were elevated in oyster tissues near stream mouths in the southern watersheds of Kane`ohe Bay. Dieldrin and chlordane concentrations in oysters from one of these sites exceeded the US Environmental Protection Agency's screening levels to protect human health, and were much higher than in oysters from the east and Gulf coasts of the temperate mainland USA.

Ingram, W. M. (1937). Fouling organisms in Kane`ohe Bay and Pearl Harbor. Zoology. Honolulu, University of Hawai`i.
A study concerned with the biological phases of the various organisms which habitually attach themselves to submerged structures, to note their rate of growth, their relative abundance and seasonal succession. Because of the economic concern in fouling organisms attention was given to various experimental and artificial means of preventing or at least discouraging the attachment of these organisms. The study was centered in Kane`ohe Bay and in Pearl Harbor for 18 and 12 months respectively starting in September 1935 and October 1935 respectively. The author notes no important difference in the species between the two areas. The total species list for each area is given.

Ingram, W. M. (1947). "Hawaiian Cypraeidae." B. P. Bishop Museum Occ. Papers 19(l): 1-23.
A paper 'filling in the gaps in our knowledge' of the twenty-nine species of Hawaiian cowries. An effort is made to summarize the available published information. Five species of *Cypraea* are found in Kane`ohe Bay.

Jander, R., K. Daumer et al. (1963). "Polarized light orientation by two Hawaiian decapod cephalopods." Zeitschrift fur vergleichende Physiologie 46: 383-394.
A study investigating the orientation behaviour of two small decapods *Euprymna morsei* and *Sepioteuthis lessoniana,* which were caught by night light fishing from the shore of Coconut Island, Kane`ohe Bay, to determine whether the rhabdom-like structures of the photoreceptors are orientated to perceive polarized light.

Johannes, R. and L. Tepley (1974). Examination of feeding of the reef coral *Porites lobata* in situ using time lapse photography. Proc. 2nd Intern. Coral Reef Symp., Brisbane, Australia.
Porites lobata is not adept at catching zooplankton but does feed both during the night and the day, with peak feeding activity occurring at dawn and dusk. Observations suggest that zooplankton did not constitute an important source of energy for *P. lobata* in outer Kane`ohe Bay during the course of this study.

Johannes, R. E. (1963). Uptake and release of phosphorus by representatives of a coastal marine ecosystem. Department of Zoology. Honolulu, University of Hawai`i**:** 42.
An examination of some of the aspects of phosphorus uptake and release in the ecological cycle in the marine environment. The study also examines the ecological significance of the phosphorus in both the living and nonliving particles in the sea.- The work was done in part at the marine lab on Coconut Island. The production and utilization of dissolved inorganic phosphate, soluble organic phosphorus and detrital phosphorus by representatives of three major trophic levels was studied using diatoms (producer), amphipod (consumer) and bacteria (transformer). Chemical analyses replaced radiometric analyses where possible using P^{32} in an effort to detect small quantities of phosphorus.

Johannes, R. E. (1964a). "Uptake and release of dissolved organic phosphorus by representatives of a coastal marine ecosystem." Limnol. Oceanogr. 9: 224-234.
A study conducted at Coconut Island, Kane`ohe Bay concerning the production and utilization of dissolved organic phosphorus (DOP) by a diatoms an amphipod and mixed species of marine bacteria. The amphipod *Lembos intermedius* Schellberg was collected from seaweed growing at the Hawai`i Marine Laboratory, Kane`ohe Bay. The diatom, *Achnanthes subhyalina* n. sp. (Dr. P. S. Conger) was found in a coarse sand . sample of mixed bacteria collected from a subsurface samples 100 meters east of Coconut Island Kane`ohe Bay. Results showed that over one-third of the soluble phosphorus released by the amphipod was in organic form (0.79,ug-at DOP/g of animal/hr). Marine bacteria utilized 80% of this DOP; 30% was hydrolyzed in sterile media, possibly by alkaline phosphotase released by the amphipods. Bacteria-free diatoms released little DOP during growth, but released 20% of their total phosphorus as DOP after growth has ceased. Growing diatoms reabsorbed 40% of this DOP; marine bacteria, 92%. No regeneration of dissolved inorganic phosphate from DOP in the presence of bacteria was noted- Marine bacteria, living or dead, released very little DOP.

Johannes, R. E. (1964b). "Uptake and release of phosphorus by a benthic marine amphipod." Limn.

Oceanogr. 9(2): 235-242.
Lembos intermedius releases phosphorus fractions into the water at the following rates: dissolved inorganic phosphate, 1.4 µg-at./g of animal (wet wt) per hr; dissolved organic phosphorus, 0.79 µg-at./g per hr; particulate phosphorus, 7.9 µg-at./g per hr. Both metabolic waste phosphorus and phosphorus that has not been assimilated but has simply passed through the gut are present in all three fractions. The total phosphorus release rate drops by more than 50% in 2 hr when the animals are deprived of food. The physiological turnover time, the time it takes an amount of phosphorus equal to that in the tissues to pass through the animal whether or not it is assimilated, is 6.6 hr. The dissolved inorganic P^{32} taken up by bacteria-free *L. intermedius* is distributed mainly in the nuclei of the muscle and hypodermis cells. A higher uptake by nonsterile animals is attributed mainly to their intestinal flora. This source of phosphorus is insignificant compared with the amphipods' food. Specimens of *L. intermedius* were collected from seaweed growing in shallow water beside the Hawai`i Marine Laboratory in Kane`ohe Bay.

Johannes, R. E. (1974). Sources of nutritional energy for reef corals. Proc. 2nd Int. Coral Reef Symp., Brisbane, Australia.
The relative significance of zooxanthellae and external sources of food for hermatypic corals requires the study of nutritional processes; it cannot be deducted from anatomical or behavioral characteristics alone. Data are presented showing that the skeleton, tissue and zooxanthellae of some species of corals grow as fast in filtered seawater as in unfiltered seawater. This study and three other studies involving a total of nine species of hermatypic coral from the Caribbean and Hawai`i all demonstrate that reef corals do not always (if ever) require zooplankton as a major source of nutrient energy. Reef corals have several distinct sources of nutrient energy. Their trophic elasticity helps individuals to adapt to shifting conditions of food supply. Interspecific variation in the development of specific feeding mechanisms helps explain the relatively high species richness often observed in relatively uniform environments. Specimens of *Fungia scutaria*, *Porites compressa*, and *Montipora verrucosa* were collected from a reef near Coconut Island, Kane`ohe Bay, Hawai`i in June 1969.

Johannes, R. E., J. Maragos et al. (1972). "Oil damages coral exposed to air." Mar. Poll. Bull. 3: 29-30.
Five different types of oil were floated on the water surface over *Porites compressa, Montipora verrucosa* and *Fungia scutaria* collected from Kane`ohe Bay for 2.5 hours. No damage was visible to these corals over 25 days of observation. However, subsequent experiments at Enewetak indicated damages to many corals species where the oil was allowed to come into contact with coral surfaces. This may have been partially due to heating of the corals surfaces which was increased in the black areas where oil adhered to the corals and temperatures reached 32 deg. C.

Johnson, F. H. (1959). "Kinetics of luminescence in *Chaetopterus* slime and the influence of certain factors thereon." J. Cell. and Comp. Physiol. 53: 259-278.
An investigation carried out at Coconut Island on *Chaetopterus variopedatus* collected from coral in Kane`ohe Bay to determine the nature and the kinetical properties of the light emitting system, particularly in the free slime. The initial rate of decay was nearly exponential, but decreased progressively, ending in a dim, long-lasting glow of luminescence. This decay rate was not altered by aeration, addition of seawater, FMN, DPNH or by ATP addition. The decay rate was increased by adding small amounts of decaldehyde to 8 volumes of distilled water. Attempts by various methods to obtain from the luminescent slime, components active in light emission led to negative or equivocal results.

Johnson, F. H. and M. M. Johnson (1959). "The luminescent flash of *Polycirrus*." J. Cell. and Comp. Physiol. 53: 179-186.
A study conducted at Coconut Island with specimens of *Polycirrus* sp. collected in shallow water from coral in Kane`ohe Bay to investigate the response of the animal to electrical stimulation. Repeated inductorium shocks produced a luminescent response consisting of short flashes on the order of a tenth of a second in duration, with times of slightly over 10 milliseconds to reach half maximum intensity, and 20 to 24 milliseconds for one half decay at 24-26 deg. C. The rate of decay from maximum intensity was exponential.

Johnson, G. E. (1965). Behavioral observations of the rock crab, *Grapsus grapsus*, at Coconut Island, Kane`ohe Bay, O`ahu, Hawai`i. Dept. Of Zoology. Honolulu, Univ. of Hawai`i**:** 26.

Johnson, L. R. (1982). Feeding chronology and daily ration of first-feeding larval Hawaiian anchovy, *Stolephorus purpureus*. Dept. of Zoology. Honolulu, Univ. of Hawai`i.
Feeding chronologies of 3 size classes of larval anchovy from 2 dates were determined by

enumerating the digestive tract contents of specimens taken in hourly plankton tows over periods of 24 hours. The larvae fed only during the daylight hours on both dates. There were no unequivocal trends in digestive tract fullness during the daytime on either date; aside from very rapid increases and decreases at sunrise and sunset, respectively, there was no correlation between digestive tract fullness and incident light measurements.

Johnson, M. M. (1959). "The luminescent flash of *Polycirrus*." J. Cell. and Comp. Physiol. 53: 179-186.
The luminescent response of *Polycirrus* sp. to repeated inductorium shocks consists of short flashes, on the order of a tenth of a second in duration. The response rarely occurred on the first stimulus and usually 10 or 12 make-break stimuli at one-second intervals were required, though occasionally as many as forty. The rate of decay from maximum intensity was exponential.

Johnson, V. R., Jr. (1967). Aspects of pair formation in the banded shrimp *Stenopus hispidus* Olivier. Department of Zoology. Honolulu, University of Hawai`i**:** 39.
Study of behavior associated with pair formation in *Stenopus hispidus* on specimens collected from patch reefs in Kane`ohe Bay and elsewhere on O`ahu.

Johnson, V. R., Jr. (1971). Individual recognition in the banded shrimp *Stenopus hispidus* (Olivier) (Decapoda, Stenopodidae). Department of Zoology. Honolulu, University of Hawai`i**:** 113 pp.
The apparent stability of *Stenopus hispidus* male-female pairs throughout this shrimps range suggested that it may be capable of individual recognition. This was tested using *S. hispidus* specimens collected from patch reefs in Kane`ohe Bay and elsewhere on O`ahu. Results are interpreted to indicate that *S. hispidus* can distinguish a singular and particular con-specific animal, and that it can distinguish its partner from all other con-specific animals.

Johnson, V. R. J. (1969). "Behavior associated with pair formation in the banded shrimp *Stenopus hispidus* (Olivier)." Pac. Sci. 23: 40-50.
A study investigating intraspecific sex recognition and pair formation in *Stenopus*. Some aspects of this behavior studied were the quickness with which the shrimps form pairs, whether the pair in the field is always male and female and how intraspecific sex recognition is accomplished. Shrimp were caught in the Ala Wai Yacht Harbor, the Diamond Head and Ala Moana reefs and one third of the specimens were taken from the Kane`ohe Bay reef.

Johnson, V. R. J. (1977). "Individual recognition in the banded shrimp *Stenopus hispidus* (Olivier)." Anim. Behav. 25(Reprint No. 32): 418-428.
Mated pairs of the shrimp *Stenopus hispidus* were given a series of tests in which individuals were temporarily isolated from conspecifics and subsequently re-paired with either their previous mate or a stranger. Each stranger was a conspecific of the same size, sex, and apparent appearance as the test individual's previous mate, but an animal with which the test individual had no previous experience. Individuals behave differently when re-paired with previous mates than when re-paired with strangers, indicating that *S. hispidus* can distinguish previous mates from other conspecifics. Therefore, *S. hispidus* is capable of individual recognition, a capability previously demonstrated in several vertebrate species but only a few invertebrates. In *S. hispidus* chemical stimuli are the most probable basis for individual recognition.

Johnston, I. S. (1976). The tissue skeleton interface in newly settled polyps of the reef coral *Pocillopora damicornis*. The mechanisms of mineralization in the invertebrates and plants. N. Watabe and K. M. Wilbur. Columbia, South Carolina, University of South Carolina Press. 5**:** 249-260.
In order to provide a cytological framework for the development and testing of hypotheses related to reef-coral calcification is under examination. Initial studies have concentrated on the newly-settled coral polyp during the first three days of benthic life. The first-formed skeletal elements are flattened lamellae of organic material produced from one or more of three distinct types of vesicle within the epithelium. Granules distributed through these lamellae may represent the site of initial calcium carbonate deposition. *Pocillopora damicornis* colonies were collected from Kane`ohe Bay, O`ahu.

Johnston, I. S. and W. H. Hildemann (1983). "Morphological correlates of intraspecific grafting reactions in the marine demosponge *Callyspongia diffusa*." Mar. Bio. 74: 25-33.
There are profound differences in the ways that the sponge *Callyspongia diffusa* reacts to self versus non-self tissue contact. Allograft rejection reactions in sponges have many of the hallmarks of histoincompatibility reactions in higher animals. Although there could be different alloimmune mechanisms operating in different animals, the salient events of allorecognition and antagonistic rejection appear strikingly similar among diverse multicellular animals.

Johnston, I. S., P. G. Jokiel et al. (1981). "The influence of temperature on the kinetics of allograft reactions in a tropical sponge and a reef coral." Biol. Bull. 160: 280-291.

Many tropical sponges and reef-building corals demonstrate highly discriminating transplantation immunity when grafted with allogeneic tissue. The speed of rejection changes seasonally, therefore the role of temperature was investigated. Replicate parabiotic allografts of a Hawaiian sponge, *Callyspongia diffusa*, and a reef-coral, *Montipora verrucosa*, (sponges and corals were collected from Kane`ohe Bay, O`ahu) were exposed to three different temperature regimens: approximately 23°. 25°, and 27°C. The influence of temperature on the outcome of intraspecific competition suggests that temperature fluctuations could maintain high levels of genetic polymorphism within individual populations of sponges and corals.

Jokiel, P. L. (1978). "Effects of water motion on reef corals." J. Exp. Mar. Biol. Ecol. 35: 87-97.

The Hawaiian reef coral *Pocillopora meandrina* Dana is restricted to turbulent environments. *P. damicornis* (L.) is most abundant on semi-protected reefs, while *Montipora verrucosa* (Lamarck) is characteristic of very calm environments. These species, collected from Kane`ohe Bay, were grown in the laboratory under various conditions of water motion. Water motion influenced the growth, mortality, and reproductive rate, of each species differently. The differences may be attributed to morphological adaptations of the corals to their normal hydrodynamic environment. Water motion appears to influence corals by controlling the rate of exchange of material across the interface between the sea water and the coral tissue.

Jokiel, P. L. (1980). "Solar ultraviolet radiation and coral reef epifauna." Science 207: 1069-1071.

Many "shade-loving" reef organisms show adverse effects when irradiated with full natural sunlight but not if radiation shorter than 400 nanometers is screened out. Shortwave solar radiation appears to be an important physical factor controlling the biology of shallow tropical benthic marine communities. The reefs of Kane`ohe Bay, Hawai`i, conform to this depauperate epifauna with photosynthetic coelenterates well represented] pattern, except where shaded by large piers or wharves.

Jokiel, P. L. (1985a). The photobiology of the reef coral *Pocillopora damicornis* and symbiotic algae. Department of Oceanography. Honolulu, University of Hawai`i: 221.

The reef coral *Pocillopora damicornis* and its symbiotic zooxanthellae show strong biological responses to subtle changes in the spectrum, intensity and modulation of the natural radiation environment in the 280 nm to 700 nm range. Corals collected form Kane`ohe Bay and *in vitro* cultures of zooxanthellae were grown in full spectrum solar radiation and in filtered sunlight having the same photosynthetically active radiance. but lacking ultraviolet (UV) radiation. Skeletal growth rate of the corals was decreased by approximately 50% in the treatment with full solar UV radiation. Corals grown in the treatment without solar UV radiation contained less of the "S-320" UV-absorbing substances. In contrast, culture of the algae grown *in vitro* in UV-transparent quartz vessels were severely inhibited by solar UV radiation The impact of UV was far more severe in the "shade loving" genetic strain of zooxanthellae than in the "sun loving" strain.

Jokiel, P. L. (1985b). "Lunar periodicity of planula release in the reef coral *Pocillopora damicornis* in relation to various environmental factors." Proc. 5th Int. Coral Reef Cong., Tahiti 4: 307-312.

The relationship between lunar phase and time of monthly spawning in the reef coral *Pocillopora damicornis* varies between and within different geographic locations. Phase relationship appears to be controlled by genetic factors. The major environmental factor controlling synchronization and timing of the monthly cycle is night irradiance. Many other environmental factors including temperature, salinity, tidal cycle, visible irradiance and ultraviolet radiation influence the number of planulae released per spawning cycle. This paper is concerned with factors that influence the monthly spawning cycle in Kane`ohe Bay, O`ahu.

Jokiel, P. L. (1986). Growth of the reef coral *Porites compressa* on the Coconut Island reef. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01): 101-110.

Direct measurement of growth of *Porites compressa* over four years between 1979 and 1973 yielded the following values for branch elongation: 1.5 cm yr^{-1} in a shallow backwater lagoon, 2.4 cm yr^{-1} on the windward reef crest, 3.5 cm yr^{-1} at 3 m depth on the reef slope and 2.8 cm yr^{-1} at a depth of 7 m. During this study Hurricane *Iwa* damaged sections of the reef and revealed a weakened layer of reef framework that was laid down during the period of sewage pollution ca. 1960-1978

Jokiel, P. L. (1998). Energetic cost of reproduction in the coral *Pocillopora damicornis*: a synthesis of published data. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 41-45.

The Hawaiian reef coral *Pocillopora damicornis* produces thousands of large larvae on a monthly cycle throughout the year and represents coral species that divert large amounts of energy into reproduction. Even so, review of existing data suggests that energetic cost of reproduction in this species represents only a few percent of net primary production. This is a conservative estimate of the energetic cost of reproduction because the analysis did not consider heterotrophic sources of energy. It appears that reproduction is a minor component of the total annual energy budget of reef corals. Data suggest that cost of maintenance and growth of coral colonies requires most of their energetic resources, with little being devoted to sexual reproduction.

Jokiel, P. L. and S. L. Coles (1977). "Effects of temperature on the mortality and growth of Hawaiian reef corals." Mar. Bio. 43: 201-208.

Three common species of Hawaiian reef corals [removed from shallow Kane`ohe Bay, O`ahu reef flats], *Pocillopora damicornis* (L.), *Montipora verrucosa* (Lamarck) and *Fungia scutaria* Lamarck, were grown in a temperature-regulated, continuous flow sea water system. The skeletal growth optimum occurred near 26°C, coinciding with the natural summer ambient temperature in Hawai`i, and was lowest at 21° to 22°C, representing Hawaiian water ambient. The corals showed greater initial resistance at the lower lethal limit, but ultimately low temperature was more deleterious than high temperature. Results suggest that a decrease in the natural water temperature of Hawaiian reefs would be more harmful to corals than a temperature increase of the same magnitude.

Jokiel, P. L., S. L. Coles et al. (1975). Effects of thermal loading on Hawaiian reef corals. Washington D. C., U.S. Environmental Protection Agency, Office of Research and Monitoring**:** 285 pp.

This investigation was initiated to provide predictive information on the effects of heated effluent on reef corals and associated biota in Kane`ohe Bay. It was begun as a result of HECO's purchase of land on the shoreline at Heeia Kea for a proposed steam electric generating station. In addition, the program was directed at providing information required for regulation of the expanding thermal pollution threat in the many tropical and subtropical locations under the EPA's jurisdiction. Field surveys and experiments to study the thermal responses of corals were conducted, and the results were used to construct recommendations.

Jokiel, P. L. and H. P. Cowdin (1976). Hydromechanical adaptation in the solitary free-living coral *Fungia scutaria*. Nature. 262**:** 212-213.

Scleractinian coral *Fungia scutaria* found on reef flats in Kane`ohe Bay, produces a dense skeleton that is adapted for stability and abrasion in turbulent water. Of several coral species tested for stability, *F. scutaria*, in addition to use of muscular activity, hydromechanical adaptation is a significant factor in many species of solitary free-living corals.

Jokiel, P. L. and E. B. Guinther (1978). "Effects of temperature on reproduction in the hermatypic coral *Pocillopora damicornis*." Bull. Mar. Sci. 23(4): 786-789.

The optimal reproductive temperature for the coral *Pocillopora damicornis* (L.) in Hawai`i compares with the 26-27°C optimum previously reported for skeletal growth. The reproductive peak is approximately ten times stronger than the observed growth response for the species. Temperature appears to influence abundance of this species primarily through control of the reproductive process. Experiments were conducted in tanks receiving lowing seawater from Kane`ohe bay and stocked with corals collected from Kane`ohe Bay reefs.

Jokiel, P. L., W. H. Hildemann et al. (1982). "Frequency of intercolony graft acceptance or rejection as a measure of population structure in the sponge *Callyspongia diffusa*." Mar. Biol. 71: 135-139.

The sponge *Callyspongia diffusa* showed a rate of graft acceptance ranging from 5 to 23% between colony pairs testing at random from a highly localized population occurring on a small fringing reef flat in Kane`ohe Bay, O`ahu, Hawai`i. The frequency of graft compatibility varied inversely with distance between the colonies over a range of from 0.1 to 11.9 m. Pairs of colonies in close proximity (5 to 50 m), but from opposite sides of deep channels, were invariably incompatible. Likewise, graft acceptance was not observed for colony pairs taken from different reefs of the bay and separated by a distance of from 2 to 3 km. *C. diffusa* propagates sexually by production of larvae and asexually by means of branch fragments.

Jokiel, P. L., W. H. Hildemann et al. (1983). "Clonal population structure of two sympatric species of the reef coral *Montipora*." Bull. Mar. Sci. 33(1): 181-187.

Determination of coral colony derivation in a natural population using immunogenetic tissue grafting was conducted using several Hawaiian species in Kane`ohe Bay, O`ahu.

Jokiel, P. L., C. L. Hunter et al. (1993). "Ecological impact of a fresh-water "reef kill" in Kane`ohe Bay, O`ahu, Hawai`i." Coral Reefs 12(3/4): 177-184.
Storm floods on the night of December 31, 1987 reduced salinity to 15 ppt in the surface waters of Kane`ohe Bay, resulting in massive mortality of coral reef organisms in shallow water. A spectacular phytoplankton bloom occurred in the following weeks. Phytoplankton growth was stimulated by high concentrations of plant nutrients derived partially from dissolved material transported into the bay by flood runoff and partially by decomposition of marine organisms killed by the flood. Within two weeks of the storm, chlorophyll a concentrations reached 40 mg m-3 one of the highest values ever reported. The extremely rapid growth rate of phytoplankton depleted dissolved plant nutrients, leading to a dramatic decline or "crash" of the phytoplankton population. Water quality parameters returned to values approaching the long-term average within 2 to 3 months. Corals, echinoderms, crustaceans and other creatures suffered extremely high rates of mortality in shallow water. Virtually all coral was killed to depths of 1-2 m in the western and southern portions of the bay. Elimination of coral species intolerant to lowered salinity during these rare flood events leads to dominance by the coral *Porites compressa*. After a reef kill, this species can eventually regenerate new colonies from undifferentiated tissues within the "dead" perforate skeleton. Catastrophic flood disturbances in Kane`ohe Bay are infrequent, probably occurring once every 20 to 50 years, but play an important role in determination of coral community structure. The last major fresh water reef kill occurred in 1965 when sewage was being discharged into Kane`ohe Bay. Coral communities did not recover until after sewage abatement in 1979. Comparison between recovery rate after the two flood events suggests that coral reefs can recover quickly from natural disturbances, but not under polluted conditions.

Jokiel, P. L., R. Y. Ito et al. (1985). "Night irradiance and synchronization of lunar release of planula larvae in the reef coral *Pocillopora damicornis*." Mar. Bio. 88: 167-174.
Pocillopora damicornis (Linnaeus), which is known to release planula larvae on a monthly cycle, was grown in full daytime solar irradiance, but with four treatments of night irradiance: (1) natural light irradiance, (2) shifted-phase (total darkness during nights of full moon with artificial irradiance at lunar intensity on nights of new moon), (3) constant full moon (full lunar irradiance every night), and (4) constant new moon (total darkness every night). Populations of corals grown either in the constant full moon or constant new moon treatment quickly lost synchronization of monthly larva production, although production of planulae continued. Thus spawning is synchronized by night irradiance. Two different morphological forms of *P. damicornis* were used. These two types and others co-occur throughout Kane`ohe Bay, O`ahu.

Jokiel, P. L., M. P. Lesser et al. (1997). "UV-absorbing compounds in the coral *Pocillopora damicornis*: interactive effects of UV radiation, photosynthetically active radiation, and water flow." Limnol. Oceanogr. 42: 1468-1473.

Jokiel, P. L. and J. I. Morrissey (1986). "Influence of size on primary production in the reef coral *Pocillopora damicornis* and the macroalga *Acanthophora spicifera*." Mar. Bio. 91: 15-26.
Size influences the photosynthesis-irradiance (P-I) relationship in colonies of the branched reef-coral *Pocillopora damicornis* and in intact plants of the branched red macroalga *Acanthophora spicifera*. Net primary production of an entire colony or plant (or rate per unit area of reef) increases with increasing size of the canopy. Production efficiency also increases with size. The coral is rigid, symmetrical and highly organized. Chlorophyll distribution is more stratified in comparison to the macroalga. The coral shows higher photosynthetic efficiency, as would be expected according to the stratified production model of Odum *et al.* (1958). This research was conducted on specimens from Kane`ohe Bay, O`ahu, Hawai`i, USA in 1981.

Jokiel, P. L., R. H. Richmond et al., Eds. (1986). Coral Reef Population Biology., University of Hawai`i Institute Marine Biology Technical Report No. 37/U. H. Sea Grant Cooperative Report UNIHI-SG-CR-86-0.
This volume is an edited collection of research conducted during the 1983 Summer Studies Program emphasizing all aspects of coral reef population biology. Forty-one separate studies are reported, describing research done by a group of highly distinguished scientists and students who gathered at the Hawai`i Institute of Marine Biology on Coconut Island during the summer of 1983 to participate in a program titled `Coral Reef Population Biology'. It contains papers in the following sections: (1) introductory material on coral reefs and communities in Kane`ohe Bay, (2) Kane`ohe Bay reef populations in transition, (3) genetic structure of coral reef populations, (4) patterns of reproduction in

coral reef population, (5) interactions among coral reef species, (6) physiology of the coral-zooxanthellae relationship, (7) coral reef populations and toxic waste, and (8) mathematical models.

Jokiel, P. L., R. H. Titgen et al. (1991). Guide to the marine environment of Kane`ohe Bay, O`ahu. Kane`ohe, Hawai`i, HIMB, UH**:** 50.
A reference for those involved in the in the interpretation of Kane`ohe Bay, with emphasis on the marine resources near Heeia State Park. It is a synthesis of extensive scientific literature on the marine environment of this region. It is written in simplified language for use by non-scientists and focuses on various facets of significant interpretive and educational value. To date, the primary users of the Heeia State Park facility (in order of numbers) have been: elementary school pupils, the community in general, and visitors (Ron Mortimer, pers. comm.). This trend is continuing. Therefore, the scope of this report is the range of technical and general interest information concerning the Kane`ohe Bay region that are of interest to the general public.

Jokiel, P. L. and S. J. Townsley (1974). "Biology of the polyclad *Prosthiostomum (Prosthiostomum)* sp., new coral parasite from Hawai`i." Pac. Sci. 28: 361-373.
This species of polyclad flatworm is an obligate ectoparasitic symbiont of the hermatypic coral *Montipora*. Studies have demonstrated an intimate parasite/host association involving the use of host corals as food and substrate by the parasite. Various aspects of the biology of the parasite are reported. It is concluded that all aspects of the lift history of this species show adaptations toward host specificity, representing a rare example of true coral parasitism since most animals known to feed on coral tissues are considered to be facultative predators. The parasite appears to become a serious coral pest only in disrupted systems such as artificial laboratory situations or in the stressed portions of Kane`ohe Bay.

Jonasson, M. W. (1986). Cleaning behavior comparison of two shrimp species (*Stenopus hispidus* and *Lysmata grabhami*). Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 361-379.
This study was conducted to determine the variance in specialization of fish cleaning behavior between the banded shrimp, *Stenopus hispidus*, and the red-backed cleaner shrimp *Lysmata grabhami,* two of seven shrimp recognized as cleaners. Shrimp were tested with three host species: the yellow butterflyfish *Chaetodon auriga*, the millet seed butterflyfish *Chaetodon miliaris* and the yellow surgeonfish *Zebrasoma flavescens*.

Jones, R. S. (1967). Ecological relationships in Hawaiian and Johnston Island Acanthuridae (surgeonfishes) with emphasis on food and feeding habits. Department of Zoology. Honolulu, University of Hawai`i**:** 245.
An investigation of the ecological relationships of the surgeonfishes of the Hawaiian Islands and Johnston Island with emphasis on the ecological separation by habitat, foraging methods and food eaten. In addition, comparative studies of the gross morphology of the alimentary canals of the species were undertaken in an effort to elucidate possible 'adaptations' in the feeding mechanisms of the species. The author had four stations in the Kane`ohe Bay area: Moku Manu (no. 9), Kane`ohe Outer reef (10), Kane`ohe Bay (11). and Kuloa Point (12). Most of the experimental work was done in La Perouse Bay, Maui, in Kealakekua Bay, Hawai`i, and on Johnston Island.

Jones, R. S. (1968). "Ecological relationships in Hawaiian and Johnston Island Acanthuridae (surgeonfishes)." Micronesica 4: 309-361.
An investigation of the ecological relationships of the surgeonfishes of the Hawaiian Islands and Johnston Island with emphasis on the ecological separation by habitat, foraging methods and food eaten. In addition, comparative studies of the gross morphology of the alimentary canals of the species were undertaken in an effort to elucidate possible 'adaptations' in the feeding mechanisms of the species. The author had four stations in the Kane`ohe Bay area: Moku Manu (no. 9), Kane`ohe Outer reef (10), Kane`ohe Bay (11). and Kuloa Point (12). Most of the experimental work was done in La Perouse Bay, Maui, in Kealakekua Bay, Hawai`i, and on Johnston Island

Jordan, D. S. and B. W. Evermann (1902). The fishes and fisheries of the Hawaiian Islands: A preliminary report, U. S. Fish Comm.**:** 353-380.
A comprehensive report on the fishes and fisheries of the Hawaiian Islands, including a qualitative and quantitative study of the commercial and shore fishes, molluscs, crustaceans and other aquatic animals and plants. The methods, extent and history of the fisheries and the fishery laws are also reviewed and the possibilities of improving methods of fishing, handling and marketing are discussed.

When discussing the fishery laws, the shoal areas around Kapapa Island in Kane`ohe Bay are noted for their abundance of fish (p. 364). This area was put under the protective taboo of the tax officers for the king at certain times of the year.

Jordan, D. S. and B. W. Evermann (1905). "The shore fishes of the Hawaiian Islands." Bull. U. S. Fish Comm. 23: 1-574.

A brief summary of ichthyological work on the Hawaiian fauna previous to 1901 and a descriptive report of the shore fishes found by the U. S. Fish Commission's studies in 1901 and 1902. Field investigations in 1901 were devoted to shore fishes (of which this is the final report) and in 1902 the studies were primarily on deeper fauna (in which there was no mention of fish caught in Kane`ohe Bay area - Bull. U. S. Fish Comm. for 1903,, par-,, 2: 765 pp.). Most of the collecting was done in Honolulu, although visits were made to Hilo, Lahaina (Maui), Kailua and Molokai and other places. The Honolulu market was the largest collecting area, while great numbers of specimens were obtained in shallow water and on coral reefs about Honolulu, Waikiki, Moana Lua, Waianae, Wailua, Waimea and Heeia. On p. 248 the authors report finding *Sectator azureus* Jordan and Evermann (family Kyphosidae) in Heeia, O`ahu . The authors commented that "this species must be very rare being unknown to the fisherman and only a single specimen having been obtained by us". Type no. 50664, U. S. N. M. (field No. 03363), 15.25 in. long, being taken off the shore near Heeia,, O`ahu.

Josephson, R. K. and S. C. March (1966). "The swimming performance of the sea-anemone, *Boloceroides*." J. Exp. Biol. 44: 493-506.

A study of the swimming ability of *Boloceroides* and the ways in which the usual anemone organization has been modified for swimming. The animals were collected in the vicinity of Coconut Island. Results showed that the anemones swim by a repeated aboral-oral inflection of the tentacles which make up over 90% of the weight of the anemone. The tentacles at different distances from the mouth were shown to beat slightly out of phase with each other. The swimming velocity was about 1.9 cm/s6cond. In tethered swimming experiments, it was shown that the maximum forward force developed during a stroke increases with animal size approximately as the square of the diameter of the tentacle crown. The average forward force of the flexion cycle is about 5% of the maximum force due to the rearward recovery portion of the cycle.

Kami, H. (1961). Introduction of marine game fishes from areas in the Pacific, Reef and Inshore Game Fish Management Research Project.

A study involving the biology of certain Pacific game fish in their native habitat, their transportation to new habitats and their recovery. Snappers *L. vaigiensis* were caught in commercially operated mullet ponds on three occasions in Kane`ohe Bay. Each was tagged and released for later compilation of growth data.

Kami, H. (1962). Introduction of marine game fishes from areas in the Pacific, Reef and Inshore Game Fish Management Research Project.

A study in which 7,200 snappers and groupers consisting of 4 species each, were collected at Moorea, French Oceania and live-shipped to O`ahu where the entire shipment was released at an artificial shoal site at Maunalua Bay. Live specimens were occasionally recovered by local commercial fishermen, measured, weighed and tagged and then released for growth rate and migration data.

Reference to Kane`ohe Bay:

40 specimens of *Lutjanus gibbus* were released into Kane`ohe Bay from Marquesas Islands in 1958 - no recoveries.

Epinephelus merra were released into Kane`ohe Bay in 1956 - no recoveries.

Kaneko, J. J., Y. R. et al. (1988). "Infection of tilapia, *Oreochromis mossambicus* (Trewavas), by a marine monogenean, *Neobenedenia malleni* (MacCallum, 1927) Yamaguti, 1963 in Kane`ohe Bay, Hawai`i, USA, and its treatment." J. Fish Dis. 11: 295-300.

A disease of saltwater, cage-cultured tilapia, *Oreochromis mossambicus* , caused by the marine monogenean, *Neobenedenia melleni* , is described. Up to 400 parasites were found attached to the body surface of individual fish. Heavily infected fish showed hyperirritability, heavy mucus secretion and discoloration. Pathology was most marked on the eye, with corneal opacity initially, followed by buphthalmos, corneal ulceration and rupture of the eye with subsequent degeneration of internal structure. The infection was successfully treated using 2 min freshwater dips.

Kaneko, J. J., II, R. Yamada et al. (1988). "Infection of tilapia, *Oreochromis mossambicus* (Trewavas), by a marine monogenean, *Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963 in Kane`ohe Bay, Hawai`i, USA, and its treatment." J. Fish Dis. 11(4): 295-300.

Kay, E. A., (ed.) (1970a). The biology of molluscs. A collection of abstracts from the National Science Foundation Graduate Research Training Program, June-September 1968. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 30 pp.
A collection of 26 abstracts of projects completed during the NSF sponsored Graduate Training Program on The Biology of Molluscs,, 'held at the Hawai`i Institute of Marine Biology during the summer of 1968 - 17 June to 6 September.

Kay, E. A. (1970b). Some common vermetid gastropods of Kane`ohe Bay, O`ahu and their methods of feeding. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 30 pp.
A description of the feeding methods of six commonly occurring vermetids (Mesogastropods: Vermetidae) in Kane`ohe Bay, O`ahu. Only one, *Dendropoma platypus* Morch has been previously recorded in Hawaiian waters; the others, 2 species of *Dendropoma*, one species of *Serpulorbis* and two species of *Vermetus* appear to be undescribed. All are solitary forms, occurring on coral, sea walls, etc.

Kay, E. A. (1973). Micromollusks. Atlas of Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Sea Grant. UNIHI-SEAGRANT-TR-72-01**:** 93-97.
This study explores some of the distribution patterns shown by several micromolluscan species in Kane`ohe Bay. Superficial sediments from 41 stations in Kane`ohe Bay were collected. The shells were identified, and the dominant species were analyzed in terms of the assemblages in which they occurred and of their distribution within Kane`ohe Bay. Three maps, which show the distribution of micromolluscan assemblages and their compositions, are included. does not identify component species.

Kay, E. A. (1976). Micromolluscan Assemblages in Kane`ohe Bay: Final Report for the US Army Engineers. Honolulu, Us Army Corps Of Engineers, Pacific Division.
The purpose of this study was to provide a report on the characteristics and distribution of the micromolluscan fauna of K-Bay which will serve to characterize their potential use as biological indicators of water quality. The scope of this work included the collection of sediment samples at sites within K- Bay representing stations from stream mouths, fringing reefs, patch reefs, the barrier reef, and bay bottom, as well as control sites outside the bay; the analysis of samples for species composition, standing crop, species diversity and trophic structure; and a study of the biology and life history of some of the more commonly occurring species.

Kay, E. A. (1979). Hawaiian Marine Shells. Reef and Shore Fauna of Hawai`i. Section 4: Mollusca. D. M. Devaney and L. G. Eldredge. Honolulu, Bishop Museum press. B. P. Museum Spec. Publ. 64(4)**:** 1-652.
Description and taxonomic revision of molluscs for Hawai`i, including those collected by author in early 1970s in Kane`ohe Bay.

Kaya, M. H. (1971). The adsorption of phosphorus by Kane`ohe Bay sediment. Honolulu, University of Hawai`i**:** 139.
In a study designed for direct application to the state's water pollution control efforts, alluvial sediment from Kane`ohe Bay near the mouth of Kane`ohe Stream was equilibrated with solutions of phosphorus free and phosphorus-containing waters. Two equilibration systems were used and the resulting concentrations of phosphorus were compared with in situ levels at the collection site and with the maximum permissible level stated in the state's water quality standards for Class AA water. Finally, the adsorption-desorption phenomena of the sediment was mathematically modeled by the Freundlich adsorption isotherm.

Key, G. S. (1973). Reef fishes in the bay. Atlas of Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Sea Grant. UNIHI-SEAGRANT-TR-72-01**:** 51-66.
Summary and description of abundance and distribution of the 18 commonest fish species found in the Bay in surveys conducted 1968-72, with notes on their favored habitats.

Kimmerer, W. J. (1980). Plankton patchiness and ecosystem stability. Dept. of Oceanography. Honolulu, Univ. Of Hawai`i**:** 177 pp.
Spatial and temporal variability in 3 measures of rate functions in Kane`ohe Bay planktonic ecosystem was determined. Temporal variation was greater than spatial. Transects and point samples were taken

in the South Bay.

Kimmerer, W. J. (1983). "Direct measurement of the production:biomass ratio of the subtropical calanoid copepod *Acrocalanus inermis*." J. Plan. Res. 5(1): 1-14.
Specific population growth rate or production:biomass (P:B) ratio of the copepod *Acrocalanus inermis* was measured by an incubation technique. The principal advantage of this method is that it is site- and time-specific and can therefore be used to determine spatial and temporal patterns in P:B. Samples were taken from the middle of southern Kane`ohe Bay.

Kimmerer, W. J. (1984). "Selective predation and its impact on prey of *Sagitta enflata* (Chaetognatha)." Mar. Ecol. Prog. Ser. 15: 55-62.
Feeding by a natural population of the chaetognath *Sagitta enflata* in southern Kane`ohe Bay, Hawai`i, was studied over 1 yr. Detailed examination of gut contents led to refinements of previous estimates of ration and of impact on prey.

Kimmerer, W. J. (1984). "Spatial and temporal variability in egg production rates of the calanoid copepod *Acrocalanus inermis*." Mar. Biol. 78: 165-169.

Kimmerer, W. J. and W. W. Durbin, Jr. (1975). The potential for additional marine conservation districts on O`ahu and Hawai`i. Honolulu, Univ. of Hawai`i Sea Grant**:** 108 pp.
The patch reefs of Kane`ohe Bay were included in a survey of potential conservation districts but were not considered suitable because the most noticeable adverse effects of man on the bay are not from fishing or collecting, which a conservation district could alleviate, but from pollution and silt.

Kimmerer, W. J., T. W. Walsh et al. (1981). "The effect of sewage discharge into a wind-induced plume front." Estuaries and Nutrients xx: 531-548.
Enhanced concentrations of particulate matter and nutrients are often associated with fronts. In Kane`ohe Bay, Hawai`i, runoff, sewage discharge, and persistent trade winds produced a plume front which was readily visible because of high chlorophyll concentrations. About 50 percent of the time the plume advected approximately all of its nutrient supply out of the south sector of the bay into the apparently more thoroughly flushed central sector. Thus about half of the nitrogen from secondary treated sewage, discharged until 1978 into the low-density side of the front, was lost to the south sector almost immediately. Several models of circulation and material flux in the bay have assumed that the south sector is well mixed and that all of the nutrient input from the sewage and streams remains there for several weeks. These models should be revised to reflect the loss of about half of the nutrient input from the south sector. These results also emphasize the importance of wind in controlling physical events in estuaries.

Kinzie, R. A., III. (1968). "The ecology of the replacement of *Pseudosquilla ciliata* by *Gonodactylus falcatus* (Crustacea: Stomatopoda) recently introduced into the Hawaiian Islands." Pac. Sci. 22: 465-475.
A study investigating the hypothesis that the coral head habitat, once almost exclusively occupied by *Pseudosquilla ciliata*, has been taken over completely by *Gonodactylus falcatus* in about the last nine years. The origins, possible mode of introduction and mechanism of replacement of this takeover were also investigated. The paper includes the distribution and notes on the new Hawaiian species, *G. falcatus* (Forskal) which was found in Kane`ohe Bay and on *G. hendersoni* Manning which was not taken in Kane`ohe Bay.

Kinzie, R. A., III (1993). "Effects of ambient levels of solar ultraviolet radiation on zooxanthellae and photosynthesis of the reef coral *Montipora verrucosa*." Mar. Biol. 116: 319-327.
Paired flat plates of the hermatypic coral *Montipora verrucosa* from Kane`ohe Bay, O`ahu, Hawai`i, were acclimated to photosynthetically active radiation (PAR) only and to full sunlight (PAR + UV) for several weeks in the summer of 1990. After the acclimation period. photosynthesis, both in PAR-only and PAR + UV as well as dark respiration were measured. Levels of the UV-absorbing compounds, "S320", density of zooxanthellae, and chlorophyll a concentration were determined. Corals acclimated in PAR + UV had higher levels of the UV-protective compounds and lower areal zooxanthellae densities than corals acclimated in PAR-only. Chlorophyll a per unit volume of coral host and per algal cell did not differ between corals from the two acclimation treatments. Corals acclimated to PAR + UV displayed higher photosynthesis in full sunlight than corals acclimated to PAR-only, but when photosynthesis was measured in the light regime to which the corals had been acclimated, there were no differences in photosynthesis. Dark respiration was the same for corals from the two acclimation treatments regardless of the light quality immediately preceding the dark period.

Kinzie, R. A., III and T. Hunter (1987). "Effect of light quality on photosynthesis of the reef coral *Montipora verrucosa*." Mar. Biol. 94: 95-109.

Pieces of the reef coral *Montipora verrucosa* (Lam.), collected from Kane`ohe Bay in 1982, were grown in four low-light treatments (11% sunlight): blue, green, red and the full spectrum of photosynthetically active radiation (PAR); and at high intensity full PAR (90% sunlight). These acclimated corals were then tested for photosynthetic ability in blue, green, red, and white light. The photosynthetic parameters that were measured were; light-saturated photosynthetic rate, the initial slope of the photosynthesis/irradiance curve, the light intensity where these two lines crossed, and dark respiration. While acclimation intensity had a pronounced effect, the results also showed that the color of the acclimation treatment influenced the photosynthetic responses of the corals. The color of the light used in the measurements of photosynthesis had much less effect on the photosynthetic responses of the corals.

Kinzie, R. A., III, P. L. Jokiel et al. (1984). "Effects of light of altered spectral composition on coral zooxanthellae associations and on zooxanthellae *in vitro*." Mar. Bio. 78: 239-248.

Pocillopora damicornis (Linnaeus) and *Montipora verrucosa* (Lamarck) were collected from Hawaiian reefs [surrounding Coconut Island in Kane`ohe Bay, O`ahu]. In two experiments, these reef corals were grown under sunlight passed through filters producing light fields of similar quantum flux but different spectral composition. *In vitro* cultures of symbiotic zooxanthellae (*Symbiodinium microadriaticum* Freudenthal) from *M. verrucosa* were cultured under similar conditions and exhibited growth rates in light of altered spectral quality that correlated with the responses of the host coral species. Blue and white light supported significantly greater growth than green light, and red light resulted in the lowest growth rate.

Kitalong, A. E. (1986a). The microfauna associated with three species of coral and their accessibility to a reef community. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 401-413.

Emergent microfauna were collected from a fringing reef adjacent to Coconut Island, Hawai`i from May 24 to August 1, 1983. Four substrates (sand, *Pocillopora damicornis, Porites compressa* and *Montipora verrucosa*) were sampled from three zones. Most microfauna showed no significant association with a coral species. Burst of fish, crab and shrimp larvae occurred in substantial numbers. However, several species did show significant association with a given coral species. Tunicate larvae showed an association with *M. verrucosa*, tanaids were most abundant over *P. damicornis* and *Acrocalanus inermis* were most abundant over P. compressa. *Acrocalanus inermis*, a holoplanktonic calanoid, and *Leptochelia dubia*, and epibenthic tainaids were ubiquitous throughout the reef. However, many holoplanktonic animals (cyclopoids, medusae, *Oikopleura diocia* and tunicate larvae were mot abundant on the reef front.

Kitalong, A. E. (1986b). A preliminary study on the emergence patterns of microfauna in Kane`ohe Bay, Hawai`i. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 414-423.

Emergent microfauna were collected over two Porites compressa heads and two Montipora verrucosa plates on a fringing reef adjacent to Coconut Island, O`ahu, during full moon (July 24-25) and new moon (August 8-9) 1983. The predominant and most effectively captured microfauna were holoplanktonic (*Acrocalanus inermis, Oithona simplex, Oithona nana, Sagitta enflata, Oikopleura diocia* and medusae)

Klim, D. G. (1969). Interactions between sea water and coral reefs in Kane`ohe Bay, O`ahu, Hawai`i. Hawai`i Institute of Marine Biology, Tech Rept. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 56 pp.

This 8 month study was undertaken to determine if measurable changes in characteristics occur in seawater passing over a shallow coral reef. The parameters studied include salinity, temperature, current velocities, dissolved oxygen, pH, dissolved organic carbon and particulate organic and suspended inorganic carbon. Staining and microscopic observations were made to supplement the other data. The results showed noticeable increases in oxygen, pH, particulate organic and inorganic carbon abundance in the central portion of the reef, which were attributed to the influence of extensive growths of benthic algae found on the seaward edge. Dissolved organic carbon concentration increased gradually across the reef, and there is evidence that inorganic carbonate is being accumulated on the leeward side of the reef.

Kling, C. J. (1984). A comparative study of *Vibrio* bacteria in two selected streams discharging into Kane`ohe Bay, O`ahu. Microbiology. Honolulu, University of Hawai`i.

Kobayashi, D. R. (1987). The distribution and abundance of certain reef fish larvae adjacent to adult habitats in Kane`ohe Bay. Dept. of Oceanography. Honolulu, Univ. Of Hawai`i: 39.
Plankton samples were taken in the Bay, with a free-fall plankton net to investigate the fine-scale distribution of larval fishes around coral reefs. Daytime samples indicated that the postflexion larvae of 2 gobiids were significantly more abundant at stations immediately adjacent to reefs than at stations in open water off the reefs. Postflexion gobiid larvae appear to be capable of resisting advection/dispersal while remaining in the water column near suitable adult habitats. The larva of an engraulid and apogonid were significantly more abundant at off-reef stations. Nighttime samples indicated that the gobiid larva depend on visual cues to remain near the reef. The near-reef concentrations of the gobiid larvae indicate that reef-based planktivore pressure may be an unimportant factor in reef fish larval distributions. Typical ichthyoplankton surveys which do not sample close to adult fish habitats would greatly underestimate the abundance of larvae such as the gobiids.

Kobayashi, D. R. (1989). "Fine-scale distribution of larval fishes: patterns and processes adjacent to coral reefs in Kane`ohe Bay, Hawai`i." Mar. Biol. 100: 285-293.
Plankton samples were taken from January to June 1987 in Kane`ohe Bay, O`ahu, Hawaiian Islands, with a free-fall plankton net, to investigate the fine-scale distribution of larval fishes around coral reefs. The data suggests that typical ichthyoplankton surveys which do not sample close to adult fish habitats would greatly underestimate the abundances of larvae such as the gobiids.

Kohn, A. J. (1959). "The ecology of *Conus* in Hawai`i." Ecological Monographs 29: 47-90.
A study based on the ecological observations of natural populations of *Conus* in different areas with emphasis on the Indo-West Pacific region. Twenty-one species of *Conus* inhabit the coral reefs and marine benches fringing the Hawaiian Islands. The objectives of the study were to describe the ecological niches of these species, to determine the extent of isolation between ecologically similar species and then to elucidate the mechanisms that permit a large number of closely related species to survive and to retain their identity in a narrow environment.

Kohn, A. J. (1961). "Studies on spawning behavior, egg masses and larval development in the gastropod genus *Conus*. Part I. Observations on nine species in Hawai`i." Pac. Sci. 15(2): 163-179.
Observations were conducted on three specimens of *Conus* found in Kane`ohe Bay:
Conus leopardus collected 25/4/56 - 19 capsules/cluster - 49-58x34-37 mm
Conus quercinus collected 9/2/56 - 40 capsules/cluster - 19-26xl7-22 mm
C. quercinus collected 9/2/56 - 3 capsules/cluster - 17-19xl8-20 mm, including the number of egg cluster cluster and the maximum height times the maximum breadth of the capsules.
The complete course of larval development within the egg capsule from spawning to hatching is described for 4 species. Early cleavage stages occur 1-3 days after spawning, trochophore stage at 2-6 days and veliger stage at 6-10 days. Freely swimming veligers hatched from egg capsules of 3 species 14-15 days after oviposition. All species have pelagic larvae produced in large numbers. Hatching in *C. pennaceus* occurred 16-26 days after oviposition at the advanced veliger or veliconcha stage. After swimming one day, they settle to the bottom and metamorphose.

Kohn, A. J. and P. Helfrich (1957). "Primary organic productivity of a Hawaiian coral reef." Limnol. Oceanogr. 2: 241-251.

Kolinski, S. P. (1998). An estimate of energetic value of the reproductive effort of colonies of *Montipora verrucosa* in Kane'ohe Bay, O'ahu, Hawai'i. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH: 45.
The energetic contribution to sexual reproduction in *Montipora verrucosa* was investigated using a Phillipson microbomb calorimeter. Corals were gathered from two locations differing in depth and turbidity (1 m depth, mean NTU=0.713; 3 m depth, mean NTU=1.222). No significant difference was detected in energetic content between egg-sperm bundles of corals from the two sites. Pooled caloric values of the gamete bundles averaged 7.74 +/- 0.25 cal per mg AFDW (32.38 +/- 1.046 J per mg AFDW; n=11 colonies), similar to values published for brooded *Pocillopora damicornis* larvae. The median estimated energetic content of an individual bundle was 2.15 cal per bundle (9.00 J per bundle; n= 7), with a range of 1.26-2.40 cal per bundle (5.26-10.06 J per bundle). A strong correlation between colony size and fecundity was found (P<0.005, Spearmans rank coefficient = 0.4164, n= 32). Mean fecundity of colonies from the two sites (normalized by colony volume) did not differ significantly (P= 0.8134, two sample t-test). The fecundity of 32 colonies with volumes of 0.162 to 1.102 (average

= 0.508 l) averaged 2611 bundles (range 0-6729), which corresponds to an mean energetic investment of 5614 cal per colony (23,488 J per colony) and a maximum value of 14,467 calories (60,533 J) for the reproductive season. All but one of the colonies released gametes. No corrections to energetic values were made for the presence of zooxanthellae.

Kosaki, R. (1999). Behavioral mechanisms of coexistence among coral-feeding butterflyfishes. Dept. of Zoology. Honolulu, University of Hawai`i**:** 179.
Corallivorous butterflyfishes occupy permanent feeding territories, and all of their metabolic requirements for growth, maintenance, and reproduction must be supplied by the corals within these territories. When two or more species maintain overlapping territories, the shared use of space and food creates the potential for competitive interactions related to use of these resources. A prerequisite for the occurrence of competition, however, is a resource in limited supply with the potential to limit populations of its consumers. Even in areas of high coral cover, territories of butterflyfishes are large relative to their body size. The impacts of their grazing on the growth and abundance of coral in their territories are unknown. Predator exclusion cages were used to test the hypothesis that predation by the obligate corallivore *Chaetodon trifasciatus* may reduce the growth and areal cover of a preferred coral species, *Pocillopora damicornis*. As the abundant corallivore on the reef at Coconut Island, Kane`ohe Bay, Hawai`i, grazing by *C. trifasciatus* significantly reduced the growth rates of *P. damicornis*. This finding provides evidence that coral is a depletable, potentially limiting resource, and thus competition may occur when two or more species of butterflyfishes must share this resource.

Krasnick, G. J. (1973). Temporal and spatial variation of phytoplankton productivity and related factors in the surface waters of Kane`ohe Bay, O`ahu, Hawai`i. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 91pp.
Data on primary productivity, chlorophyll a, nitrate and phosphate in surface waters were collected on a 14-month series of biweekly cruises in Kane`ohe Bay.

Krupp, D. A. (1981). The composition of the mucus from the mushroom coral, *Fungia scutaria*. Proc. 4th Int. Coral Reef Symp., Manila.
The mucus of the solitary mushroom coral, *Fungia scutaria*, purified of particulate contamination and low molecular weight solutes, was assayed for a variety of trophic parameters, including caloric value, elemental composition (C, N and P), lipid content, total protein content and amino acid composition. The compositional evidence indicates that the mucus of *F. scutaria* is relatively low in trophic quality. Specimens of *F. scutaria* were collected from Kane`ohe Bay, O`ahu.

Krupp, D. A. (1983). "Sexual reproduction and early development of the solitary coral *Fungia scutaria* (Anthozoa: Scleractinia)." Coral Reefs 2: 159-164.
Fungia scutaria spawned vigorously with a lunar periodicity during the summer months of 1981 to 1982. Spawning activity declined in the fall of both years and was absent in winter and spring (1983). There was only one short spawning event (in the evening 1-4 days after full moon) per lunar cycle. Negatively buoyant eggs are expelled similarly to expulsion of spermatozoa by the male and ciliated planulae develop by the next morning. Within 24 h a mouth begins to develop with probable ability to feed within 39 h. Zooxanthellae infection occurred 4-5 days following spawning with possible competence for settlement within 7 days (settlement results were ambiguous). Specimens were collected from various shallow water locations in Kane`ohe Bay, O`ahu, Hawai`i.

Krupp, D. A. (1984). " Mucus production by corals exposed during an extreme low tide." Pac. Sci. 38: 1-11.
An extreme low tide resulted in the severe exposure of coral on the reef flat surrounding Coconut island in Kane`ohe Bay, O`ahu, Hawai`i. The exposed corals produced vast quantities of mucus that aggregated as mucus ropes near the shoreline. These mucous ropes were heavily laden with carbonate sediments, amorphous materials, microflora, and microfauna. Compared to the purified liquid mucus of the coral *Fungia scutaria*, the consolidated mucous ropes were rich in organic material and phosphorus. Pure mucus was relatively low in trophic quality. While the pure mucus may provide corals with some protection against desiccation, it is not a particularly rich source for reef heterotrophs. Perhaps the most important role of coral mucus is the consolidation of microscopic organic particulates into macroscopic aggregates of considerably higher trophic quality than pure mucus itself.

Krupp, D. A. (1985). "An immunochemical study of the mucus from the solitary coral *Fungia scutaria* (Scleractinia, Fungiidae)." Bull. Mar. Sci. 36(1): 163-176.
The mucus of reef corals may be an important component of coral reef trophic structure. However, difficulties in the collection, purification and analyses of coral mucus have resulted in inconsistencies among compositional studies, making interpretations about the trophic importance of coral mucus

uncertain. Thus, immunochemical studies were undertaken to understand the biochemistry of the mucus of the solitary scleractinian coral *Fungia scutaria*. One component of the mucus may be a sulfated acid polysaccharide (MAP) strongly associated with protein or peptide. Specimens of *F. scutaria* were collected from Kane`ohe Bay, O`ahu.

Krupp, D. A., P. L. Jokiel et al. (1993). Asexual reproduction by the solitary scleractinian coral *Fungia scutaria* on dead parent coralla in Kane`ohe Bay, O`ahu, Hawaiian Islands. Proc. 7th Int. Coral Reef Symp., Guam.

Kruschwitz, L. G. (1967). Some aspects of the ecology and ethology of the shrimp, *Saron marmoratus*. Department of Zoology, University of Hawai`i.
An ecological and ethological study of the shrimp, *S. marmoratus*. The shrimp were observed and collected in several areas around O`ahu, including a patch reef in Kane`ohe-Bay and Coconut Island. The habitat, aggregations, social behavior activity patterns and feeding were studied in the field. These studies provided a basis for the morphological and behavioral studies in the laboratory.

Kuffner, I. B. (1999). The effects of ultraviolet radiation on reef corals and the sun-screening role of mycosporine-like amino acids. Department of Zoology. Honolulu, University of Hawai`i**:** 163.
The seasonal variation in mycosporine-like amino acids (MAA) were investigated for two corals in Kane`ohe Bay, Hawai`i, *Porites compressa* and *Pocillopora damicornis*. Regression of MAA concentration and the amount of ultraviolet radiation (UVR) measured prior to collection date were not significant for total MAA concentration of either species. However, individual MAAs, shinorine in P. compressa and palythene in *Montipora verrucosa*, did show significant correlation with UVR. Additional experiments were performed testing the combined effects of UVR and water motion on the MAAs of *P. compressa*, and the effect of UVR on planulae of *Pocillopora damicornis*.

Lamberson, P. B. (1974). The effects of light on primary productivity in south Kane`ohe Bay. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 41 pp.
Over a six-month period vertical profiles of production, plant biomass, light, and temperature were obtained and the data applied to a production model. The diel changes in surface production were measured and used to estimate daily production. Samples from the approximate center of south Kane`ohe Bay were taken to determine primary productivity over the period of the study. Plant pigments, productivity, illumination and temperature were taken over a depth gradient down to 10 m. Light appeared to limit production below about five meters depth.

Lamberts, A. E. (1973). Alizarin deposition by corals. Department of Zoology. Honolulu, University of Hawai`i**:** 162.
The hydroquinone dye Alizarin red S was used to visualize sites f calcification in reef corals under controlled laboratory conditions using the reef coral *Pocillopora damicornis* and ten other species collected form Kane`ohe Bay. Corals deposit alizarin in a pattern corresponding to the calcium deposition during the test period, producing a magenta stain. Deposition was often most marked in areas far removed from zooxanthellae concentrations. Incorporation of the dye reflects the biological activity of the corals and was deposited most actively by the youngest growth forms.

Lamberts, A. E. (1974). Measurement of alizarin deposited by coral. Proc. 2nd Int. Coral Reef Symp., Brisbane, Australia.
The hydroquinone dye Alizarin red S was used to visualize sites f calcification in reef corals under controlled laboratory conditions using the reef coral *Pocillopora damicornis* and ten other species collected form Kane`ohe Bay. Corals deposit alizarin in a pattern corresponding to the calcium deposition during the test period, producing a magenta stain. Deposition was often most marked in areas far removed from zooxanthellae concentrations. Incorporation of the dye reflects the biological activity of the corals and was deposited most actively by the youngest growth forms.

Landry, M. R., L. W. Haas et al. (1984). "Dynamics of microbial plankton communities experiments in Kane`ohe Bay, Hawai`i." Mar. Ecol. Prog. Ser. 16: 127-133.
The dynamics of the microbial plankton community of Kane`ohe Bay, Hawai`i were investigated in September 1982 using in situ diffusion chambers and dilution manipulations. Total community carbon at the time of the experiments was estimated at 86 mu g Cl^{-1} of which *Chlorella* sp. accounted for 47%, autotrophic microflagellates 14%, chroococcoid cyanobacteria 11%, and heterotrophic microflagellates and bacteria each 9%. Instantaneous growth rates ranged from 1.2 to 1.9 d^{-1} and 1.4 to 2.0 d^{-1} and mortality rates varied from 0.5 to 1.1 d^{-1} and 0.1 d^{-1} for heterotrophic bacteria and cyanobacteria, respectively, yielding net population growth rates of 1.0 to 1.3 and 1.5 to 2.7 doublings d super(-1) for

the 2 populations, *Chlorella* sp., on the other hand, experienced only slight net growth (0.1 to 0.3 doubling d^{-1} despite a growth coefficient of about 0.9 d^{-1}. Phagotrophic microflagellates presumed to be the dominant grazers, consumed about 4.7 times their body carbon d^{-1}) and grew at net population rates of 1.4 to 1.9 doublings d^{-1}. However, microflagellates were food limited and did not control bacterial populations.

Larned, S. T. (1998). "Nitrogen- versus phosphorus-limited growth and sources of nutrients for coral reef macroalgae." Mar. Biol. 132: 409-421.
Recent investigations of nutrient-limited productivity in coral reef macroalgae have led to the conclusion that phosphorus, rather than nitrogen, is the primary limiting nutrient. In this study, comparison of the dissolved inorganic nitrogen:phosphorus ratio in the water column of Kane`ohe Bay, Hawai`i, with tissue nitrogen:phosphorus ratios in macroalgae from Kane`ohe Bay suggested that nitrogen, rather than phosphorus, generally limits productivity in this system. Results of nutrient-enrichment experiments in a flow-through culture system indicated that inorganic nitrogen limited the growth rates of 8 out of 9 macroalgae species tested. In 6 of the species tested, specific growth rates of thalli cultured in unenriched seawater from the Kane`ohe Bay water column were zero or negative after 12 d. These results suggest that, in order to persist in low-nutrient coral reef systems, some macroalgae require high rates of nutrient advection or access to benthic nutrient sources in addition to nutrients in the overlying water column. Nutrient concentrations in water samples collected from the microenvironments inhabited or created by macroalgae were compared to nutrient concentrations in the overlying water column. On protected reef flats, inorganic nitrogen concentrations within dense mats of *Gracilaria salicornia* and *Kappaphycus alvarezii*, and inorganic nitrogen and phosphate concentrations in sediment porewater near the rhizophytic algae *Caulerpa racemosa* and *C. sertularioides* were significantly higher than in the water column. The sediments associated with these mat-forming and rhizophytic species appear to function as localized nutrient sources, making sustained growth possible despite the oligotrophic water column. In wave-exposed habitats such as the Kane`ohe Bay Barrier Reef flat, water motion is higher than at protected sites, sediment nutrient concentrations are low, and zones of high nutrient concentrations do not develop near or beneath macroalgae, including dense *Sargassum echinocarpum* canopies. Under these conditions, macroalgae evidently depend on rapid advection of low-nutrient water from the water column, rather than benthic nutrient sources, to sustain growth.

Larned, S. T. and M. J. Atkinson (1997). "Effects of water velocity on NH4 and PO4 uptake and nutrient-limited growth in the macroalga *Dictyosphaeria cavernosa*." Mar. Eco. Prog. Ser. 157: 295-302.
Dictyosphaeria cavernosa is a spatially dominant macroalga on coral reefs in Kane'ohe Bay, Hawai'i, USA, and occupies a range of habitats from low energy reef slopes to a high energy barrier reef flat. Previous studies demonstrated that *D. cavernosa* growth is limited by the availability of dissolved inorganic nitrogen (DIN) in Kane'ohe Bay, and that, on protected reef flats and slopes, the rate at which DIN is supplied to thalli from the water column is too low for sustained growth. Under these conditions, DIN released from sediments into the water-filled chambers beneath thalli is used for growth. At exposed sites such as the barrier reef, nutrient-rich sediments do not accumulate but *D. cavernosa* is abundant, suggesting that high levels of water motion supply nutrients from the water column to thalli at rates high enough for sustained growth. To test the hypothesis that nutrient acquisition by *D. cavernosa* increases with increasing water velocity, rates of NH4 and PO4 uptake were measured at a range of water velocities within the range measured in *D. cavernosa* habitats (0.02 to 0.13 m s-1). Rates of uptake for both nutrients were positively correlated with velocity and with concentration. Results from the uptake experiments were used to construct a simple model to predict the combinations of nutrient concentration and water velocity at which the nitrogen and phosphorus requirements for growth can be met by uptake from the Kane'ohe Bay water column. The model predicts that, at sites in Kane'ohe Bay where average water velocities are higher than 0.05 m s-1, DIN supplied to thalli from the Bay water column can support the specific growth rate measured in the field. At sites where average water velocities are less than 0.05 m s-1, thalli must utilize DIN supplied from benthic sources in addition to water column nitrogen to maintain growth rates at field levels. Similarly, at sites where water velocities are higher than 0.01 M s-1, PO4 supplied to thalli from the water column can support growth at field levels, while thalli at sites with lower water velocities must utilize PO4 supplied from benthic sources.

Larned, S. T. and J. Stimson (1996). "Nitrogen-limited growth in the coral reef chlorophyte *Dictyosphaeria cavernosa*, and the effect of exposure to sediment-derived nitrogen on growth." Mar. Ecol. Prog. Ser. 145: 95-108.
The macroalga *Dictyosphaeria cavernosa* grows profusely on the reef slopes of Kane`ohe Bay, Hawai`i, despite low inorganic nutrient concentrations in the water column. Results from tissue

nutrient analyses suggested that the nitrogen storage capacity of *D. cavernosa* is very low; the alga appears to require a continual supply of dissolved inorganic nitrogen, at a concentration greater than that of the water column, to sustain growth.

Lau, C. J. (1987). A study on the feeding ecology of two species of shallow-water Hawaiian slipper lobsters. Depart. of Zoology. Honolulu, Univ. of Hawai`i: 184.
A model for studies of feeding and consequent growth is reported for two large tropical species of decapod crustacea. The feeding biology of two shallow-water slipper lobsters, *Parribacus antarcticus* (Lund) and *Scyllarides squammosus* (H. Milne Edwards) was studied by determining the natural diet from the stomach contents of specimens collected from Kane`ohe Bay. A survey of prey groups revealed that *P. antarcticus* fed on a diverse array of slow moving or sedentary benthic organisms. *S. squammosu*s also fed on benthic invertebrates but was found to be more specialized in the number of prey groups it was found to ingest. Molluscs were th sole group found in the foregut and bivalves were especially important.

Lawn, I. D. and D. M. Ross (1982). "The behavioural physiology of the swimming anemone *Boloceroides mcmurrichi*." Proc. R. Soc. Lond. B216: 315-334.
The Indo-Pacific sea anemone, *Boloceroides mcmurrichi*, swims by coordinated lashing of tentacles and can cast off tentacles by autotomy. A predator of *Boloceroides*, the aeolid *Berghia major*, makes a lunge into the tentacles and causes the anemone to detach its pedal disc, autotomize seized tentacles and swim away, a response apparently due to a chemical substance in the aeolid. Two adaptations, swimming and autotomy, while not preventing predation, keep it to levels easily countered by regeneration. In electrophysiological studies on *Boloceroides*, the pulses associated with the conduction systems in other anemones (NN, SS1 and SS2) were not detected. Pulses that were detected (TBP, FTP, STP, SAP and TCP) reflect the behavioural capacities and the special adaptations of this atypical anemone, but pulses associated with overall coordination remain to be discovered. *B. mcmurrichi* were collected from Coconut Island and sandy reef flats from Kane`ohe Bay, O`ahu.

Laws, E. A. (1985). Nutrient and energy cycling among phytoplankton, bacteria, and zooplankton. Kane`ohe, Univ. of Hawai`i, Hawai`i Inst. Mar. Biology: 102.
During the summer of 1985 students and senior faculty who participated in the HIMB Summer Studies Program (Kane`ohe Bay) utilized a variety of experimental techniques to study nutrient and energy cycling among phytoplankton, bacteria, and zooplankton.

Laws, E. A., C. B. Allen et al. (1996). "Water quality in a subtropical embayment more than a decade after diversion of sewage discharges." Pac. Sci. 50: 194-210.
Concentrations of chlorophyll a (Chl a), particulate carbon and nitrogen (PC and PN, respectively), inorganic nutrients, and Secchi depths were measured from October 1989 to June 1992 in Kane'ohe Bay, an embayment on the windward coast of O'ahu, Hawaiian Islands. Results were compared with values reported in 1978-1979, the year immediately following diversion of two sewer outfalls from the southeast sector of the bay. Nutrient enrichment experiments indicated that the bay is now distinctly nitrogen limited. In many respects the water column appears more oligotrophic now than in 1978-1979. Inorganic nitrogen and phosphate concentrations now border on the limit of detection by colorimetric methods. Chl a concentrations have declined by 35-40% (0.3-0.5 mg m-3) and Secchi depths have increased by 15-35% (1.0-1.5 m) in the southeast sector of the bay since 1978-1979. This has happened despite a population increase of 7,762 persons in the watershed from 1980 to 1990. Characteristics of the water column are now remarkably similar in all sectors of the bay. About 40% of the phytoplankton Chl a is accounted for by picoplankton. Pigment analyses indicate that diatoms and cyanobacteria make up ca. 45 and 25%, respectively, of the phytoplankton biomass. It is postulated that the drawdown of inorganic nutrient concentrations and increase in PN/Chl a and PC/Chl a ratios reflect a shift of the phytoplankton community toward smaller species characteristic of oligotrophic environments. An increase of PN in the central and northwest sectors of the bay is postulated to have been caused by an increase in nitrogen fixation and export from the barrier reef. There is no evidence that human population growth has altered nutrient loading from stream runoff.

Laws, E. A. and D. G. Redalje (1979). "Effect of sewage enrichment on the phytoplankton population of a subtropical estuary." Pac. Sci. 33: 129-144.
Phytoplankton primary production; concentrations of chlorophyll a, particulate carbon and nitrogen, adenosine triphosphate, inorganic nitrogen and phosphorus; and secchi depths were measured at four stations in Kane`ohe Bay, O`ahu, on a biweekly basis for 20 months prior to diversion of sewage discharges from the bay. Nutrient enrichment experiments designed to determine biomass limitation

indicated that phytoplankton biomass, as measured by chlorophyll a, was nitrogen-limited in all parts of the bay, and that phosphorus was simultaneously limiting in the sector of the bay furthest from the sewer outfalls. Nitrogen recycling was estimated to account for 80% of phytoplankton nitrogen uptake in the part of the bay receiving direct sewage inputs, and for over 90% of phytoplankton nitrogen uptake in the other sectors of the bay. Living carbon was found to vary by a factor of 3-4 between the sewage-enriched and unenriched sectors of the bay. Estimated detrital carbon concentrations of inorganic nitrogen were uniform throughout the bay, as were the measured concentrations of inorganic nitrogen. These results are consistent with the interpretation that the population of microorganisms, both bacteria and phytoplankton, are substrate-limited in all sectors of the bay.

Laws, E. A. and D. G. Redalje (1982). "Sewage Diversion Effects on the Water Column of a Subtropical Estuary." Mar. Environ. Res. 6.
A study of the phytoplankton community and water column chemistry in Kane`ohe Bay, O`ahu, Hawai`i, before and after the diversion of secondary treated sewage from the bay has shown that changes in total nutrient concentrations in the water column cannot be accurately predicted without taking into account water column-benthos interactions. During the first year after sewage diversion, the decomposition of about 400 tonnes of benthic organisms, primarily filter feeders, resulted in water column dissolved organic nitrogen and phosphorus concentrations roughly an order of magnitude higher than those expected in the absence of such interactions. The biomass of phytoplankton appears to have been N-limited both before and after sewage diversion, with internal nutrient recycling accounting for 70-99% of phytoplankton nutrient uptake. Both the biomass and growth rate of the phytoplankton declined as a result of the sewage diversion, with post-diversion growth rates evidently well below nutrient-saturated values. Since the principal stresses on the bay's coral reef community as a result of the sewage discharges appear to have resulted from the elevated concentrations of plankton in the water, various measures of seston concentration appear to be the most ecologically significant indicators of nutrient enrichment in this system.

Leary, D. F. and G. I. Murphy (1975). "A successful method for tagging the small, fragile engraulid, *Stolephorus purpureus*." Trans. Amer. Fish. Soc. 104(1): 53-55.
Survival of anchovies (*Stolephorus purpureus*), held in tanks for 30 days after being tagged with a tiny wire implanted automatically by a new device, was 80.5% and tag loss 14.7%. Both criteria were superior to those reported for engraulids tagged by other methods. Advantages of the new tag are small size, internal location, ease of implantation, and capability of being detected automatically.

Leary, D. F., G. I. Murphy et al. (1975). "Fecundity and length at first spawning of the Hawaiian anchovy, or nehu *(Stolephorus purpureus* Fowler) in Kane`ohe Bay, O`ahu." Pac. Sci. 29: 171-180.
Fecundity, length at first spawning, and spawning seasonality of *Stolephorus purpureus* were determined by examining preserved ovarian eggs and fish captured throughout a 4 year period. Fecundity was estimated from the number of eggs in the most advanced ovarian mode after it was determined that all these eggs hydrated and were spawned. Fecundity (Y) was related to fish weight (X) by the fish having a weight equal to the mean for the population contains 566 eggs/g of fish weight. Large variations in fecundity from year to year were attributed primarily to environmental factors whose influence on reproduction by *Stolephorus purpureus* has not been studied. Spawning occurred year around but the incidence was higher during the spring and summer than during the remainder of the year.

Leber, K. M. (1995). "Significance of fish size-at-release on enhancement of striped mullet fisheries in Hawai`i." J. World Aquaculture Soc. 26: 143-153.
A tag-release-recapture study was conducted to evaluate size-at-release impacts upon recruitment of cultured, juvenile striped mullet, *Mugil cephalus* released in inshore habitats of O`ahu, Hawai`i, USA. In June and July 1990, 85,848 juvenile mullet were graded into five size groups (ranging from 45 to 120 mm in length), identified with binary-coded wire tags, and released into two estuaries (2 times 5 factorial design). Of the tagged fish, 42,822 were released into Kane`ohe Bay on the east (windward) coast of O`ahu; 43,026 were released into Maunalua Bay on O`ahu's dryer south shore. The fish were released into both bays simultaneously. Releases were blocked in time across 5 release lots. To evaluate growth and survival rates of released mullet, both bay systems were sampled monthly with cast nets over a ten-month period after release. Overall, 733 tagged *M. cephalus* were recaptured, 277 from Kane`ohe Bay and 456 from Maunalua Bay. Overall proportions of tagged fish in samples declined from 33.4% (+-25.2%) of the total M. cephalus catch at week 5 to 1.88% (+-0.95%) by week 23. From week 23 on, tagged fish averaged 2.09% (+-0.23%) of the striped mullet in monthly samples. Within 9 wk after releases, recapture frequencies were clearly skewed in favor of fish that were larger at the time of release. Fish smaller than 70 mm when released were rare or absent in collections within

18 wk after release. This confirms results of a smaller-scale pilot study in Maunalua Bay and shows that fish size-at-release can have a major impact on the success of hatchery releases in marine habitats. Pilot studies to identify minimum fish size-at-release should be conducted at all sites targeted for full-scale marine hatchery releases.

Leber, K. M. and S. M. Arce (1996a). "Stock enhancement in a commercial mullet, *Mugil cephalus* L., fishery in Hawai`i." Fish. Manage. Ecol. 3: 261-278.
This study showed that cultured striped mullet, *Mugil cephalus* L., released as juveniles can make a significant contribution to landings in an island commercial fishery. Following pilot hatchery releases from 1990 to 1993, striped mullet fisheries in Kane`ohe Bay, Hawai`i, USA, were sampled to recover cultured fish from the bay-wide catch. Direct sampling of 181 fishing trips resulted in recovery of 211 cultured striped mullet. By autumn 1994, cultured fish comprised 13.0% (+- 2.8%) of the commercial mullet catch in Kane`ohe Bay, and the percentage was increasing logarithmically. This study corroborated predictions from previous studies of juveniles about effects of release strategies on survival of cultured mullet. Following summer releases, recapture rates were strongly affected by fish size-at-release, with a critical release size of 60 mm total length (the smallest size released that was subsequently detected in the fishery). Over 30 000 juveniles stocked in 1990 (but not in a nursery habitat preferred by striped mullet) apparently suffered complete mortality.

Leber, K. M., S. M. Arce et al. (1996b). "Marine stock-enhancement potential nursery habitats of striped mullet, *Mugil cephalus*, in Hawai`i." Fish. Bull. 94: 452-471.
Results from pilot experiments were used to modify release strategies to test marine stock enhancement potential in Kane`ohe Bay, Hawai`i. Of 80,507 native, cultured, striped mullet fingerlings tagged with coded wire and released during spring and summer, 2,642 fish were recovered by cast-net sampling during 11 months. Recapture rate increased 600% compared with initial studies in Kane`ohe Bay. This increase was the result of confining releases to the vicinity of fresh-water streams and of imposing a minimum size of 70 mm TL during summer releases. After 11 months, cultured fish represented 50% of the striped mullet in collections at the release site, 20% in a nursery habitat 1 km to the north, and 10% in a nursery 3 km north. The location of releases (stream mouth vs. upstream lagoon) significantly affected dispersal patterns but did not affect growth or recapture rate. This study corroborated earlier results which showed that the smallest fish released (45-60 mm) could survive relatively well if released in spring. At least three measures were needed to describe hatchery effect: 1) hatchery contribution (% cultured fish in samples), 2) catch per unit of effort for cultured and wild striped mullet, and 3) recovery rate (no. captured/no. released). This study documents that survival of cultured fish in coastal nurseries can be significantly improved by using information from pilot release experiments to revise release parameters.

Leber, K. M., H. L. Blankenship et al. (1997). "Influence of release season on size-dependent survival of cultured striped mullet, *Mugil cephalus*, in a Hawaiian estuary." Fish. Bull. 95: 267-279.
The concept that depleted populations of marine fishes can be revitalized by releasing cultured fish is being tested in Hawai`i. In this study we evaluated effects of interaction between release season and size-at-release on recapture rates of cultured striped mullet, *Mugil cephalus*, released into Kane`ohe Bay, Hawai`i. Over 90,000 cultured *M. cephalus* fingerlings, ranging in size from 45 to 130 mm total length, were tagged with binary coded-wire tags. Half were released in spring, the remainder in summer. In both seasons, releases were made in three replicate lots. In each replicate, five size intervals of fish were released at two nursery habitats in Kane`ohe Bay. Monthly cast-net collections were made in 6 nursery habitats over a 45-week period to monitor recapture rates, growth, and dispersal of cultured fish. Recapture rate was directly affected by the seasonal timing of releases. Greatest recovery of the smallest fish released (individuals lt 60 mm) occurred following spring releases and coincided with peak recruitment of similar-size wild *M. cephalus* juveniles. In contrast, recovery of fish that were 60 mm at release was very poor after summer releases. Overall survival was similar at both release sites. We hypothesize that survival of released cultured fish will be greater when releases are timed so that fish size-at-release coincides with modes in the size structure of wild stocks. To optimize effectiveness of stock enhancement as a fishery-management tool, pilot release-recapture experiments should be conducted to evaluate effects of release season on size-dependent recovery of released animals.

Leber, K. M., N. P. Brennan et al. (1995). "Marine enhancement with striped mullet: are hatchery releases replenishing or displacing wild stocks?" Am. Fish. Soc. Symp. 15: 376-387.
The hypothesis that marine hatchery releases can increase fish abundances has at least two corollaries that need to be tested: (1) cultured fish can survive and grow when released into coastal environments; and (2) cultured fish do not displace wild individuals. Both are being tested in Hawai`i.

The present study was conducted to evaluate whether hatchery releases of striped mullet Mugil cephalus actually increase abundances or displace wild stock. In summer 1993, 5,811 wild striped mullet were captured, tagged, and released in three lots back into two primary nursery habitats in Kane`ohe Bay. Three weeks later, quantitative sampling with cast nets was conducted in several striped mullet nursery habitats within the bay to evaluate pretreatment dispersal of wild fish. Following those initial collections, cultured striped mullet were released to establish the primary treatment condition, a hatchery release. A total of 29,354 cultured striped mullet were tagged and released, but at only one of the nursery sites (treatment site). Monthly monitoring was conducted over an 8-month period to determine if there was greater dispersal of wild fish at the treatment site. There was no significant difference in the dispersal rates of wild fish from the treatment site compared with the control (no hatchery release) site. As expected, based on earlier pilot hatchery releases, a majority of tagged and released cultured and wild striped mullet remained within those nursery habitats where they were released. Hatchery releases in this study did not result in displacement of wild individuals from the principal nursery habitat in Kane`ohe Bay. The cultured fish released there increased abundances of striped mullet at the treatment site by around 33%. Thus it appears that even small-scale releases could help replenish the depleted striped mullet fishery in Kane`ohe Bay; conducting small-scale hatchery releases in several nursery habitats in Kane`ohe Bay should increase overall striped mullet abundances in this estuary. This study also corroborated earlier experiments in Hawai`i showing a direct relationship between fish size at release and recapture rate. These results indicate hatchery releases can increase abundances of targeted inshore fish populations in Hawai`i. If a careful approach is used, marine stock enhancement appears to have considerable potential as an additional fishery management tool.

Leber, K. M. and C. S. Lee (1997). "Marine stock-enhancement potential with striped mullet, *Mugil cephalus*, in Hawai`i." Bull. Nat. Res. Inst. Aquaculture. 0 (SUPPL. 3).

Three common methods have been used to replenish depleted stocks: regulating fishing effort; restoring degraded nursery and spawning habitats; and increasing recruitment through propagation and release. Declines in world fishery landings have prompted new interest in using cultured fishes to help replenish depleted stocks. With advances in tagging methods and aquaculture technology for marine finfish, stock enhancement through the release of hatchery-produced juveniles is becoming one of the solutions for replenishing depleted coastal fishes. The hypothesis that hatchery releases can increase population size has at least two corollaries that need to be tested: (1) released cultured fish survive, grow and contribute to natural recruitment, and (2) cultured fish do not displace wild stocks. The concept that depleted populations of marine fishes can be revitalized using cultured fish is being tested in Hawai`i, where landings of coastal species have declined by 80% since the turn of the century. Striped mullet (*Mugil cephalus)* and Pacific threadfin (*Polydactylus sexfilis*) have been selected as top priority species for stock enhancement research. Intensive studies on striped mullet stock enhancement have been carried out at The Oceanic Institute in cooperation with the State of Hawai`i. The research approach in Hawai`i followed three steps: select test species, evaluate release strategies with pilot releases, and conduct a test release using optimal release protocol. During pilot releases, three important factors (fish size-at-release, release habitat and release season) were evaluated. To evaluate the initial success of hatchery releases in Hawai`i, we tracked survival of released fish prior to and after their entry into the fishery. Each year, beginning about 2 weeks after releases, monthly cast-net collections were made in six nursery habitats over about a 10-month period to monitor recapture rates, growth and dispersal of the juvenile cultured fish. Recapture rate of cultured fish during the juvenile nursery stage of the life cycle was directly affected by the release site, fish size-at-release and the seasonal timing of releases. Over 30,000 juveniles stocked in 1990 (but not in a nursery habitat preferred by striped mullet) apparently suffered complete mortality. However, there was good survival of fish when they were released into documented nursery habitats of wild mullet. Greatest recovery of the smallest fish released (individuals <60 mm) occurred following spring releases, which coincided with peak recruitment of similar-size wild *M. cephalus* juveniles. After summer releases, recapture rates were strongly affected by fish size-at-release, with a critical release size of 60 mm total length (the smallest size released that was subsequently detected in the fishery). We hypothesized that survival of released cultured fish will be greater when releases are timed so that fish size-at-release coincides with modes in the size structure of wild stocks. Following pilot hatchery releases from 1990 to 1993, striped mullet fisheries in Kane`ohe Bay, Hawai`i, were also sampled to recover cultured fish from the bay-wide catch. Direct sampling of 181 fishing trips resulted in recovery of 211 cultured striped mullet. By. autumn 1994, cultured fish comprised 13.0% (+-2.8%) of the commercial mullet catch in Kane`ohe Bay, and the percentage was increasing logarithmically. To optimize effectiveness of stock enhancement as a fishery-management tool, pilot release-recapture experiments should be conducted to evaluate effects of release protocol on recovery of released animals. For example, In Hawai`i, hatchery production cost-per-fish-caught in the fishery was lower for releasing 70-85mm size fingerlings compared to 45-60mm fingerlings when releases were conducted in summer. By refining release protocol over a 3-year period, proportions of cultured fish in nursery habitats 10 months after release increased from 3% to 10% and finally to 50% of the total striped mullet (wild and cultured) collected in net samples. At least three measures were needed to describe hatchery effect: (1) hatchery contribution (% cultured fish in samples), (2) catch-per-unit-effort for cultured and wild striped mullet, and (3) recovery rate (no. captured/no. released). Our studies demonstrate how survival of cultured fish in coastal nurseries can be significantly improved using information from pilot release experiments to revise release parameters. Results at The Oceanic Institute have shown that the targeted inshore fish population can be increased through the release of hatchery-produced juveniles. However, to provide adequate conservation of the wild stocks we are attempting to replenish, a responsible approach should be used for any stock enhancement activities.

Lee, K. H. and E. G. Ruby (1994). "Effect of the squid host on the abundance and distribution of symbiotic *Vibrio fischeri* in nature." Appl. Environ. Microbiol. 60: 1565-1571.
Euprymna scolopes, a Hawaiian species of bioluminescent squid, harbors *Vibrio fischeri* as its specific light organ symbiont. The population of symbionts grew inside the adult light organ with an average doubling time of about 5 h, which produced an excess of cells that were expelled into the surrounding seawater on a diurnal basis at the beginning of each period of daylight. These symbionts, when expelled into the ambient seawater, maintain or slightly increase their numbers for at least 24 h. Hence, locations inhabited by their hosts periodically receive a daily input of symbiotic *V. fischeri* cells and, as a result, become significantly enriched with these bacteria. As estimated by hybridization with a species-specific luxA gene probe, the typical number of *V. fischeri* CFU, both in the water column and in the sediments of *E. scolopes* habitats, was as much as 24 to 30 times that in similar locations where squids were not observed. In addition, the number of symbiotic *V. fischeri* CFU in seawater samples that were collected along a transect through Kane`ohe Bay, Hawai`i, decreased as a function of the distance from a location inhabited by *E. scolopes*. These findings constitute evidence for the first recognized instance of the abundance and distribution of a marine bacterium being driven primarily by its symbiotic association with an animal host.

Lee, M. H. (1973). Establishment and characterization of a marine fish cell line, *Caranx mate* (Omaka). Dept. of Zoology. Honolulu, Univ. of Hawai`i.
A cell-line of larval *Caranx mate* tissue was produced and characterized. Larvae where collected from surface waters around Coconut Island.

Lee, R. S. K. (1963). "The structure and reproduction of *Dudresnaya hawaiiensis* sp. nov. (Rhodophyta)." Amer. J. Bot. 50: 315-319.
A taxonomic description of sp. nov., the first time that this genus has been reported from the Hawaiian Islands. The gross vegetative structure of this new species is unique and the basal structures involved in post-fertilization which are typical of the genus are described. The typical locus for this species in Hawai`i is in Kane`ohe Bay. Specimens were collected in May, 1959 (Doty no. 19041) and in March, 1961 (Soegiarto no. 137).

Leis, J. M. and J. M. Miller (1976). "Offshore distributional patterns of Hawaiian fish larvae." Mar. Biol. 36: 359-367.
An analysis of ichthyoplankton samples based on relative abundance reveals pronounced inshore/offshore distributional gradients for most Hawaiian fish larvae. Larvae of pelagic bay species are found almost exclusively in semi-enclosed bays and estuaries. Larvae of pelagic neritic species are more or less uniformly distributed with distance from shore. The larvae of reef species with non-pelagic eggs are most abundant close to shore, while those of reef species with pelagic eggs are most abundant offshore. Finally, the larvae of offshore (primarily mesopelagic) species show no clear pattern but frequently occur in high numbers nearshore. Within any group, variation in pattern was often evident. These findings indicate to the inshore adult habitat to obtain a complete picture.

Lenz, P. H. and D. K. Hartline (1999). "Reaction times and force production during escape behavior of a calanoid copepod, *Undinula vulgaris*." Mar. Biol. 133: 249-258.

Lesser, M. P. and S. Lewis (1996). "Action spectrum for the effects of UV radiation on photosynthesis in the hermatypic coral *Pocillopora damicornis*." Mar. Ecol. Prog. Ser. 134(171-177).
Colonies of the hermatypic coral *Pocillopora damicornis* were collected from the shallow reefs of Kane`ohe Bay, Hawai`i, to assess the wavelength-dependent effects of ultraviolet (UV) radiation on photosynthesis. Measurements of photosynthesis and respiration were made while corals were exposed to different UV irradiances, keeping visible radiation constant, using long-band pass filters. A

differential action spectrum (biological weighting function) for the inhibition of photosynthesis by UV radiation was then determined for *P. damicornis*. The action spectrum revealed an increase in the wavelength-dependent effects of UV radiation on photosynthesis between 290 and 310 nm that is greater than those increases reported for action spectra on natural assemblages and uni-algal cultures of marine microalgae. The greater effect at these wavelengths is a result of the high biologically effective doses of UV radiation experienced by these corals on shallow reefs, and the decrease in the absorbance of UV radiation by UV absorbing compounds found in the host tissues and algal symbionts between 290 and 310 nm. The irradiances of wavelengths in the region between 290 and 310 nm are those which will increase in the event of any decrease in stratospheric ozone over equatorial regions. If the observed sensitivity of *P. damicornis* in this spectral region is common in other species, it may have important consequences for growth, reproduction, and occurrence of the bleaching phenomenon for shallow water corals.

Lesser, M. P., V. M. Weis et al. (1994). " Effects of morphology and water motion on carbon delivery and productivity in the reef coral, *Pocillopora damicornis* (Linnaeus): diffusion barriers, inorganic carbon limitation, and biochemical plasticity." J. Exp. Mar. Biol. Ecol. 178: 153-179.

Levy, O. (1998). Preliminary experiments on the effects of wavelength on growth, survival and settlement of larvae of *Pocillopora damicornis*. Reproduction in reef corals. Cox, E. F., D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 105-111.
Survival, settlement and growth of larvae of the coral *Pocillopora damicornis* at different wavelengths were studied. The mean number of surviving larvae in the three treatments after 18 days was significantly different, with lower survivorship under the green filter (480-600 nm) than the blue filter (400-550 nm) or Photosynthetically Active Radiation treatment (PAR, 400-700 nm). In the settlement experiments there were no significant differences among the three wavelength treatments, and it appears that there is no connection between spectrum of light and settlement behavior after 18 days. During this study of larval growth at three wavelengths (PAR, 663 nm, 447 nm) and in the dark, there was a significant difference in growth among the treatments in the first trial, but only between the dark and the PAR treatments. I propose that there may be competition for carbon dioxide between the zooxanthellae, which use the carbon for photosynthesis, and the coral which uses the carbon for calcification. The results from these trials also show that larvae can continue to grow for 3 days in the dark. Larvae were collected from *P. damicornis* collected from the reefs surrounding Coconut Island, Kane`ohe, O`ahu.

Lewis, A. G. (1963). "Life history of the caligid copepod *Lepeophtheirus dissimulatus* Wilson, 1905 (Crustacea: Calogoida)." Pac. Sci. 17: 195-242.
A descriptive histological study of the life history of *Lepeophtheirus dissimulatus* which were collected from host material, the Hawaiian acanthurid (surgeon) fishes, in Kane`ohe Bay.

Lewis, C. R. (1980). Sessile invertebrate colonization of a coral patch reef: a study of two reefs in Kane`ohe Bay, Hawai`i. Department of Biological Sciences. DeKalb, Northern Illinois University**:** 132.
Marine invertebrate colonization for a complete annual cycle was examined on two patch reefs in Kane`ohe Bay, O`ahu, Hawai`i. PVC panels provided the substratum for settlement along windward to leeward transects on both reefs. Counts of individual organisms and area covered by colonies provided data for site and inter-reef comparisons of temporal and spatial colonization trends. Over 80% of total invertebrate settlements could be ascribed to five taxonomic groups: oysters, barnacles, serpulid worms, bryozoans and tunicates. The greatest numbers of new settlements consistently occurred at the shallow windward site of each reef, whereas the least amount of colonization occurred in the middle of the study reefs. Five months into the study, all the fishes were removed from the smaller of the two patch reefs, providing a temporary means of examining the effects of fish on invertebrate colonization. Due to the rapid recolonization of the reef, particularly by dominant herbivores, major effect on invertebrate colonization patterns by fishes were not detected.

Lindstedt, K. J. (1971). Valine activation of feeding in the sea anemone *Boloceroides*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 92-99.
Evidence is presented showing chemical control of feeding in an anthozoan coelenterate; the feeding response of the Hawaiian swimming actinian, *Boloceroides* sp., is controlled by the branched amino acid valine. Specimens were collected from reefs at the northern end of Coconut Island, Kane`ohe Bay, O`ahu. Feeding appears to require mechanical stimulation along with chemical activation which suggests that cilia along the body surface are influenced by the feeding activator. The amino acid valine when dissolved in seawater did not elicit a feeding response unless the animal experienced

mechanical stimulation.

Lindstedt, K. J., L. Muscatine et al. (1968). "Valine activation of feeding in the sea anemone *Boloceroides*." Comp. Biochem. Physiol. 26: 567-572.
Evidence is presented showing chemical control of feeding in an anthozoan coelenterate; the feeding response of the Hawaiian swimming actinian, *Boloceroides* sp., is controlled by the branched amino acid valine. Specimens were collected from reefs at the northern end of Coconut Island, Kane`ohe Bay, O`ahu. Feeding appears to require mechanical stimulation along with chemical activation which suggests that cilia along the body surface are influenced by the feeding activator. The amino acid valine when dissolved in seawater did not elicit a feeding response unless the animal experienced mechanical stimulation.

Lloyd, M. (1970). Distribution and abundance of the common vermetids of Checker Reef, Kane`ohe Bay, O`ahu, Hawai`i (Abstr.). Kane`ohe, University of Hawai`i, Hawai`i institute of Marine Biology.
A description of the distribution and abundance of vermetid gastropods (mesogastropoda: Vermetidae) which form the dominant component of the molluscan fauna of Checker Reef, Kane`ohe Bay. They commonly occur on hard, silt-free substrate from the water surface to a depth of six meters. Relative abundances of the vermetid species differed considerably on the *Porolithon* ridge, dead coral heads and on *Porites* heads.

Losey, G. S., Jr. (1982). "Ecological cues and experience modify interspecific aggression by the damselfish, *Stegastes fasciolatus*." Anim. Behaviour 81: 14-37.
Aggression between species has been established as an important biological process. This report is an extension of the results presented by Losey (1981). The purpose of this study was to determine the cause of interspecific aggression of *Stegastes fasciolatus*.

Losey, G. S. (1971). Communication Between Fishes in Cleaning Symbiosis. Aspects of the Biology of Symbiosis. T. C. Cheng. Baltimore, Univ. Park Press**:** 45-76.
In the interactions between some cleaner and host fishes, the following list of stimuli act as communicative signals and increase the possibility of the response shown in parentheses; morphology, coloration, and general swimming movements of the cleaner (host-pose), morphology, coloration, and general swimming movements of the host (cleaner-inspect), host-pose (cleaner-inspect), and cleaner-inspect (host-pose). Cleaning is a distinct type of symbiotic behavior and yet the highly developed communication system suggests that it is much more than just a casual relationship.

Losey, G. S. (1972). "The ecological importance of cleaning symbiosis." Copeia 1972(820).
The removal of most of the cleaner fish, *Labroides phthirophagus*, from a reef resulted in an increase in cleaning behavior by the remaining cleaners and changes in the behavior and distribution of the host fish. After the removal of all of the L. phthirophagus there was no increase in the ectoparasitic infestation of the host fish as compared with a similar control reef. The form of the behavioral changes and the lack of change in ectoparasites removal, the proximate causal factors are not related to ectoparasites. Thus, in some areas, the relationship of the cleaner to the host may become commensal or even parasitic.

Losey, G. S. (1977). "The validity of animal models." Biology of Behavior 2: 223-238.
Experiments were conducted to test the critical assumption that responses to a model of a cleaning fish depends on much the same causal system as response to the natural stimulus. The assumption was supported by two lines of evidence: 1-Three measures of the tendency to respond to the natural stimulus all correlated with strength of response to the model. 2-Exposure to either the model or the cleaner induced changes in subsequent responses to the other. In addition, a higher relative response to the model appeared to suggest that it is a supernormal stimulus. But this interpretation is not favored because the differences in response appeared to result from the model lacking certain aversive stimuli that were experienced in interaction with the cleaner

Losey, G. S., Jr. (1979). "Fish cleaning symbiosis: proximate causes of host behavior." Anim. Behaviour 27: 669-685.
Proximate causes for response to a cleaner fish were studied in two host fishes, *Chaetodon auriga* and *Zebrasoma flavescens*. Response to a model of a cleaner fish indicated whether ectoparasites, deprivation of exposure to the model, and aversive stimulation had any effect on cleaning symbiotic behaviour. An evolutionary scheme is suggested in which some cleaner fish have exploited their hosts' tendency to respond to rewarding tactile stimuli. Adult fish were captured on reefs in Kane`ohe Bay, Hawai`i.

Losey, G. S., G. H. Balazs et al. (1994). "Cleaning symbiosis between the wrasse, *Thalassoma duperry*, and the green turtle, *Chelonia mydas*." Copeia 1994: 684-690.

Losey, G. S. and L. Margules (1974). "Cleaning symbiosis provides a positive reinforcer for fish." Science 184: 179-180.
Chaetodon auriga, a common marine fish in Hawai`i, can be conditioned by presentation of a moving model of a cleaner fish as a positive reinforcement on an instrumental schedule. Reinforcement is probably through tactile stimulation and might help to shape the response of fish to cleaners. Tactile stimulation might serve as valuable reinforcer in studies of fish learning.

Lutnesky, M. (1989). "Stimulation, inhibition, and induction of "early" sex change in the pomacanthid angelfish *Centropyge potteri*." Pac. Sci. 43: 196-197.
Centropyge potteri is a protogynous hermaphrodite occurring in discrete social groups (harems) of 1 male with 1-8 females. Early sex change (ESC) is sex change in the presence of a male. The purpose of this study is to describe the socio-demographic patterns of C. potteri in high- and low-density populations; introduce encounter rate threshold hypotheses for the proximate control of ESC; and test if ESC can be induced in captivity. Socio-demographic patterns of *C. potteri* were measured in high and low-density populations offshore of and inside Kane`ohe Bay, O`ahu. Current hypotheses (sex ratio threshold, size ratio threshold, and inhibition hypotheses) of the proximate control of sex change in fishes suggest that females assess the social environment (e.g., sex ratio) as a cue to change sex. Introduced here are 3 encounter rate threshold hypotheses.

MacCaughey, V. (1917). A footpath journey. Mid-Pacific Magazine. 14**:** 181-196.
A narrative of a tramp from Honolulu to the Mokapu Peninsula on O`ahu. A map of O`ahu depicts a pineapple cannery, old mill and coral gardens as well as Coconut Island near the shores of Kane`ohe Bay. The terrain, flora and fauna of the area are described. The author also draws a map of the western portion of Mokapu Peninsula showing Hawai`i Loa Crater and ancient ruins.

MacCaughey, V. (1918). "A survey of the Hawaiian coral reefs." Am. Naturalist 52: 409-438: 409-438.
A paper on the natural history of the Hawaiian coral reefs. The author combines a mass of scattered literature which was until this time, unavailable to the general reader. Kane`ohe Bay is described as essentially a drowned valley region. In addition to the geology of the region, the author describes the flora and fauna of the bay.

MacDonald, C. D. (1976). "Nesting rhythmicity in the damselfish *Plectroglyphidodon johnstonianus* (Perciformes, Pomacentridae) in Hawai`i." Pac. Sci. 30: 216.
The nesting frequency of a total of 70 nesting males of *P. johnstonianus* was continuously recorded at 6-day intervals for 19 months in Kane`ohe Bay, O`ahu, Hawai`i. Two peaks in the spawning frequency of nesting males occur annually from Sept through Oct and again from Feb through May. Time series analyses by periodogram indicated that 3 oscillatory components of approximately 120-, 180-, and 360-day periods are responsible for the observed rhythmicity. A lunar component does not exist. It is anticipated that several differentially phased, interrelated environmental cues will be found to be responsible for the entrainment of this rhythm in adults. There is also some agreement between periods of peak production of damselfish larvae and the periodic maximum densities of microcopepods upon which the larvae presumably prey.

MacDonald, C. D. (1981). Reproductive strategy social organization in damselfishes. Dept. of Zoology. Honolulu, University of Hawai`i.
The purpose of this research was to develop and test a series of hypotheses based upon life history and sociobiological theory that explains the evolution of reproductive strategies in 2 sympatric damselfishes. The co-evolution of behavioral adaptations and life history characteristics are stressed.

MacDonald, C. D. (1985). Oceanographic climate and Hawaiian spiny lobster larval recruitment. HOE, The Hawaiian Ocean Experiment. Proceedings of the Aha Hulikoa Hawaiian Winter Workshop, University of Hawai`i, Honolulu, Hawai`i, University of Hawai`i at Manoa.

Mackaye, A. C. (1915). "Corals of Kane`ohe Bay." Hawaiian Almanac and Annual for 1916: p. 135-139.
A description of coral life in Kane`ohe Bay. The author describes the bay as originally being "a deep pit of an immense crater" which had one side blown to the sea and the coral animaculae of the waters have built up the reefs within the crater. Over a hundred varieties of corals are known to exist in

Kane`ohe Bay being colored yellow, red, green, brown, and lavender.

Mackaye, D. C. G. (1945). "Notes on the aggregating marine animals of Hawai`i." Ecology 26: 205-207.
Notes on the aggregations of certain marine invertebrates on O`ahu as observed by the author during 1941-42. Sedentary animals such as colonial protozoans, hydroids, bryozoans, teredos, tunicates and serpulid worms have been purposely left out as have aggregating fishes. The purposes of such behavior cannot be guessed at and the author ventures no guesses but refers the reader to Allee (1931). Mackaye notes that the brittle star, *Ophiactis saviqnyi* (Muller and Troschel) is a cosmopolitan species which lives in the canals of sponges, crevices in dead coral or in tangled masses of seaweed and is common in Kane`ohe Bay.

MacNamee, C. G. (1961). Life history, morphology habits and taxonomy of *Haplocarcinus marsupialis* Stimpson (Arthropoda, Crustacea, Decapoda). Department of Zoology. Honolulu, University of Hawai`i**:** 64.
A study of *Haplocarcinus marsupialis* examining the complete external morphology of the female and male noting the variations other than size between the juvenile and mature females and the life history. giving the developmental and larval stages. A correlation is made between the morphological features of the species and their ecological requirements and behavior. Specimens were collected from the reefs in Kane`ohe Bay, particularly on the windward reef of Moku 0 Loe Island, Checker Reef and the Channel Island Reef.

Maginnis, L. A. (1970). Osmotic and ionic regulation of the Hawaiian anchovy, *Stolephorus purpureus*. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 95 pp.
This study examines some of the osmoregulatory processes of the anchovy under controlled laboratory conditions. Nehu were exposed to a variety of sea water concentrations and the variables; mortality, body water, and serum salts were then analyzed to provide indices of tolerance and regulatory ability. Sampling was conducted in Kane`ohe Bay at various locations but the exact dates of collections are unknown (the study was conducted from August to December, 1969).

Maginnis, L. A. and M. J. Wells (1969). "The oxygen consumption of *Octopus cyanea.*" J. Exp. Biol. 51: 607.

Mahi, C. A. (1969). Food and feeding habits of the kumu, *Parupeneus porphyreus*. Zoology. Honolulu, University of Hawai`i.

Mainland, G. B. (1939). Gobioidea and freshwater fish on the island of O`ahu. Department of Zoology. Honolulu, University of Hawai`i.
A two-year study (1937-1939) of the habitats and distribution of the fresh water fish and marine gobioid fish found on O`ahu. Collections were made on the mud flats of Kane`ohe Bay, the streams and brackish water areas of Kaaawa and Waihee and many other areas of O`ahu.

Major, P. F. (1977). "Predator-prey interactions in schooling fishes during periods of twilight: a study of the silverside *Pranesus insularum* in Hawai`i." Fish. Bull. 75: 415-426.
Observations of free living and captive silversides were made in Kane`ohe Bay, Hawai`i, in October and November 1972 and September 1973. The silversides demonstrated changes in schooling behavior associated with changes in light levels during the periods of twilight. During morning twilight, individual silversides formed schools, which in some areas moved from deep water to shallow water over reefs. All silversides remained in large inactive schools in shallow water or along the edge of channels throughout the day. During evening twilight, schools left the reef and/or broke up, with individual silversides spreading out to feed near the surface. Predation upon the silversides, as evidenced by their jumping behavior, was most intense during the twilight periods as schools formed and broke up. Captive silversides, when not in the presence of predators, tended to increase their interfish distance when in diurnal schools. The formation and breakup of schools of these silversides appear to be very similar to behavioral patterns of related and unrelated species of fish in many parts of the world. The formation and break up of silversides schools appear to be related to the threat of predation, the availability of the silverside's food, and the visual sensitivity and thresholds of both the silversides and their predators

Mann, D. A. and P. S. Lobel, . (1998). "Acoustic behavior of the damselfish *Dascyllus albisella*: behavioral and geographic variation." Env. Biol. Fishes 51: 421-428.
Behavioural and geographic variation in animal communication has been well-studied in insects, frogs, birds and mammals, but little is known about variation in fishes. We used underwater audio-video recordings of the behavior and associated sounds produced by the domino damselfish, *Dascyllus*

albisella, at Johnston Atoll and Hawai`i, which are separated by 1000km, to study behavioral and geographic variation in communication sounds. Males produced pulsed sounds during the courtship behavior known as the signal jump, visiting by females (during pseudospawning), mating, aggression to heterospecifics and conspecifics, and nest preparation. Females made only aggressive sounds. The following features of the sounds were measured: number of pulses, pulse rate, pulse duration, inter-pulse interval, dominant frequency, and frequency envelope. The only difference between visiting and mating sounds was a small difference in pulse duration. Two types of aggressive sounds were produced, pops and chirps. Pops contained only one or two pulses and were more commonly made towards heterospecifics than conspecifics. Aggressive chirps had between 3-11 pulses and were made most often towards conspecifics. The pulse rate of aggressive chirps was faster than signal jump sounds. The only difference in signal jump sounds made by males from Johnston Atoll and Hawai`i, was a small difference in pulse duration, which was likely due to differences in the depths of the recording environment and not in the sounds produced.

Manning, R. B. and M. L. Reaka (1981). "*Gonodactylus aloha*, a new stomatopod crustacean from the Hawaiian Islands." J. Crustacean Biol. 1: 190-200.

Maragos, J. E. (1972). A study of the ecology of Hawaiian reef corals. Oceanography. Honolulu, Univ. of Hawai`i: 290.
The importance of various environmental factors in regulating the growth, survival, and other responses of reef corals is investigated in this study. Numerous locations were first surveyed to determine the abundance and distribution of reef coral species in Kane`ohe Bay. In the latter portion of this study, coral specimens of six species were transplanted at 25 localities in Kane`ohe Bay. Information on growth, survival, water properties, substrate composition, and weather were obtained over a year-long period. The results of the growth studies and regression analysis performed on the gathered data as well as other pertinent topics are comprehensively discussed.

Maragos, J. E. (1973). Distribution and abundance of reef corals. Atlas of Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam, University of Hawai`i, Sea Grant Advisory Program, Manoa: 37-49.
The regional abundance and distribution of coral reefs in Kane`ohe Bay are controlled by local circulation, water chemistry patterns and substrate type. The maps in this section contain data for all corals observed and for nine of the more frequently observed species in terms of percent cover or presence-absence. A brief discussion of the survey results is presented.

Maragos, J. E. (1974). Coral transplantation: a method to create, preserve, and manage coral reefs. Honolulu, University of Hawai`i Sea Grant Program.
The feasibility of using transplanted coral as a method to shorten the recovery time of stressed corals and to create new coral reefs is investigated. Two coral species, *Porites compressa* and *Montipora verrucosa*, were transplanted in three areas of Kane`ohe Bay and were monitored for growth and survival over an 18-month period. Results show that transplantation may be an effective procedure for preserving and creating coral reefs in certain areas.

Maragos, J. E. (1976). The status of available information on reef coral populations in Kane`ohe Bay. Honolulu, Us Army Corps Of Engineers, Pacific Division: App. 2.17.

Maragos, J. E. and K. E. Chave (1973). Stress and interference of Man in the Bay. Atlas of Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam, University of Hawai`i, Sea Grant Advisory Program, Manoa: 119-123.
The regional abundance and distribution of coral reefs in Kane`ohe Bay are controlled by local circulation, water chemistry patterns and substrate type. The maps in this section contain data for all corals observed and for nine of the more frequently observed species in terms of percent cover or presence-absence. A brief discussion of the survey results is presented.

Maragos, J. E., C. Evans et al. (1985). "Reef corals in Kane`ohe Bay six years before and after termination of sewage discharges (O`ahu, Hawaiian Archipelago)." Proc. Intern. Coral Reef Congr., Tahiti 4: 189-194.
Watersheds surrounding Kane`ohe Bay were dominated by rural and agricultural use before 1939. Reef coral communities flourished on lagoon reef slopes and were protected from the open ocean by a large barrier reef. After 1939, military dredging and filling, residential development, and population growth occurred, especially in and around the confined southeast bay. As population grew, sewage discharges into the lagoon increased, culminating in the construction of large sewage outfalls in the

southeast bay by 1963. After 1965, the scientific community, including Maragos (1972), began to study changes in the lagoon. It was speculated that eutrophication and sedimentation, as a result of urbanization and construction, were the cause of an observed decline in lagoon coral communities in the south lagoon and explosive growth of the green algae *Dichtyosphaeria cavernosa*, which was smothering coral, in the middle lagoon. Reef corals in the bay's northwest lagoon remained abundant and appeared unaffected. Pressure from the public and scientific community compelled the local government and military to terminate large sewage discharges in the southeast lagoon by 1978. Now only a minor amount of sewage is discharged in the northwest lagoon. In 1983, we re-surveyed the lagoon and coral transect sites of Maragos (1972) using the same methods. These surveys revealed a remarkable recovery of corals, especially, *Porites compressa* and *Montipora verrucosa*, in the southern and middle lagoon and continued high coral abundance in the northern lagoon. Minor coral species, *Pocillopora damicornis* and *Cyphastrea ocellina*, also were more abundant in the lagoon. In contrast, *Dichtyosphaeria* declined greatly except for a minor increase in the northern lagoon. This study and other recent investigations corroborate that sewage was a major stress to lagoon corals and a stimulant to *Dichtyosphaeria* growth. In addition, these studies indicate that the detrimental effects of sewage on corals are generally magnified in confined embayments with restricted circulation.

Marine Research Consultants (1988). Marine environmental survey in the vicinity of the Waikane Golf Course, O'ahu, Hawai'i. Draft Environmental Impact Statement for the Proposed Waikane Golf Course Project, Waikane, Ko'olaupoko District, O`ahu, Hawai'i, Volume II. November 1988. Honolulu, Marine Research Consultants.

Marine Research Consultants (1990). Environmental assessment He'eia wastewater collection system. He'eia, Koolaupoko, O`ahu, Calvin Kim and Assoc, Inc.
Gerald Park, Urban Planner**:** 76.
This report includes an environmental assessment of He'eia, Koolaupoko, O`ahu, Hawai`i.

Marine Research Consultants (1993). Baseline assessment of the nearshore marine environment of Kane`ohe Bay in the vicinity of the airfield pavement repairs, Kane`ohe Marine Corps Air Station, O`ahu, Phase I. Honolulu, Marine Research Consultants.

Marine Research Consultants (1994). Airfield pavement repairs, phase 1. H. Helber, and Fee. Kane`ohe, O`ahu, Dept. of the Navy**:** 50.
A baseline assessment of the nearshore environment fronting the project site was conducted by Marine Research Consultants in April and June 1993.

Mariscal, R. N. (1971a). The chemical control of the feeding behavior in some Hawaiian corals. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 96-113.
This study investigated the chemical stimuli that elicit mouth opening and feeding behavior in the Hawaiian coral *Cyphastrea ocellina*, and, to a lesser degree, *Fungia scutaria, Pocillopora damicornis, Tubastrea manni, Pocillopora meandrina,* and *Leptastrea bottae*. The corals were collected from the reefs in Kane`ohe Bay.

Mariscal, R. N. (1971b). Effect of a disulfide reducing agent on the nematocyst capsules from some coelenterates, with an illustrated key to nematocyst classification. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 157-168.
This study tested the action of dithioerythritol (DTE) on the nematocysts of five species of corals, one zoanthid, one scyphozoan and one hydroid collected form Kane`ohe Bay.

Mariscal, R. N. and H. M. Lenhoff (1968). "The chemical control of feeding behavior in *Cyphastrea ocellina* and in some other Hawaiian corals." J. Exp. Bio. 49: 689-699.
This study investigated the chemical stimuli that elicit mouth opening and feeding behavior in the Hawaiian coral *Cyphastrea ocellina*, and, to a lesser degree, *Fungia scutaria, Pocillopora damicornis, Tubastrea manni, Pocillopora meandrina,* and *Leptastrea bottae*. The corals were collected from the reefs in Kane`ohe Bay.

Mariscal, R. N. and H. M. Lenhoff (1969). "Effect of a disulfide reducing agent on coelenterate nematocyst capsules." Experientia 25(3): 330-331.
Recent work has revealed the presence of a single hydroxyproline-rich, collagen-like protein linked by disulfide bonds in the microbasic mastigophore nematocyst capsule of a sea anemone. Subsequently, other workers have confirmed this in a different species of sea anemone. Since the presence in

protein of the amino acid hydroxyproline is diagnostic of collagens, and since collagens were thought to be devoid of disulfide bonds, the above discovery is of considerable interest. Because of this and because of the great complexity and diversity of these intracellular organelles, the present study was undertaken to determine how widespread was this phenomenon among the various classes of coelenterates. This study tested the action of dithioerythritol (DTE) on the nematocysts of five species of corals, one zoanthid, one scyphozoan and one hydroid collected form Kane`ohe Bay. The coelenterates used were collected in Kane`ohe Bay, O`ahu, Hawai`i.

Marsh, J. A. (1968). Primary productivity of the reef-building calcareous red algae. Department of Zoology. Athens, GA, University of Georgia**:** 84.
A study of the biological role of calcareous red algae in the life of a reef. It presents a determination of their primary productivity and an evaluation of their contribution to the total reef economy. The study was done at Eniwetok Atoll, Marshall Islands and at Coconut Island, Kane`ohe Bay, O`ahu, Hawai`i. Primary productivity was studied using polarographic oxygen electrodes and before-and-after Winkler titrations. Gross productivity was found to be .048-.002 mg 02 cm- 2 hr-1. Photosynthesis was found to increase with increased light intensity up to approximately 100 foot-candles and was constant between 1000 and 8000 foot-candles. Water circulation increased respiration and photosynthesis by a factor of 3 over the rates in still water. Gas exchange in flowing water showed no correlation with water velocity. Estimated productivity of the zones dominated by algal growth was noted to be lower than the productivity reported in the literature for other reef zones on atolls. All in all, this study indicates that calcareous algae are less important as primary producers than expected.

Marsh, J. A., Jr. (1970). "Primary productivity of reef-building calcareous red algae." Ecology 51: 255-63.
Samples from the reefs of Eniwetok Atoll and Kane`ohe Bay were put in a closed system, and oxygen exchange was measured in the light and the dark. Daily patterns of photosynthesis were calculated for populations of calcareous algae living on the submarine faces of the windward sides of atolls. The results indicate that island reefs are less productive than previously studied inter-island reefs.

Martin, W. E. (1958). "Hawaiian helminths 1. *Trigoncryptus conus* n. gen., n. sp. (Trematoda: Fellodistomidae)." Pac. Sci. 12: 251-254.
A description of a new species and new genus of trematode found in the stomach of the balloon fish, *Tetraodon hispidus* L., collected at the Hawai`i Marine Laboratory, Kane`ohe Bay.

Martin, W. E. (1960). "Hawaiian helminths, Part III. New Opecoelid trematodes." Pac.-Sci. 14: 411-415.
Descriptions of opecoelid trematodes found in fishes caught in Kane`ohe Bay, O`ahu:
Coitocaecum banneri - in the gall bladder of wrasse, *Thalassoma duperrey* (Quoy and Gaimard)
Coitocaecum hawaiensis - in the gall bladder of wrasse *T. duperrey* Quoy and Gaimard)
Coitocaecum norae - in the gall bladder of *Ctenochaetus strigosus*
Opecoelus lanceolatus - in the intestine of goatfish *Mulloidichthys samoensis* (Gunther)
Pseudopecoelus tenuoides - in the intestine of *Priacanthus cruentatus*

Martin, W. E. (1960). "Hawaiian helminths, Part IV. *Paracardicola hawaiensis* n. gen., n. sp. (Trematoda: Sanguinicolidae) from the balloon fish, *Tetradon hispidus* L." J. Parasitology 46: 648-650.
Description of a new species and new genera of Trematode found in the mesenteric veins of the balloon fish, *Tetraodon hispidus* collected in Kane`ohe Bay.

Mate T., J. L. (1998a). New reports on the timing and mode of reproduction of Hawaiian corals. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 7.
Seven Hawaiian scleractinian corals were monitored in the laboratory to observe spawning during the months of June-September 1997.

Mate T., J. L. (1998b). Genetic relationships between two scleractinian reef-corals in Kane`ohe Bay, Hawai`i: *Pavona varians* Verrill and *Pavona duerdeni* Vaughan. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 127.
Pavona is a very common and conspicuous coral genus with a distribution that ranges from the Red Sea and western Indian Ocean to the far eastern Pacific. Approximately twenty-two *Pavona* species are known worldwide. Two *Pavona* species are found within Kane`ohe Bay, Hawai`i: *Pavona varians* and *P. duerdeni*. Horizontal starch gel electrophoresis was used to study the genetic relationships between and within two populations of *P. duerdeni* and six populations of *P. varians*. An initial survey of these species have showed differences in enzyme banding patterns on 12 loci (8 enzyme systems) using 2 buffer systems. Eight loci were polymorphic: GTDH-1, GTDH-2, TPI-2,HK, PGDH, MDH-1, MDH-2, GPI, LVP, LPP-2, while two loci are monomorphic: TPI-1, LPP-1. Preliminary results indicated

a fixed difference between *P. varians* and *P. duerdeni* at the TPI-2 locus. This fixed difference between both *Pavona* species indicates a lack of genetic exchange between both species and as such validates the species status for *P. varians* and *P. duerdeni*.

Mate T., J. L., J. Wilson et al. (1998c). Fertilization dynamics and larval development of the scleractinian coral *Montipora verrucosa* in Hawai'i. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 27-39.

Sexual reproduction, fertilization dynamics and larval development were studied in the Hawaiian coral *Montipora verrucosa* from June 1997 to August 1997. Intraspecific crosses yielded very high fertilization rates compared to the extremely low or zero rates of self-fertilization. Sperm concentration and water motion appear to be critical to the fertilization success of *M. verrucosa*. The inability to culture large numbers of *M. verrucosa* planulae had been a major barrier to post-larval studies in this species. We have developed a larval raising technique that allow large number of planulae to be obtained relatively easily. Preliminary results suggest that crustose coralline algae may be an important requirement in the settlement of *M. verrucosa* larvae. Coral specimens were collected from Kane`ohe Bay, O`ahu.

Mather, J. A., D. L. Mather et al. (1997). "Cross-species associations of *Octopus cyanea* Gray, 1849 (Mollusca: Cephalopoda)." Veliger 40: 255-258.

Casual observation of several *Octopus* species suggested that the modification of the habitat involved in construction of sheltering dens might attract other animal species, sometimes called "den associates." A study comparing the presence of motile epibenthos in areas around dens of *O. cyanea* with nearby control areas quantified this assumption. One species group, juvenile *Scarus* parrotfish, was significantly less likely to be found around *O. cyanea* dens, possibly because den construction disrupted growth of algae on which the parrotfish fed. Two species, the wrasse T*halassoma duperrey* Quoy & Gaimard, 1824, and the hermit crab *Calcinus latens* Randall, 1839, were more likely to be found at dens of *O. cyanea*. Both species appeared to be scavenging on the remains of prey left by octopuses, and their presence thus appeared to indicate an opportunistic but loose association.

Matsuda, C. (1973). A shoreline survey of free-living intertidal barnacles (class Crustacea; subclass Cirripedia; order Thoracica) on the island of O`ahu, Hawai`i. Depart. of Zoology. Honolulu, Univ. of Hawai`i**:** 60 pp.

This thesis summarizes the findings of a shoreline survey conducted from June 1972 to August 1973 to update the literature on the Hawaiian barnacle fauna. The barnacles were classified according to abundance, size, water clarity, salinity, wave action; and substrata. A number of sites were located in Kane`ohe Bay.

Matthews, D. C. (1951). "The origin, development, and nature of the spermatophoric mass of the spiny lobster, *Panulirus penicillatus* (Oliver)." Pac. Sci. 5(4): 359-371.

Although many thorough investigations of crustacean spermatozoa have been made, few have included more than desultory accounts of the spermatophores. The material presented in this paper not only extends our knowledge of the biology of the spiny lobster *Panulirus penicillatus* (Oliver) through an account of the origin, development, and nature of its spermatophoric mass, but also suggests the method by which its spermatophora are liberated. Specimens of *P. penicillatus* taken in the vicinity of Kane`ohe Bay, O`ahu, between July, 1947, and January, 1948, were used in this study.

Matthews, D. C. (1953). "New Hawaiian Records of Folliculinids (Protozoa)." Trans. Am. Micro. Soc. 72: 344.

A paper recording the occurrence of two additional species to the Hawaiian Islands: *Metafolliculina andrewsi* Hadzit growing on oyster (*Crassostrea virginica*) valves near Coconut Island, and *Lagotia simplex* Dons found growing on a small alga (*Chondria tenuissima*) on the reef at the marine laboratory in Kane`ohe Bay.

Matthews, D. C. and S. J. Townsley (1964). "Additional records of Hawaiian Platyctenea (Ctenophora)." Pac. Sci. 18: 344-351.

A previous study of Platyctenea in Hawai`i revealed the finding of *Coeloplana dubosequii* on the alga, *Hvpnea nidifica* in Kane`ohe Bay and other platyctenids found on spines of *Echinothrix diadema* on Buoy no. 8 in Kane`ohe Bay. In this study, three more urchins were found to be hosts for platyctenids:
C. echinicola Tanaka on *Tripneustes pileolus*
C. willeyi Abbott on *Heterocentrotus mamillatus*
C. willeyi Abbott on *Echinothrix diadema*

May, R. C. (1967). Larval survival in the maomao, Abudefduf abdominalis (Quoy and Gaimard). Department of Zoology. Honolulu, University of Hawai`i.
The larvae of the maomao were studied both in laboratory and in field conditions to investigate the factors influencing the mortality of the species during the larval stage, especially during the apparent 'critical period'. The work was divided into three stages: a general description of the fish and certain aspects of its spawning behavior; laboratory rearing attempts and finally, laboratory work utilizing a rearing net designed by P. Helfrich to study the mortality of the fish under semi-natural conditions. The author includes data on the frequency of spawning of this species at Coconut Island.

May, R. C., . : (1976). Studies on the Culture of the Threadfin, *Polydactylus sexfilis*, in Hawai`i. Tech. Conf. on Aquaculture, Dec. 1975, Rome, FAO.
A 2-year study of the aquacultural potential of *Polydactylus sexfilis* was carried out in Hawai`i. Fish maintained in a suspended net enclosure displayed spontaneous spawning with a lunar rhythm over a 6-month spawning season. Larvae were reared from captive-spawned eggs to the juvenile stage. Juveniles and adults could be conditioned to feed on dried artificial rations, including floating pellets, and food conversion rates were favorable. Measurements of growth in small cages showed that marketable fish of 300 g. could be produced from 9 g. fry in 300 days at ambient temperatures in Hawai`i. Growth rates could be increased by maintaining temperature and salinity within optimal ranges. These results indicate that this species has high potential for aquaculture in Hawai`i, where it fetches a high market price. It is suggested that the culture of *Polydactylus sexfilis*, and perhaps other polynemid fishes, may also be feasible in other parts of the Indo Pacific.

May, R. C., G. S. Akiyama et al. (1979). "Lunar spawning of the threadfin, *Polydactylus sexfilis*, in Hawai`i." Fish. Bull. 76: 900-904.
Juvenile *P. sexfilis* were captured on unspecified reef flats in Kane`ohe Bay and raised to maturity in tidal ponds. Spawning coincided to lunar phases in these tanks from May to October. Spawning usually took place between 2030 and 2130 h during the spawning season and was unrelated to time of sunset or moonrise. Spawning behavior is described.

McDermid, K. J. (1991). Survey of benthic marine algae on the fringing reef adjacent to the planned Malulani Sports Complex, Heeia, Kane`ohe Bay, O`ahu. Honolulu, Marine Research Consultants.

McMahon, J. J. (1975). Estimation of selected production parameters for iao, *Pranesus insularum insularum*. Dept. of Oceanography. Honolulu, Univ. Of Hawai`i**:** 83.
The present study was designed to determine selected production parameters for iao in Kane`ohe Bay. Of particular interest were: growth rate spawning season, the relationship between length and weight, and feeding periodicity. Estimates of sampling variability and food passage rate through the digestive tract were obtained as necessary precursors to the above. Field sampling was continued for one year to obtain estimates of seasonal variation in the parameters studied.

Medvick, P. A. (1976). Temperature selection and growth of three Hawaiian reef fishes and their distribution in an area of heated effluent. Dept. Of Oceanography. Honolulu, Univ. Of Hawai`i**:** 136 pp.
The selected temperature of three species of Hawaiian reef fishes, A*canthurus triostegus sandvicensis* (manini), *Abudefduf abdominalis* (maomo) and *Chaetodon multicinctus* (pebbled butterflyfish) were determined under several experimental regimes in an electronically controlled temperature selection apparatus. Experiments were designed to evaluate difference: 1) of median selected temperature between juveniles and adults, 2) induced by shelter changes and 3) induced by a food ration.

Medvick, P. A. (1979a). "Growth rates of juvenile maomao, *Abudefduf abdominalis*, at constant and cyclic temperatures." Amer. Fish. Soc. 108: 293-298.
Growth rate and growth efficiency of juvenile maomao are related to temperature. I grew isolated fish at six temperature regimes (constant: 23.4, 26.4, 29.4, 32.4 C; daily cyclic: 23.4-29.4 C, 26.4-32.4 C) and at three food rations. Growth rates (wet weight) of fish fed *ad libitum* were greatest at the two highest constant temperatures which are near the species' preferred temperature of 30.1 C. At two lower rations fastest growth occurred at 26.4 C. Growth rates in cyclic temperatures were not significantly different from those at constant temperatures equivalent to the mean temperature of the cycle. Maomao fed limited rations at cyclic temperatures which bracketed the preferred temperature grew at rates near the maximum for limited rations, indicating little, if any, energy penalty for living at cyclic temperatures.

Medvick, P. A. and J. M. Miller (1979b). "Behavioral thermoregulation in three Hawaiian reef fishes." Env. Biol. Fish. 4(1): 23-28.

The preferred temperature of three Hawaiian coral-reef fishes - *Acanthurus triostegus sandvicensis*, *Abudefduf abdominalis*, and *Chaetodon multicinctus* - were determined in two-chambered tanks that permitted the fish to regulate behaviorally tank temperature. Median selected temperatures over 72 h were as follows: adult *C. multicinctus*, 24.0 C; juvenile *C. multicinctus*, 27.0 C; adult *A. abdominalis*, 25.9 C; juvenile *A. abdominalis*, 30.2 C; adult *A. triostegus*, 29.2 C; juvenile *A. triostegus*, 29.3 C. Juvenile *A. abdominalis* selected significantly higher median temperatures than the adults. *C. multicinctus* and juvenile *A. abdominalis* selected higher median temperatures during the day than at night.

Menez, E. G. (1962). The ecology and taxonomy of *Polysiphonia* in Hawai`i. Department of Zoology. Honolulu, University of Hawai`i.

A study to evaluate the taxonomy of *Polysiphonia* previously reported from the Hawaiian Islands and to determine and describe any new species. Some of the ecological factors thought to determine the distribution of *Polysiphonia* were tides and light, temperature and salinity, turbulence, pH, oxygen, P04-P, and N03-N. Measurements were made on these parameters from October - December, 1959.

Menez, E. G. (1964). "The taxonomy of *Polysiphonia* in Hawai`i." Pac. Sci. 18: 207-222.

A taxonomic study of the genus *Polysiphonia* in Hawai`i. Six species of *Polysiphonia* have been reported in the literature from Hawai`i.

Miller, B. (1970). Preliminary studies on the biology and ecology of *Terebra gouldii* Deshayes (Abstr.). Kane`ohe, Univ. of Hawai`i, Hawai`i Institute of Marine Biology.

Preliminary studies on the distribution abundance, migration habits, reproduction and feeding preferences of the toxoglossan gastropod, *Terebra gouldii* on the sand flats of Ahu 0 Laka, Kane`ohe Bay. *T. gouldii* is primarily a carnivore, feeding exclusively on the enteropneust, *Ptychodera flava* and feeding mainly at night. *T. gouldii* is preyed upon by the gastropod *Natica macrochiensis* and by the sand crab *Calappa hepatica*. The terebrid can crawl 1-2 m a night over the hard sand. Spawning is by means of egg capsules, there is no planktonic stage.

Miller, B. A. (1975). "The biology of *Terebra gouldi* Deshayes, 1859, and a discussion of life history similarities among other Terebrids of similar proboscis type." Pac. Sci. 29(3): 227-241.

Although gastropods of the family Terebridae are common in subtidal sand communities throughout the tropics, *Terebra gouldi*, a species endemic to the Hawaiian Islands, is the first terebrid for which a complete life history is known. Unlike most toxoglossan gastropods, which immobilie their prey through invenomation, *T. gouldi* possesses no poison apparatus and captures its prey with a long muscular proboscis. It is a primary carnivore, preying exclusively on the enteropneust *Ptychodera flava*, a nonselective deposit feeder. The sexes are separate, and copulation takes place under the sand. Six to eight spherical eggs are deposited in a stalked capsule, and large numbers of capsules are attached in a cluster to coral or pebbles. There is no planktonic larval stage. Growth after hatching is relatively slow. Young individuals may grow more than 1 cm per year, but growth rates slow considerably with age. Adults grow to a maximum size of 8 cm and appear to live 7-10 years. Other terebrids with a proboscis nearly identical in structure to that of *T. gouldi* exhibit similar life history aspects, including habitat preference and prey choice. It is suggested that proboscis types may be useful in predicting basic life history aspects throughout the family.

Miller, B. A. and R. A. Croker (1972). "Distribution and abundance of an isolated population of *Terebra gouldi* (Gastropoda: Teribridae) on a Hawaiian subtidal sand flat." Ecology 53: 1120-1126.

Species of the carnivorous gastropod genus *Terebra* are common members of tropical subtidal sand associations. Despite superficially uniform sand habitats, these species occupy well-defined population centers. The distributional pattern of *Terebra gouldi,* an endemic Hawaiian species, and the physical and biological factors influencing this pattern, were studied on a subtidal sand flat surrounding Ahe O Laka Island in Kane`ohe Bay, Hawai`i. The species was not widely distributed around this sand flat, but rather was concentrated in two sub-populations located on the windward and leeward sides of the island, where densities were as high as 15 animals per square meter. Of more than 40 associated infaunal species, only the prey, *Ptychodera flava*, appeared to have an important effect on *T. gouldi* distribution. Two hypotheses are advanced to explain observed intra-population density gradients. These are chemoreceptive locomotory activity in response to prey, and life history factors including recruitment of young in high density adult population centers, followed by gradual dispersal of maturing animals.

Miller, J. M. et al. (1973). "A quantitative push-net system for transect studies of larval fish and macrozooplankton." Limnol. Oceanogr. 18: 175-178.

A surface plankton sampler that quantitatively samples contiguous segments of a transect has characteristics that include operability in shallow water by two investigators, paired, self-cleaning nets, a minimum of obstructions preceding the nets, and a high ratio of filtering area to mouth area.

Miller, J. M. and B. Y. Sumida (1974). "Development of eggs and larvae of *Caranx mate* (Carangidae)." Fish. Bull. 72(2): 497-514.

The development of eggs and larvae of omaka (*Caranx mate*) is described from approximately 2h after fertilization to day 36 after hatching. The pelagic, spherical eggs (700-740 □ diameter) had a single oil droplet and hatched after about 26 h incubation at 24.5□C. The average growth rate in culture was 0.44 mm/day; feeding began four days after hatching. Fin development and ossification of omaka occurred at smaller sizes, but in the same sequence as jack mackerel (*Trachurus symmetricus*) off California. Of the body proportions measured, body depth was most useful in separating omaka from at least two other species of carangid larvae. The pigment pattern was also of diagnostic value. Reared larvae were indistinguishable from similar-sized field specimens. Omaka eggs can be taken with fair regularity from March through September from the surface waters of Kane`ohe Bay, O`ahu.

Miller, J. M., W. Watson et al. (1973). Larval fishes. Atlas of Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Sea Grant. UNIHI-SEAGRANT-TR-72-01**:** 101-105.

Species and relative abundances of larval fishes sampled in Kane`ohe Bay 1971-72 are listed. Occurrences of certain species is attributed to two factors: presence of reefs and incoming tides transporting water from offshore. Larval fish fauna of Kane`ohe bay is therefore a mixture of transported species and species from eggs spawned in Kane`ohe Bay.

Miller, J. M. e. a. and Annotation: (1979). "Nearshore abundance of tuna (Pisces: Scombridae) larvae in the Hawaiian Islands." Bull. Mar. Sci. 29: 19-26.

Ichthyoplankton surveys of the nearshore waters of the Hawaiian Islands of Kauai, O`ahu, and Maui and more intensive sampling at Kahe Point, O`ahu disclosed abundances of tuna (Scombridae) larvae as high as 441/1000 m^3, and frequently one or two orders of magnitude higher than those typical of the Central Pacific Ocean. Inter-station spatial variability was higher than 1-h temporal variability at a single station. Both the abundance of larvae and the variability increased toward shore. Leeward catches were significantly greater than windward. It appeared most likely that large numbers of tuna larvae are upwelled along leeward coasts by wind-driven nearshore currents from horizontal strata containing even higher densities of larvae.

Miller, M. A. (1941). "The isopod crustacea of the Hawaiian Islands. II. Asellota." B. P. Bishop Museum Occ. Papers 16: 305-320.

A taxonomic study of the superfamily Asellota (Aselloidea) of the crustacean order Isopoda which is represented in Hawai`i by four new species belonging to four genera and to three families.

Moberly Jr., R. and J. Campbell (1969). Hawaiian shallow marine sand inventory. Part I. Introduction Part II. Ahu O Laka sand deposit, Kane`ohe Bay, O`ahu, University of Hawai`i, Hawai`i Institute of Geophysics**:** 24.

Moehring, J. L. t., , . (1972). Communication systems of a goby-shrimp symbiosis. Department of Zoology. Honolulu, University of Hawai`i.

The behavioral symbiotic association between a gobiid fish and 2 species of alpheid shrimp was studied using information theory and correlated chi-square analyses. In this association, the gobies use the burrows shrimp dig as shelters. One goby, or a pair, sit at the burrow entrance apparently alert to danger, while two or three shrimp dig and maintain the burrow. If disturbed, the goby gives a barely visually perceptible tail flick. If the disturbance persists, the goby flees into the burrow, always after the shrimp. Animals for study were collected from Kane`ohe Bay, however the locations of these collections are unknown.

Moffitt, R. B. and F. A. Parrish (1996). "Habitat and life history of juvenile Hawaiian pink snapper, *Pristipomoides filamentosus*." Pac. Sci. 50: 371-381.

Eteline snappers are an important component of commercial demersal fisheries in the central and western Pacific, but there is a substantial gap in the knowledge of their life histories, specifically the larval and juvenile stages. Juvenile pink snapper, *Pristipomoides filamentosus* (Valenciennes), ranging in size from 7 to 25 cm fork length, inhabit a nearly featureless plain offshore of Kane'ohe Bay, O'ahu, at depths of 65-100 m. Bottom samples and underwater video footage showed the bottom to be uniformly composed of fine, silty sand with little relief. Conductivity-temperature-depth data indicate that an internal tide brings cold water over the bottom on a tidal basis. Telemetric studies show that juveniles undergo small-scale crepuscular migrations from deeper daytime locations to shallower nighttime locations but move relatively little during day and night periods. Analysis of length frequency distributions obtained over a 17-month period resulted in an estimate of the von Bertalanffy growth constant (K) of 0.21 yr^{-1}.

Monger, B. C. and M. R. Landry (1991). Size-selective grazing by heterotrophic nanoflagellates: An analysis using live-stained bacteria and dual-beam flow cytometry. 5th Int. Workshop on the Measurement of Microbial Activities in the Carbon Cycle in Aquatic Environments, Helsinger (Denmark), Advances in Limnology. Stuttgart.

The effect of prey size on clearance rates of a direct-contact feeding chrysomonad (HNAN-1) was examined using dual-beam flow cytometry (FCM) and fluorescently-labelled prey prepared from living and heat-killed cultures. Over the range in prey sizes used in These experiments (0.7 to 1.4 mu m diameter, clearance rate increased approximately linearly with prey diameter. These results are consistent with model predictions based on the balance of hydrodynamic (repulsive) and van der Waals (attractive) forces. The high precision of FCM analysis allows unequivocal rejection of size-dependencies with exponents greater than 1.8. HNAN-1 does not discriminate between living Synechococcus cells or polystyrene micospheres of comparable size, or between living and heat-killed preparations of the heterotrophic bacteria Vibrio damsela and Pseudomonas diminuta . Significantly higher clearance rates were observed for HNAN-1 feeding on a small, living bacterial isolate from Kane`ohe Bay, Hawai`i, USA compared to heat-killed cells from the same culture or any of the larger prey used in our experiments.

Morrey, C. E., M. Nakamura et al. (1998). "P450scc-like immunoreactivity throughout gonadal restructuring in the protogynous hermaphrodite *Thalassoma duperrey*." Int. J. Dev. Biol. 42: 811-816.

Morris, J. E. (1960). Some relationships of the physical environment to self- and cross-fertilization and to early development in an Hawaiian tunicate, *Herdmania momus*. Department of Zoology. Honolulu, University of Hawai`i**:** 50.

A study divided into three main sections: the anatomy and physiology of the gonads and gametes with special emphasis on the fertilization membrane; the technique used in the self-sterility experiments and results of such experiments; and the anatomy of the development and the effect of temperature on development rate. Specimens were collected from various areas on O`ahu, but all the experimental animals were obtained from pilings and rocks on the leeward side of Coconut Island, Kane`ohe Bay.

Morris, R. A. and G. H. Balazs (1994). "Experimental use of cryosurgery to treat fibropapillomas in the green turtle, *Chelonia mydas*." NOAA Tech. Memorandum NMFS-SEFSC 341: 111-114.

Morrisey, J. (1985). Carbon flow through fleshy algae on coral reefs. Dept. of Oceanography. Honolulu, Univ. Of Hawai`i**:** 136.

Pathways of carbon flow through coral reef fleshy algae were investigated by an annual study of biomass, primary production, detritus production and degradation on Checker reef in Kane`ohe Bay. the selected species were *Acanthophora spicifera* and *Sargassum echinocarpum*. Biomass harvesting and respirometry experiments were conducted monthly. Macroalgal detritus production was assessed routinely with detritus nets and sediment traps. Degradation was investigated in static incubation systems and supplemented by data from outdoor flow-through experiments and field observations.

Moynihan, M. (1983). "Notes on the behavior of *Euprymna scolopes* (Cephalopoda: Sepiolidae)." Behaviour 85: 25-41.

18 individuals of the sepiolid *Euprymna scolopes* were collected in Kane`ohe Bay, O`ahu, Hawai`i. They were observed in the laboratory for a brief period. They were found to be non-gregarious and primarily nocturnal. It was possible to study feeding and defensive behavior. The species seems to prefer shrimps as prey. It is often cryptic. Among the adaptations for crypsis are color changes to match backgrounds (substrates), sand burrowing, and the cementing of sand grains to the back of an individual itself. The grains presumably are held in place by adhesive secretions of the skin. The captive animals also produced patterns which were conspicuous rather than cryptic. They were highly visible, occasionally intricate, combinations of light and dark. Some of them were distinctive. A single copulation was peculiar in certain respects (the spatial positions of the performers), but reminiscent of true cuttlefishes of the genus Sepia in other respects (color displays of both male and female).

Muir, B. S. and A. J. Niimi (1972). "Oxygen consumption of the euryhaline fish aholehole (*Kuhlia* *sandvicensis*) with reference to salinity, swimming, and food consumption." J. Fish. Res. Bd. 29: 67-77. Active and standard metabolism of *Kuhlia sandvicensis* increase with fish weight to a power of about 0.8 and active is nine times standard. No significant difference was found between experiments in fresh water and 30□□□ sea water at 23 C. At low swimming speeds the fish may be unable to physically take up as much oxygen as at higher speeds. Swimming activity may be essential to circulatory adequacy. Elevated oxygen consumption lasted for 42 hr following a ration of 2.3% of body weight and for 60 hr after one of 4.5%. It amounted to about 76 mg O_2/g ration, equivalent to about 16% of the energy of the ration, in both cases. For a nonswimming fish the highest oxygen consumption observed following the maximum daily ration is no more than half of the difference between active and standard rates. Specimens of aholehole were caught by angling in Kane`ohe Bay, O`ahu.

Muir, D. G. (1997). "New records of pericarid Crustacea in Hawai`i (Crustacea: Pericarida)." Occ. Pap. B. P. Bishop Museum 49: 50-54.

Murdock, G. R. (1971). The formation and assimilation of alcohol-soluble proteins during intracellular digestion by *Hydra littoralis* and *Aiptasia* sp. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press.
Coelenterate intracellular digestion has been well documented, but there is little information on the chemical changes actually taking place within the food vacuole. In this study observations on *Hydra littoralis* and on *Aiptasia* sp. are discussed in which a labeled protein of ingested food is degraded and radioactively traced. Sea anemones of *Aiptasia* sp., were collected in Kane`ohe Bay.

Murdock, G. R. and H. M. Lenhoff (1968). "Alcohol soluble proteins: Their formation and assimilation during intracellular digestion in *Hydra littoralis* and *Aiptasia* sp." Comp. Biochem. Physiol. 26: 963-970.
Coelenterate intracellular digestion has been well documented, but there is little information on the chemical changes actually taking place within the food immense . In this study observations on *Hydra littoralis* and on *Aiptasia* sp. are discussed in which a labeled protein of ingested food is degraded and radioactively traced. Sea anemones of *Aiptasia* sp., were collected in Kane`ohe Bay.

Murphy, C. (1972). An annual cycle of phytoplankton populations in Kane`ohe Bay, O`ahu. Dept. Of Botanical Sciences. Honolulu, Univ. Of Hawai`i**:** 109 pp.
The present study, planned as a quantitative investigation of the phytoplankton of Kane`ohe Bay, over a period of one year, was undertaken to supplement present knowledge of seasonal, distributional, floristic and ecological features of the phytoplankton in the Bay. The objectives were to 1) identify and enumerate phytoplankton collected at selected stations at regular intervals over a period of on year; attempt to determine the factors that control variations in the qualitative and quantitative makeup of the phytoplankton; and 3) relate the quantitative data obtained in this study with other ecological data obtained by other investigators in a concurrent study.

Murphy, G. I. (1960). "Introduction of the Marquesan sardine, *Harengula vittata* (Cuvier and Valenciennes) to Hawaiian waters." Pac. Sci. 15: 185-187.
A report on the introduction of the Marquesan sardine, *Harengula vittata*, into Hawaiian waters in the hopes of supplementing the supply of the nehu *Stolephorus purpureus* Fowler, used as a baitfish in the tuna industry. The report includes data on releases and recoveries during 1955 to 1958. Several recoveries were made in Kane`ohe Bay although no releases were made in the Bay.

Murphy, G. I. and R. I. Clutter (1972). "Sampling anchovy larvae with a plankton purse seine." Fish. Bull. 70: 789-798.
A sampling purse seine (100 ft by 21 ft) was constructed of 333 micron Nitex. It was used in Kane`ohe Bay, Hawai`i, together with a 1-m plankton net constructed of the same material in order to evaluate the sampling efficiency of the towed plankton net on anchovy larvae (*Stolephorus purpureus*). The results show that during the day, the purse seine is at least an order of magnitude more efficient for larvae over 5.5 mm in length. The largest larvae caught by the plankton net was 14.5 mm and by the purse seine 29.5 mm. At night the plankton net was relatively more effective than during the day, catching about 60% as many larvae as the purse seine over the interval 3.5-19.5 mm. The maximum size taken increased to 21.5 mm, but the maximum taken by the purse seine increased to 50 mm. An attempt was made to rationalize the difference between the day plankton net and purse seine catches by a geometric model involving alarm distance and larval swimming speed.

Muscatine, L. and E. Cernichiari (1969). "Assimilation of photosynthetic products of zooxanthellae by a reef coral." Biol. Bull. 137: 506-523.

This paper describes experimental studies on the metabolism of $^{14}C0_2$, the *in situ* translocation of ^{14}C and its assimilation by the Hawaiian reef coral *Pocillopora damicornis i*n Kane`ohe Bay. Included area data on specific labeled substrates in the algae and animal tissues, the magnitude of heterotrophic fixation, the nature of the translocated material, and the acquisition of ^{14}C by the skeleton of *Pocillopora*. Intact corals were exposed to $^{4}C0_2$ in the light and dark for varying lengths of time up to 24 hours, and then the amount and nature of the fixed ^{14}C within the coral was ascertained.

Muscatine, L. and C. F. D'Elia (1978). "The uptake, retention, and release of ammonium by reef corals." Limnol. Oceanogr. 23(4): 725-734.
Of several genera tested, only those Pacific reef corals symbiotic with zooxanthellae take up and retain ammonium. Uptake and retention are enhanced by light, and the normal daylight period is sufficient to sustain ammonium retention during the night. Ammonium uptake kinetics for several species indicate that a two-process mechanism may be involved. If a correction is made for diffusion, uptake kinetics can be characterized by the Michaelis-Menten equation. Incubations of *Pocillopora damicornis* and *Tubastrea aurea* from Kane`ohe Bay, Hawai`i were successful as well as symbiotic corals tested in other locales.

Muscatine, L., C. Ferrier-Pages et al. (1998). "Cell-specific density of symbiotic dinoflagellates in tropical anthozoans." Coral Reefs 17: 329-337.

Nakamura, E. L. (1970). Synopsis of biological data on Hawaiian species of *Stolephorus*. The Kuroshio. J. C. Marr. Honolulu, East-West Center Press, University of Hawai`i**:** 425-46.
Data on identity, distribution, bionomics, and life history, population, and exploitation of the nehu (*Stolephorus purpureus*) are summarized. Used as live bait for skipjack tuna, the nehu is found in abundance in Kane`ohe Bay. Data on the identity and distribution of the roundhead (*Stolephorus buccaneeri*), a second Hawaiian engraulid, are also summarized.

Nakamura, M., T. F. Hourigan et al. (1989). "Histological and ultrastructural evidence for the role of gonadal steroid hormones in sex change in the protogynous wrasse *Thalassoma duperrey*." Env. Bio. Fishes 24(2): 117-136.
The process of sex change in the protogynous wrasse, *Thalassoma duperrey*, was investigated through histological and ultrastructural observations on the gonads of females changing sex to male. Changes in plasma steroid levels concommitant with structural changes were measured by radio-immunoassay. The process of sex change from ovary to testis was divided into six stages on the basis of changes in the structure of the germinal and somatic elements. Fish were collected in Kane`ohe Bay, O`ahu.

Nakamura, R. (1968). "An additional contribution to the biology of the aholehole, *Kuhlia sandvicensis* (Steindacher)." Pac. Sci. 22: 493-496.
Growth and age of a common inshore species, the aholehole, collected from a population of individually marked fish over a period of a year in a pond on Coconut Island, Kane`ohe Bay. Length and weight measurements taken monthly with scale samples for a study of scale growth.

Nandi, J. and H. A. Bern (1960). "Corticosteroid production by inter-renal tissue of teleost fishes." Endrocrinology 66: 295-303.
Investigation on the secretion of adrenocortical steroid hormone by the interrenal glands of teleost fishes and the tentative identification of these hormones by chromatographic methods. The study was conducted at the Dept. of Zoology and its Cancer Research Genetics Laboratory, University of California, Berkeley. Specimens of *Mugil cephalus*, caught by commercial seining in Kane`ohe Bay, were supplied by the Hawai`i Marine Laboratory.

Neves, E. G. (1998). Histological analysis of reproductive trends of three *Porites* species from Kane`ohe Bay, Hawai`i. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe Bay, O`ahu, HIMB, UH**:** 9-22.
Gonad development and synchrony among *Porites compressa*, *P. lobata* and *P. evermanni* colonies, collected in Kane`ohe Bay during the summer of 1997, were histologically examined and compared. All three species are gonochoric broadcast spawners, releasing gametes predominantly in the full moon during the breeding season. Histological sections of fertile polyps confirmed the maturity of gonads and the presence of zooxanthellae, surrounding the oocytes and moving into the ooplasm of the mature eggs before spawning.

Newbury, T. K. and E. F. Bartholomew (1976). "Secondary production of microcopepods in the southern,

eutrophic basin of Kane`ohe Bay, O`ahu, Hawaiian Islands." Pac. Sci. 30: 373-384.
The microcopepods function as an important herbivorous group in the planktonic community of the southern, sewage-rich portion of Kane`ohe Bay, O`ahu, Hawaiian Islands. Most of the microcopepod biomass was composed of a rapidly producing species of Paracalanidae. The Paracalanidae population production rate was calculated with the field population stage composition, the length:dry weight relationship, and the species development rate in both laboratory and in situ containers. The population production rate:biomass ratio equaled 78% per day during summer 1968. For all of the microcopepods, secondary production was estimated to be 1.8 mg nitrogen/m^{-3}/day

Newman, W. A. (1961). "On certain littoral species of *Octolasmis* (Cirripedia, Thoracica) symbiotic with decapod Crustacea from Australia, Hawai`i and Japan." Veliger 4: 99-107.
A paper concerned with the reinstatement of *Octolasmis neptuni* (MacDonald) long held in synonymy with *0. lowei* (Darwin) - Australian and Japanese subspecies are designated. The paper also reports a remarkable new species of *Octolasmis* from Hawai`i (Kane`ohe Bay). Analysis of the ontogeny and adult morphology suggests a new interpretation of the origin and the phylogeny of this and other related forms.
Octolasmis (Octolasmis) indubia Newman spec. nov. Coconut Island. Numerous specimens were found of the mouth parts of a single specimen of *Scyllarides squamosus* (Milne-Edwards). The gills of this specimen were infected with *Octolasmis lowei* (Darwin). Holotype of *0. indubia*, U.S.N.M. Cat. no. 107'310; paratypes, U.S.N.M. Cat. no. 1071311 and 1071312.

Nishioka, R. S. (1959). A comparative histology of the male reproductive system of 3 portunid crabs. Department of Zoology. Honolulu, University of Hawai`i**:** 70.
A study attempting to ascertain if the manner of spermatophore elaboration bears similar relationship in 3 species of portunid crabs - *Portunus sanquinolentus*, *Podophthalmus vigil* and *Lissoncarcinus orbicularis*. All three species were found in Kane`ohe Bay. Results showed that the morphological microscopical anatomy of the male reproductive systems of these 3 species were identical except for two very minor characteristics. These features provide the basis of a more exact method of classification than the present use of external morphological characteristics.

Nutting, C. C. (1905). "Hydroids of the Hawaiian Islands collected by the steamer Albatross in 1902." U. S. Fish. Comm. Bull. for 1903 Part 3: 931-959,.
The first major taxonomic report on hydroids from the Hawaiian Islands, 29 of the 49 species collected were new to science. The specimens were collected by the U. S. Fisheries steamer Albatross in 1902. The author includes a systematic discussion of the hydroids in the introduction.

Olla, B. L. (1962). The perception of sound in small hammerhead sharks, *Sphyrna lewini*. Department of Zoology. Honolulu, University of Hawai`i.
A study dealing with the response of *Sphyrna lewini* (Griffith) to sound. The objectives were to train young hammerhead sharks to associate sound with an unconditioned stimulus and to determine what range of frequencies at relative intensity thresholds can be detected. The sharks were caught by hook and line in Kane`ohe Bay and the experimental work was conducted at the marine laboratory on Coconut Island from June 1961 to September 1961. Results showed that small hammerhead sharks could be trained to develop an association between sounds of certain frequencies and an aversive or punishment stimulus consisting of a yank on a cord connected through the dorsal fin. Sound frequencies between 250 cps and 750 cps can be perceived, but they may be able to perceive sounds higher

Olsen, D. A. (1971). The potential for an abalone fishery in Hawai`i. Dept. Of Zoology. Honolulu, Univ. Of Hawai`i**:** 136.
In an attempt to predict the outcome of a proposed introduction of the green abalone *Haliotis fulgens* to Hawai`i, an investigation of the Hawaiian biota and the physiology of the abalone was undertaken. The species diversity of Hawaiian corals, intertidal mollusks and benthic marine algae was investigated. The equitability component of species diversity was near the biological minimum, indicating biotic instability, and low resistance to invasion. Potential competition between abalone and three Hawaiian urchin species was demonstrated and could limit abalone numbers. Fish predation would probably be important.

Ostergaard, J. M. (1928). "Fossil marine mollusks of O`ahu." Bishop Museum Bull. 51.
A study comparing the fossil animals and plants with those living in the surrounding water in an attempt to throw light on the ecological conditions under which the emergent limestones of Hawai`i were built up. Discussion is restricted to the phylum Mollusca and in particular the classes Gastropoda

and Pelecypoda. One of the 22 stations on O`ahu was the Mokapu peninsula in Kane`ohe Bay. *Strombus ostergaardi* Pilsbry was found in this area.

Ostergaard, J. M. (1950). "Spawning and development of some Hawaiian marine gastropods." Pac. Sci. 4: 75-115.
A taxonomic study of the spawning habits and development of some Hawaiian marine gastropods. This is the first such study to be published in this area. Included is a key to the spawn of the gastropods described.

Ostergaard, J. M. (1955). "Some opisthobranchiate Mollusca from Hawai`i." Pac. Sci. 9: 110-136.
Taxonomic descriptions of some opisthobranchs from Hawai`i. Found in Kane`ohe Bay:
Placobranchus ianthobapus Gould - found on mud flats near Coconut Island.

Oyama, S. (1964). The morphological and histological structure of the digestive tracts and diverticula of the brachiopod, *Lingula reevi* Davidson, with additional studies on their physiological activity. Department of Zoology. Honolulu, University of Hawai`i**:** 71.
A study of the gross and histological anatomy of the digestive tract of the inarticulate brachiopod, *Lingula reevi*, and to compare it with that of *Lingula unquis* (Linne) described by Chuuang. The roles of the various digestive organs in digestion and absorption of food materials were investigated from the standpoint of their anatomy, histology and physiology. Using labeled C14 glucose and diatoms, attempts were made to study the rate and site of absorption within the digestive tract of *L. reevi*. Using specific cytological staining techniques, differences in the digestive organs cells between fed and starved animals were examined.

Palaki, A. (1998). The effect of salinity on fertilization and larval survivorship and settlement in *Fungia scutaria* and *Pocillopora damicornis*. Reproduction in reef corals. Kane`ohe, O`ahu, HIMB, UH**:** 73-82.
Gametes and larvae of *Fungia scutaria* and *Pocillopora damicornis* were exposed to lowered salinity by dilution of Kane`ohe Bay water (□34 ppt) with freshwater. Below 20 ppt there was no fertilization in *F. scutaria*, and no larvae survived or settled during a 20 day exposure to 20 ppt. *P. damicornis* larvae exposed to 20 ppt showed 100% mortality. Exposure to reduced salinity, below 24 ppt, lead to depressed fertilization success, larval survival and larval settlement.

Papagni, D. (1967). Some aspects of the behavioral ecology of three species of hermit crabs from Kane`ohe Bay. Zoology. Honolulu, University of Hawai`i**:** 47.
A study to determine whether a social dominance hierarchy exists between sympatric species of hermit crabs, to look for social interactions which might reveal interspecific dominance and to look at some aspects of the behavioral ecology of the hermit crabs studied. The crabs C*alcinus laevimanus, C. latens* and *Clibanarius zebra* were studied in the field and collected for lab experiments from a coral rubble reef northeast of Coconut Island. The adults were found in the shells of T*rochus sandwichensis* and *Turbo intercostalis*. The three test shells used were *Tegula finebralis, Acanthina spirata* and *Olivella biplicata*. Results indicated a 3 rank hierarchy with *C. laevi* first, followed by *C. latens* and then *C. zebra*. Species membership may take precedence over other factors in determining dominance, but it may become to individual differences such as body weight.

Pararas-Carayannis, G. (1967). The barium content in the calcareous skeletal materials of some recent and fossil corals of the Hawaiian Islands. Department of Zoology. Honolulu, University of Hawai`i.
A study involving ion concentrations in the skeletal materials of some corals. The amount of aragonite decreases with depth in the fossil corals confirming the theory that age and increasing temperatures and pressures gradually convert aragonite to calcite and that at greater depths, complete recrystalization occurs. The barium content in the skeletal materials of living corals varies considerably even in species that belong to the same family. Fossil corals do not contain detectable amounts of barium. A linear relationship between aragonite content and barium concentration was found. It is suggested that barium possibly behaves in the same manner that was shown for strontium, in that it acts as an inhibitor for the aragonite-calcite conversion.

Pardy, R. L. (1971). The feeding biology of the gymnoblastic hydroid *Pennaria tiarella*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 84-91.
This chapter discussed the role in food capture of the nematocysts on the filiform and capitate tentacle of *Pennaria tiarella* as well as the identification of a feeding activator. Colonies of *P. tiarella* were collected from encrusted docks in front of the marine station (HIMB, Coconut Island, Kane`ohe Bay, O`ahu).

Pardy, R. L. and H. M. Lenhoff (1968). "The feeding biology of the gymnoblastic hydroid, Pennaria tiarella." J. Exp. Zoo. 168(2): 197-202.

This study discusses the role in food capture of the nematocysts on the filiform and capitate tentacle of *Pennaria tiarella* as well as the identification of a feeding activator. Colonies of *P. tiarella* were collected from encrusted docks in front of the marine station (HIMB, Coconut Island, Kane`ohe Bay, O`ahu).

Park, C. and M. R. Landry (1993). " Egg production by the subtropical copepod *Undinula vulgaris*." Mar. Biol. 117: 415-421.

Egg production by *Undinula vulgaris*, collected off Kane`ohe Bay, Hawai`i (USA), was measured under field and laboratory conditions on 16 occasions from June to December 1991. In situ rates ranged from 0 to 15.7 eggs female-1 d-1, with a mean of 6.4 eggs female-1 d-1, 2.1% female body carbon d-1. Maximum in situ production was 53 eggs female-1 d-1, 17.2% C d-1. Average egg production (Y eggs female-1 d-1) was related to the concentration of particulate carbon (X, mu-g C l-1) by the Ivlev function, Y = 13.9(1-e-0.0097(X-10)), with R-2 = 0.96. Individuals with the same feeding history produced more eggs at lower temperatures in the laboratory. Egg production was not significantly correlated with dry weight, and no noticeable temporal trend was found. Despite the elevated habitat temperatures (26 to 27 degree C) of this subtropical copepod, maximum fecundity of *U. vulgaris* was comparable to, but average rates were lower than, egg production rates of similarly-sized, temperate and boreal species of the genus *Calanus*. Our results caution against broad extrapolations of the temperature-growth relationship for temperate coastal copepods to species from poorly studied, oligotrophic regions of the oceans.

Parker, B. W. (1835-1862). Kane`ohe Missionary Station Reports.

In the 1836 report, Rev. Parker notes the census of the whole population of the Kane`ohe station, which was recorded during the previous year. The census was 4636, "351 less than in 1831". The records of births and deaths commenced in January of 1836, 14 births and 28 deaths in a period of January 1 to June 1, when Rev. Parker submitted his report.

In the 1841 report, the population is stated to be 4000 according to the census of the district taken in the previous year.

In the 1846 report, a register of births and deaths at Kane`ohe among a population of 1000 inhabitants for the last six years is given. Rev. Parker mentions that there is some evidence of a diminution in the population although it is not very rapid.

In 1845, the increase in the death rate was due to an epidemic which spread through the islands in .April of that year. There has been no census of the entire population associated with the station although the number was not far from 6000 according to Rev. Parker.

In the 1849 report, the census was 2813 compared with the census of 4987 in the year 1832.

In the 1862 report, mention is made of the beginnings of rice cultivation in the area by foreigners.

Pearse, V. B. (1971). Sources of carbon in the skeleton of the coral *Fungia scutaria*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 239-45.

In order to examine further the possibility that some skeletal carbonate may originate from metabolic C02, the author fed ^{14}C-labeled mouse tissue to small individuals of the coral *Fungia scutaria* in Kane`ohe Bay. The experiments offer direct evidence that metabolic ^{14}C02 is incorporated into skeletal carbonate in this coral. Also presented are data on the effects of light and starvation on calcification and information concerning the origin of the coral matrix.

Peterson, W. T. (1969). Species diversity and community structure of the zooplankton of Kane`ohe Bay, O`ahu, Hawai`i. Department of Oceanography. Honolulu, University of Hawai`i**:** 91.

A study considering both the micro- and the macrozooplankton communities in quantitative terms for all of Kane`ohe Bay. The study involved the distribution and abundance of all component species; the description of communities in pre-defined areas in terms of various distributional statistics; the analysis of community structure in terms of community and of feeding habits of the components, the food chain and the probable pathways of energy flow. Results of this study are important in the pollution aspects of the bay and in a general understanding of the dynamics of the Kane`ohe Bay ecosystem.

The environmental gradient was shown to extend from the southern section of the bay, where the standing stock of macrozooplankton was $1104/m^3$, to the northern section, where the standing stock was $82/m^3$. Certain species were found abundant in certain sections of the bay, while others were ubiquitous. In terms of probable energy flow through the proposed food chain and the relative abundances of the major components, the southern section of the bay was shown to be the most simply structured area of the bay - this structure is governed by only 2 primary consumers and 2 secondary consumer species. Pollution may theoretically effect this area's flora and fauna, but no major alterations are expected.

Peterson, W. T. (1975). Distribution, abundance and biomass of the macrozooplankton of Kane`ohe Bay, O`ahu, Hawai`i, 1966-1971. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology: 122 pp.
This study considers both micro- and macrozooplankton, and defines, describes and analyzes the macrozooplankton communities in quantitative terms for all of Kane`ohe Bay. All components were identified, although a generic name could not be assigned to some members. The distribution and abundance of each component was estimated. Communities in several predefined areas were described in terms of various distributional statistics of each component. Community structure was analyses in terms of community diversity and was further studied and discussed in terms of feeding habits of the components, the food chain and probable pathways of energy flow.

Pierce, M. (1969). The distribution and abundance of diatoms in Kane`ohe Bay, O`ahu, Hawai`i. Dept. Of Biology. Honolulu, Univ. Of Hawai`i: 138.
Weekly or bimonthly microplankton samples were taken from 8 stations in Kane`ohe Bay. Counts were made of diatoms, some dinoflagellates, microcopepods, and nauplii. A detailed study of the distribution and abundance of diatoms within and around Kane`ohe Bay was made. Special emphasis was placed on taxonomy of the diatoms and the seasonal distribution of diatoms within the various geographical sectors. It was found that the highest diatom populations occurred in the south sector; the lowest, outside the Bay in the neritic zone. The diatom population structure is similar in all sectors except the North Channel sector and Neritic zone. Skeletonema and Chaetoceros are the dominant diatom genera. Subblooms and blooms (100,00 cells/l +) occurred in all but North Channel and Neritic Zone. The majority of blooms and subblooms occurred in the South Sector.

Pietschmann, V. (1938). "Hawaiian shore fishes." Bishop Mus. Bull. 156: 1-55.
A taxonomic study of Hawaiian shore fishes, 1927-1928. The author presents a uniform fish fauna for the entire islands which may be broken into smaller areas of coastline. Many new species are listed.

Pillai, C. S. G. and G. V. Scheer (1973). "Bemerkungen uber einige Riffkorallen von Samoa und Hawai`i." Zool. Jb. Syst. 100: 466-76.
Two coral collections were gathered, one from Kane`ohe Bay in 1968. Altogether 33 specimens were present belonging to 27 species from 15 genera, with 7 species from Kane`ohe Bay. The corals were treated systematically and supplied with notes about geographical distribution.

Pilsbry, H. A. (1917). "Marine mollusks of Hawai`i, IV-VII." Proc. Nat. Sci. Phil. 69: 309-333.
A continuing study of Hawaiian marine mollusks (first paper, Proc. Nat. Sci. Phil. 6-9: 207-230) including an important collection made by Prof. Wm. Alanson Bryan and Mrs. Bryan. Most of the shells are from Kauai, O`ahu and Molokai.

Pilsbry, H. A. (1917). "Marine mollusks of Hawai`i, VII-XIII." Proc. Nat. Sci. Phil. 72: 296-328.
A taxonomic description of material submitted to the author by Mr. D. Thaanum, W. A. Bryan, J. M. Ostergaard and material collected by the author in 1913. Included in the work also are keys to the Hawaiian *Terebra* and a partial key to *Mitra* and *Vexillum.*

Pilsbry, H. A. (1927). "Littoral barnacles of the Hawaiian Islands and Japan." Proc. Acad. Nat. Sci. Phil. 79: 305-317.
Descriptions of the shore barnacles in the Bernice Pauahi Bishop Museum, from Hawai`i and Japan collected by the *Tanager* Expedition.

Piyakarnchana, T. (1965). The plankton community in the southern part of Kane`ohe Bay, O`ahu, with the special emphasis on the distribution, breeding season and population fluctuation of *Sagitta enflata* Grassi. Dept. Of Zoology, Univ. of Hawai`i: 193.
A one year study (1963-1964) of the zooplankton community in Kane`ohe Bay emphasizing the ecological relationships of the members of the community and some aspects of the biology of *Sagitta enflata* Grassi. The bay was described in terms of temperature, salinity, water temperature, current patterns and phosphate concentration. Samples were made with a 46.5-cm plankton net towed at the surface.

Polacheck, T. (1978). The population biology of four common Hawaiian corals. Department of Zoology. Honolulu, University of Hawai`i: 151 pp.

The population biology of four Hawaiian corals (*Porites compressa, Montipora verrucosa, Pocillopora damicornis and Pocillopora meandrina*) was studied to learn the factors that are important in structuring the composition of coral communities, *P. meandrina* was studied on the fore reef, a low coral coverage community dominated by this species. The other three species were studied on a patch reef in Kane`ohe Bay which has almost 100% coverage of *P. compressa* and *M. verrucosa*.

Portlock, N. (1789). A Voyage Around the World: But More Particularly to the Northwest Coast of America: Performed in 1785, 1787 and 1788 in the "King George" and "Queen Charlotte." Captains Portlock and Dixon. London, John Stockdale.

Powers, D. A. (1970). "A numerical taxonomic study of Hawaiian reef corals." Pac. Sci. 24(2): 180-86.

Sixty characters were measured and used in multivariate statistical programs to study the systematics of 20 species of Hawaiian corals, mostly from Kane`ohe Bay. Correlation and distance phenograms and a computer-generated, three-dimensional model were used to develop phenetic rankings of species groups at levels corresponding to the taxonomic categories of genus, family, and, provisionally, suborders.

Powers, D. A. (1971). Glucose-6-phosphate dehydrogenase and 6-phophogluconate dehydrogenase activities in coelenterates. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press: 169-175.

A variety of coelenterates were surveyed at the Hawai`i Institute of Marine Biology to see if the distribution of the two enzyme activities observed in hydras were specific for the Hydridae, or whether similar activities could be found in other coelenterates. All of the marine animals were collected off Coconut Island in Kane`ohe Bay, O`ahu.

Powers, D. A., H. M. Lenhoff et al. (1968). "Glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase activities in coelenterates." Comp. Biochem. Physiol. 27: 139-144.

I surveyed a wide variety of coelenterates at the Hawai`i Institute of Marine Biology in order to see if the distribution of the two enzyme activities observed in hydras were specific for the Hydridae, or whether similar activities could be found in other coelenterates. All of the marine animals were collected off Coconut Island in Kane`ohe Bay, O`ahu.

Preston, E. M. (1971). Niche overlap and competition among five sympatric congeneric species of xanthid crabs. Dept. of Zoology. Honolulu, Univ. of Hawai`i: 25 pp.

Five species of xanthid crabs which are obligate commensals of the branching corals *Pocillopora*, are examined. Similarities in microhabitat, food habits, and behavior patterns make these species potential competitors. This study attempts to characterize the potential competitive interactions among these 5 species and to assess their importance. Specimens were collected from Kane`ohe Bay, however no detailed collection sites are given.

Preston, E. M. (1973). "A computer simulation of competition among five sympatric congeneric species of xanthid crabs." Ecol. 54(3): 469-483.

In Hawai`i, five species of xanthid crabs of the genus *Trapezia* are commensals of the branching coral *Pocillopora meandrina* var. *nobilis*. As adults, crabs are found in heterosexual pairs. Intraspecifc agonistic interactions typically restrict host occupancy to one pair per species but multiple species combinations are common. A stochastic computer model of host selection produces species distributions similar to those observed in the field. In the absence of evidence consistent with alternative hypotheses, this suggests that interference competition resulting from random encounters during host selection by adults is sufficient to account for site variability in the distribution patterns of species of *Trapezia*. Patch reefs in Kane`ohe Bay were selected as study sites.

Preston, J. L. (1978). "Distribution of crabs in Kane`ohe Bay, Hawai`i." Anim. Behav. 26(3): 791-802.

Interphyletic communication is quantitatively shown to occur in a behavioral, mutualistic symbiotic association between the goby *Psilogobius mainlandi* and two species of shrimps, *Alpheus rapax* and *A. rapacida*, by the use of information theory and x^2 analyses. Communication between gobies and shrimps is primarily tactual. Gobies use as shelter burrows dug and maintained by shrimps. Gobies sit at the burrow entrance and warn shrimps of danger by a flick of the tail. Shrimps communicate their presence outside the burrow by touching gobies with their antennae. Gobies never give warning signals in the absence of shrimps. It is postulated that the spacing of the burrows in nature is a result of the complex interaction of three communication systems; tactual communication among shrimps and between gobies and shrimps and visual communication among gobies. It is suggested that the analysis techniques used here be applied to the analysis of other symbiotic associations.

Preston, J. L. (1978). "Communication systems and social interactions in a goby-shrimp symbiosis." Anim. Behav 26: 791-802.

Interphyletic communication is quantitatively shown to occur in a behavioral, mutualistic symbiotic association between the goby *Psilogobius mainlandi* and two species of shrimps, *Alpheus rapax* and *A. rapacida*, by the use of information theory and X^2 analyses. Communication between gobies and shrimps is primarily tactual. Gobies use as shelter burrows dug and maintained by shrimps. Gobies sit at the burrow entrance and warn shrimps of danger by a flick of the tail. Shrimps communicate their presence outside the burrow by touching gobies with their antennae. Gobies never give warning signals in the absence of shrimps. It is postulated that the spacing of the burrows in nature is a result of the complex interaction of three communication systems: Tactual communication among shrimps and between gobies and shrimps and visual communication among gobies. It is suggested that the analysis techniques used here be applied to the analysis of other symbiotic associations.

Pritchard, A. W. (1953). The oxygen requirements of Hawaiian tuna baitfish. Department of Zoology. Honolulu, University of Hawai`i.

A study analyzing the oxygen requirements of the baitfish to obtain basic information which will be of value in preventing the high mortality of baitfish in the livebait tuna industry. Oxygen consumption under various conditions was noted with special emphasis on the effects of temperature flow rates, degrees of crowding and oxygen concentration of the water. Experiments were also conducted to determine the lethal value of oxygen for the fish. The baitfish were caught in Kane`ohe Bay and experiments were conducted on Coconut Island.

Results showed that the oxygen consumption in the iao fluctuated hour to hour even when there were no outward signs of increased or decreased activity of the fish. No rhythmic cycle of metabolic rate could be demonstrated. Oxygen consumption increased with an increase in flow rate. The critical oxygen level could not be precisely delimited but lay somewhere between 1.5 and 2.5 cc/l. Individual iao showed marked differences in resistance to oxygen deficiency. Lethal values of oxygen ranged between 0.50 to 1.58 cc/l. Oxygen consumption increased slowly at first and then more rapidly at the higher temperatures between 190 and 290. Lethal values for oxygen showed a greater increase between 260 and 310C.

Pritchard, A. W. (1955). Oxygen requirements of some Hawaiian baitfish. Honolulu, U. S. Dept. Interior - Fish and Wildlife Service.

A study to analyze in the laboratory, the oxygen requirements of the local tuna baitfish, the nehu *Stolephorus purpureus* Fowler and the iao *Pranesus insularum* (Jordan and Evermann) with emphasis on the effects of temperature, flow rates, degrees of crowding, oxygen concentration of the water and the lethal level of oxygen for the fish. The fish were seined in the shallow waters and maintained at the Hawai`i Marine Laboratory on Coconut Island. This was a paper published from a doctoral thesis of the same title finished in 1953. Results of the work are included in Pritchard, 1953. The oxygen consumption of the iao fluctuated hourly without activity of the fish. No rhythmic cycle in metabolic rate could be demonstrated. Oxygen consumption did increase with an increase in flow rate, this effect being more pronounced in the summer months. The critical oxygen level could not be determined exactly, but it lay in the region of 1.5 and 2.5 cc/l. Lethal values ranged from 0.50 to 1.58 cc/l.

Over the temperature interval of 19-29° the rate of oxygen consumption increased slowly at first and then more rapidly; lethal values of oxygen measured over the same range also showed a greater increase between 26° and 31°C.

Quan, E. L. (1969). Some aspects of pollution in Kane`ohe Bay, O`ahu and its effect on selected microorganisms. Department of Microbiology, University of Hawai`i, Manoa**:** 140.

A study of surface water quality in the waters of the southeastern section of Kane`ohe Bay undertaken between February and mid-April 1968 in an attempt to determine the impact of surface runoff on water quality in the Bay; the chemical and bacterial quality of wastewater emerging from the two sewage treatment plants outfalls and whether the overall water quality standards imposed by the State were met as a result of the preceding investigations. High rainfall and surface runoff in this area of the Bay introduce high concentrations of nitrate-nitrogen and fecal streptococci in the lower areas of Keaahala and Kane`ohe Streams; the water temperature is lowered by 2°C over dry weather flow and silt-turbidity is caused along the nearshore waters of the Bay. Although surface runoff does not contribute significantly to the phosphates in the Bay, the phosphate-phosphorus concentrations averaged 0.046 mg/l at the Kane`ohe sewage treatment plant and 0.033 mg/l at the Kane`ohe MCAS, exceeding the limit established for class A waters by 0.021 and 0.008 mg/l respectively.

Dissolved oxygen and pH adequately met the quality standards at all stations except for two low dissolved oxygen readings in Keaahala Stream. From the mid-Bay region to the northern portion of the Bay, the overall water quality met the standards for both class AA and class A waters.

Radtke, R. L. (1985). "Life history characteristics of the Hawaiian damselfish, *Abudefduf abdominalis* defined from otoliths." Proc. 5th Intern. Coral Reef Congr., Tahiti 5: 397-401.
The otoliths of juvenile damselfish, *Abudefduf abdominalis*, were analyzed structurally and chemically to define their use as indicators of life history events. Morphometric measurements of all three otoliths (sagita, lapillus, asteriscus) established their species specificity and that fish size and possibly individual growth were related to otolith size. Examination of otolith micro-structure by light and Scanning Electron Microscopy indicated that rhythmic patterns were present which were assumed to be daily. Discrete micro-structure architecture was considered to be a result of settlement on to the reef and had a change from the postlarval to the juvenile life history stage. Examination of otolith micro-structure suggested that they have a larval life of 20 to 28 days and grow rapidly once recruited to the reef. Chemical analyses of stable isotopes and Ca/Sr concentrations suggest that fish recruit from cold waters and progressively encounter cooler waters as they mature. Use of structural and chemical analyses made it feasible to relate growth to life history events

Ralston, S. (1976). "Anomalous growth and reproductive patterns in populations of *Chaetodon miliaris* (Pisces, Chaetodontidae) from Kane`ohe Bay, O`ahu, Hawaiian Islands." Pac. Sci. 30: 395-403.
Specimens of *Chaetodon miliaris* collected in Kane`ohe Bay, O`ahu, during a 15-month study appeared to be reproductively inactive and were smaller than were those from other Hawaiian study areas. Additionally, they lacked calanoid copepods in their diet, the main food consumed elsewhere. It is suggested that the absence of this food in their diet resulted in a dietary deficiency leading to poor growth and reproductive inactivation.

Ralston, S. V. (1975). Aspects of the age and growth, reproduction, and diet of the millet-seed butterflyfish, *Chaetodon miliaris* (Pisces: Chaetodontidae), a Hawaiian endemic. Dept. of Zoology. Honolulu, Univ. of Hawai`i**:** 102 pp.
Aspects of the growth, reproduction and diet of *Chaetodon miliaris*, the millet-seed butterflyfish, were studied in an effort to characterize populations of fish exploited by the aquarium fish industry. Age determinations were accomplished by examination of daily growth rings within otoliths. Age estimates were corroborated by growth experiments, analysis of a size-frequency distribution, and the determination of the onset of reproductive maturity. Estimates of the duration of the larval stages were also obtained from study of the otoliths. Individuals from Kane`ohe Bay were small and appeared to be reproductively inactive when compared to fish from other areas.

Randall, J. E. (1955). "A revision of the surgeon fish genera *Zebrasoma* and *Paracanthurus*." Pac. Sci. 9: 396-412.
A taxonomic study of surgeon fish in the two genera, *Zebrasoma and Paracanthurus* in all known localities. A 18 mm post larval specimen of *Zebrasoma veliferum* was collected by Joseph E. King of the Pacific Oceanic Fishery Investigations on 26/12/51 offshore from Kane`ohe Bay in an oblique haul from the surface to 200 m with a 6 foot trawl.

Randall, J. E. (1958). "A review of the labrid fish genus *Labroides* with descriptions of two new species and notes of their ecology." Pac. Sc. 12: 327-347.
A taxonomic study of four species of labrid fishes including underwater observations on their food habit of removing ectoparasites from other fishes.

Randall, J. E. (1961). "A contribution to the biology of the convict surgeonfish of the Hawaiian Islands, *Acanthurus triostegus sandvicensis*." Pac. Sci. 15: 215-272.
A study involving aspects of habitat, environmental extremes, predators, parasites, food habits and the digestion, reproduction, growth, development and behavior of the convict surgeonfish, *A. triostegus sandvicensis* - conducted in part at the Hawai`i Marine Laboratory, Kane`ohe Bay, O`ahu.

Randall, J. E. (1999). "Review of the dragonets (Pisces: Callionymidae) of the Hawaiian Islands, with descriptions of two new species." Pac. Sci. 53: 185-207.

Randall, J. E. and L. Taylor (1988). "Revision of the Indo-Pacific fishes of the serranid genus *Liopropoma*, with descriptions of seven new species." Indo-Pacific Fishes 16: 1-47.

Rastetter, E. B. and W. J. Cooke (1979). "Response of marine fouling communities to sewage abatement in

Kane`ohe Bay, O`ahu, Hawai`i." Mar. Biol. 53: 271-280.

Rathbun, M. J. (1906). "The brachyura and macura of the Hawaiian Islands." U. S. Fish Comm. Bull. for 1903, Part III: 827-930.
A taxonomic description of the known brachyura and macura of the Hawaiian Islands. There are 314 known species to date, the majority of these specimens were collected by the U. S. Fish Commission explorations carried out in connection with a cable survey between California and Hawai`i, and the remainder of the specimens were collected by the *Albatross*, expedition of 1902. Moku Manu is the type locality for *Thalamita auauensis* n. sp.

Reaka, M. L. (1975). "Molting in stomatopod crustaceans. I. Stages of the molt cycle, setagenesis and morphology." J. Morph. 146: 55-80.

Reaka, M. L. (1976). "Lunar and tidal periodicity of molting and reproduction in stomatopod crustacea: a selfish nerd hypothesis." Biol. Bull. 150: 468-490.

Reaka, M. L. (1979a). "Patterns of molting frequencies in coral-dwelling stomatopod crustacea." Biol. Bull. 156: 328-342.

Reaka, M. L. (1979b). The evolutionary ecology of life history patterns in stomatopod crustacea. Reproductive Ecology of Invertebrates. S. E. Stancyk. Columbia, SC, Univ. of South Carolina Press**:** 235-260.
Overview of ecological study of stomatopods, including those sampled in Kane`ohe Bay

Redalje, R. C. (1976). The responses of two species of hermatypic corals and their zooxanthellae to changes in light intensity. Department of Zoology. Honolulu, University of Hawai`i**:** 42 pp.
The effects of four experimental light treatments on pigment response and zooxanthellae density were investigate for two species of hermatypic corals, Cyphastrea ocellina, a shallow reef species, and *Leptoseris incrustans*, a deep or shade dwelling coral.

Reed, L. K. (1986). Effect of varying solar radiation intensities and ultraviolet radiation on growth rates of *Symbiodinium microadriaticum* isolated from different hosts. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 430-439.
Growth rates of zooxanthellae isolated form five different hosts were determined at five levels of incoming solar radiation. The various strains differed significantly in their growth rates, as well as in their abilities to adapt to low and high irradiance, and did not appear to be correlated with solar radiation intensities in the environments from which they were isolated. The effect of UV radiation on zooxanthellae growth rates was also monitored. Full incoming UV radiation was shown to completely inhibit growth in three of four stains tested

Reed, M. (1906). The economic seaweeds of Hawai`i and their food value. Honolulu, Hawai`i Agricultural Experimental Station**:** 61-88.
A collection of notes and observations from various sources including a personal study of the markets and beaches wherever the limu gatherers were at work collecting or preparing the algae. Methods of gathering, preparing and serving seaweeds, the popular varieties, methods of cultivation, the chemical properties and the food value are all discussed. Apparently, limu pakaelaewaa or *Grateloupia filicina* was planted in Kane`ohe Bay many years ago by a chief who brought it from Hawai`i. At the time of publications the author reports it to be growing luxuriantly on the rocks near the shores of the Bay.

Reed, S. A. (1971a). Some common coelenterates in Kane`ohe Bay, O`ahu, Hawai`i. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 35-44.
This list of the more common coelenterates found in Kane`ohe Bay contains comments on identifying characteristics, interesting points of natural history, and information on specific collecting sites of those species that are not generally distributed or easily located on the reefs.

Reed, S. A. (1971b). Collection and maintenance of planula larvae and newly settled polyps of the colonial coral *Pocillopora damicornis*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, University of Hawai`i Press**:** 58-62.
Techniques for collection, maintenance, and feeding of the planula larvae and polyps of corals are

described. Also included are some general comments that may be useful to those who are Interested in using these organisms in research.

Rees, J. (1971). Paths and rates of food distribution in the colonial hydroid *Pennaria*. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 119-128.
Methods are described for measuring the rate and paths of distribution of radioactive food in the colonial hydroid *Pennaria tiarella*. Colonies of *P. tiarella* were collected from floating docks at the HIMB, Coconut Island, Kane`ohe Bay, O`ahu. Food fed to the terminal hydranth appeared as a gradient, decreasing in proportion to the distance where fed with the central stem as the most radioactive part of the colony.

Rees, J., L. V. Davis et al. (1970). "Paths and rates of food distribution in the colonial hydroid *Pennaria*." Comp. Biochem. Physiol. 34: 309-316.
Methods are described for measuring the rate and paths of distribution of radioactive food in the colonial hydroid *Pennaria tiarella*. Colonies of *P. tiarella* were collected from floating docks at the HIMB, Coconut Island, Kane`ohe Bay, O`ahu. Food fed to the terminal hydranth appeared as a gradient, decreasing in proportion to the distance where fed with the central stem as the most radioactive part of the colony.

Reese, E. S. (1962a). "Shell selection behaviour of hermit crabs." Animal Behaviour 10: 347-360.
An analysis of the behavioral pattern of shell selection by the hermit crab in an effort to determine whether the hermit crabs were capable of discriminating one species of shell from another and to what extent the behaviour was composed of acquired and innate components by rearing the crabs from eggs through the pelagic larval stages to the stage in their ontogeny when shells are first taken by young crabs. *Calcinus laevimanus* was studied in Kane`ohe Bay where they were collected from the coral rubble in the intertidal regions of the Bay. Results showed that the natural occurrence of hermit crabs in certain species of shells was explicable by at least two factors - an actual preference for certain species of shells and the relative abundance of shells of different species in different habitats. Dominance relationships may play a part in this behaviour.
The hermit crabs tested were able to distinguish between at least 3 different species of shells regardless of previous experience with these shells. The hermit crabs were able not only to distinguish between shells of the same species but also of different weights; they chose a shell of a specific weight relative to their own weight. The behaviour associated with entry into shells appears to be composed of innate components and is fully expressed in the glaucothoe stage. The ability to discriminate between shells of different weights and also between shells of different species does not appear to depend on experience with shells.

Reese, E. S. (1962b). "Submissive posture as an adaptation to aggressive behavior in hermit crabs." Sonderdruck aus Zeitschrift fur Tierpsychologie 19: 645-651.
Description of the aggressive behavioral patterns of the hermit crab, *Calcinus laevimanus,* studied in the coral reefs of Kane`ohe Bay and also in the laboratories of the Hawai`i Marine Laboratory, Kane`ohe Bay.

Reese, E. S. (1962c). "The behavioral mechanisms underlying shell selection by hermit crabs." Behavior 21: 78-126.
A study conducted in part at the Hawai`i Marine Laboratory with animals collected from Kane`ohe Bay, on some of the behavioral mechanisms underlying shell selection by hermit crabs, *Pagurus sameulis* and *Calcinus laevimanus*. Aspects of the behavior such as the sense organs and motor structures involved, and the properties of the shells releasing such behavior and the variability of the pattern were studied. Previous rearing experiments showed that the shell behavior is fully and completely expressed the first time it is released. A functional scheme is presented which explains a selection process which is not dependent upon previous experience with the stimulus objects. Weight and internal configuration of the shell appear to contribute to the total determination of the total stimulus value of the shell. Other shell properties may release specific fixed motor patterns as well as contribute to the evaluation of the shell as a stimulus object.

Reese, E. S. (1968). "Annual breeding seasons of three sympatric species of tropical intertidal hermit crabs, with a discussion of factors controlling breeding." J. Exp. Mar. Biol. Ecol. 2: 308-318.
A paper examining the annual breeding seasons of three sympatric species of intertidal hermit crabs from Kane`ohe Bay - *Calcinus laevimanus, C. latens* and *Clibanarius zebra* and these results are compared with the known knowledge of breeding seasons of hermit crabs from tropical as well as

north temperate seas. In addition, the breeding seasons of related anomuran crustaceans, 2 species of *Emerita* and 3 species of *Petrolisthes* are discussed.

Reese, E. S. (1969). "Behavioral adaptations of intertidal hermit crabs." American Zoologist 9: 343-355.
As an ecotone, the littoral environment is often complex and is generally rich in numbers and species of organisms. The disadvantages of the biotope in terms of exposure to physical factors of both the marine and terrestrial environments are patent, but the advantages are not so evident. The continual replenishment of food brought from the sea, particularly for detritus-feeding animals such as hermit crabs, coupled with the possibility and ability to establish microhabitats with microclimatic conditions may constitute the principal advantage. Escape from specialized predators may also be important. Hermit crabs have successfully exploited most intertidal environments. As members of the "benthic detritus-feeding guild" food is abundant, and by utilizing their shells in conjunction with movements within the littoral zone they have met successfully most of the rigors of the environment. The shell also provides some protection from predation, particularly from non-specialized predators. Indeed, the behavioral patterns associated with living in shells which permit the shell to serve as a microhabitat constitute the major adaptation enabling the hermit crabs to exploit the intertidal environment so successfully.

Reese, E. S. (1977). "Co-evolution of corals and coral feeding fishes of the family Chaetodontidae." Proc. 3rd Intern. Coral Reef Symp., Miami 1: 267-274.
Field observations of the feeding behavior and the nature of the substrata to which the feeding behavior is directed reveal that species of chaetodontids belong to one of three feeding categories: coral feeders, omnivores which feed on benthic invertebrates other than corals, and plankton feeders. The coral feeders are subdivided into obligative and facultative species. Stomach content analyses confirm the behavioral observations. Data are presented from three geographical areas: Hawai`i, Enewetak Atoll in the Marshall Islands, and Heron Island on the Great Barrier Reef. Laboratory studies on two species of chaetodontids presented with three species of corals, indicate that certain species of corals may be preferred to others as food. Co-evolution of corals and coral feeding fishes is discussed. Coral feeding chaetodontids are candidates as indicator organisms for the "health" or coral reefs.

Reimer, A. (1971). Uptake and utilization of ^{14}Glycine by *Zoanthus* and its coelenteric bacteria. Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 119-128.
This paper describes the uptake of ^{14}C-glycine solution by *Zoanthus sandwichensis* and the bacteria living in the animal's coelenteron, and the metabolic fate of glycine in these organisms. Specimens were collected from Kane`ohe Bay.

Richmond, R. H. (1983). Reproduction, larval physiology and dispersal potential of the coral *Pocillopora damicornis*. Depart. of Biolog. Sciences. Stony Brook, State Univ. of New York at Stony Brook**:** 118 pp.
Colonies of the hermatypic coral *Pocillopora damicornis* have been found to release brooded planulae larvae in excess of several thousand per month at Enewetak Atoll. Marshall Islands and in Kane`ohe Bay, Hawai`i. A monthly periodicity in larval release was found in 1980, with Enewetak colonies peaking between the new moon and the lunar first quarter, with two sympatric Hawaiian types (type "Y" and type "B") peaking at the lunar third quarter and between the first quarter and the full moon, respectively.

Richmond, R. H. (1985a). "Variations in the Population Biology of *Pocillopora damicornis* across the Pacific." Proc. 5th Intern. Coral Reef Congr., Tahiti 6: 101-106.
The scleractinian hermatypic coral *Pocillopora damicornis* is widely distributed across the tropical Pacific. Major differences occur in the life history characteristics and population biology of *P. damicornis* between widely separated populations of this coral. These include differences in fecundity, reproductive allocation, growth rate, age specific mortality and interspecific competitive ability. Data collected on *Pocillopora damicornis* from Enewetak Atoll, Marshall Islands, Kane`ohe Bay, Hawai`i and eastern Pacific reefs of Panama support the hypothesis that differences between populations are the result of divergent evolution via adaptation to local biotic and abiotic factors.

Richmond, R. H. (1985b). "Reversible metamorphosis in coral planula larvae." Mar. Ecol. Prog. Ser. 22: 181-185.
When planktonic planula larvae of the scleractinian coral *Pocillopora damicornis* settle, they secrete a calcareous exoskeleton for substrate attachment and metamorphose into a benthic polyp complete with mouth, tentacles, and mesenteries. If, however, these polyps are stressed within 3 d of settlement, they can retract all tissue from the skeleton and revert to a motile planktonic form

resembling the initial larval stage. These 'secondary larvae' are capable of resettling and once again metamorphosing into a benthic polyp. Also, planulae may undergo a pelagic metamorphosis to a planktonic polyp with mouth and tentacles. This developmental plasticity permits an enhanced microhabitat selection ability, and has likely contributed to the broad dispersal of this pan-Pacific species. Planulae used in this study were collected from adult colonies of *P. damicornis* from both Enewetak Atoll, Marshall Islands, and Kane`ohe Bay, O`ahu, Hawai`i.

Richmond, R. H. (1986). "Energetics, competency and long distance dispersal of planula larvae of the coral *Pocillopora damicornis*." Mar. Bio. 93: 527-533.

Pocillopora damicornis (Linnaeus) were collected from Enewetak Atoll, Marshall Islands, in 1980-1981, and Kane`ohe Bay, Hawai`i, in 1982. Their planula larvae contained 17% protein, 70% lipid, and 13% carbohydrate by dry weight. Calculations based on stored energy reserves and daily metabolic expenditure indicate that planulae could survive approximately 100 d and still settle successfully. Competency experiments demonstrated that larvae settled and metamorphosed after 103 d. This period of time is sufficient to allow immigration of larvae from the Central Pacific to the eastern Pacific, and supports the hypothesis of long-distance dispersal of larvae for the origin of present eastern Pacific populations of *P. damicornis*.

Richmond, R. H. (1987). "Energetic relationships and biogeographical differences among fecundity, growth and reproduction in the reef coral *Pocillopora damicornis*." Bull. Mar. Sci. 41: 594-604.

Data on larval production versus colony growth for the pan-Pacific coral *Pocillopora damicornis* indicate major differences exist in allocation between geographically separated populations. At Enewetak Atoll, Marshall Islands, *P. damicornis* releases planula larvae throughout the year. Measured growth rates ranged from 1.5 to 3.5 cm per year, while the caloric value of planulae released ranged from 20.2% to 167.4% of colony caloric content on a yearly basis. In the eastern Pacific (Panama), colonies did not release planulae over the 2-year period sampled, but exhibited a higher growth rate of 3.6 to 6 cm per year. Colonies from both Enewetak and the eastern Pacific allocate similar amounts of colony caloric content to biomass production annually (80% to 100%). At Enewetak, the majority of this energy is represented by planulation, while in the eastern Pacific, the energy is allocated to colony growth and subsequent fragmentation.

Richmond, R. H. and P. L. Jokiel (1984). "Lunar periodicity in larva release in the reef coral *Pocillopora damicornis* at Enewetak and Hawai`i." Bull. Mar. Sci. 34: 280-287.

Simultaneous daily measurements of planulation in the reef coral *Pocillopora damicornis* at Enewetak, Marshall Islands and Kane`ohe Bay, showed phase differences between and within populations. At Enewetak, the time of maximum larva release occurred consistently between new moon and first quarter. In Hawai`i, two morphological variants of this species were studied. The first type showed peak release of larvae near the lunar third quarter. The second consistently showed a peak between first quarter and time of full moon. A positive relationship was found to exist between environmental variability and degree of variation in the pattern of larval release.

Rodgers, K. (1997). "O`ahu's invasive algae." Aliens 6: 10.

Since 1950, at least 18 species of macroalgae have been introduced and became established on the island of O'ahu in the Hawaiian archipelago. Commercial, experimental, and accidental introductions have resulted in the establishment of alien species from several South Pacific locations, as well as Florida, California and Japan. Kane`ohe Bay is one of many O`ahu locations where some algae have established and become particularly successful.

Rodgers, R. G. (1967). Aspects of the reproduction of the Hawaiian limpet *Cellana exarata* (Reeve) (Mollusca: Gastropoda). Zoology. Honolulu, University of Hawai`i**:** 27.

A study of certain aspects of the reproduction of the Hawaiian limpet, *Cellana exarata*. Gonad development, spawning cycle, maturation and sex proportions of *C. exarata* were examined over a two year period, August 1960 - August 1962. Field collections were made on Pyramid Rock, Kane`ohe Bay. Results showed that both males and females matured at the same time when the shell length was 15-22 mm. There is a change in sex proportion of males and females with the males predominating in the smaller sizes and females more abundant at larger sizes. The sex proportion for the whole community of males to females was 1:4:1. Spawning occurred from April to August. The spawning cycle was described using 4 methods - mean egg diameter/month; visual stages of gonad development; egg diameter frequency/ month; and the gonad/body volume ratio.

Rodgers, S. K. and E. F. Cox (1999). "Rate of spread of introduced Rhodophytes *Kappaphycus alvarezzii*, *Kappaphycus striatum*, and *Gracilaria salicornia* and their current distributions in Kane'ohe Bay, O'ahu,

Hawai'i." Pac. Sci. 53(3): 232-241.
Spread of the introduced macroalgae *Kappaphycus alvarezzii* (Doty), *K. striatum* Schmitz, and *Gracilaria salicornia* C. Ag. was measured on reefs in Kane`ohe Bay, O`ahu, Hawai`i. The red algae *K. alvarezii* and *G. salicornia* were introduced to specific sites in Kane`ohe Bay in the 1970s. Since that time their distributions have increased, and the algae have spread through the bay. To assess the current extent of these algae in the bay and determine their rate of spread, we performed surveys with a manta tow board. In addition, abundance of these species was determined by detailed reef transects in the central bay in three habitats: barrier reef, patch reef, and fringing reef. All three species have become well established. These algae were found in all areas of Kane`ohe Bay. Distributions are not uniform within the central bay. Abundance of *Kappaphycus* spp. was highest on patch reefs in shallow water. *G. salicornia* was most abundant on the fringing reef. *K. alvarezii* and *K. striatum* have spread 6 km from their points of introduction in 1974, an average rate of spread of approximately 250 m per yr. *G. salicornia* has spread over 5 km since its introduction in 1978, an average rate of spread of approximately 280 m per yr. High abundance of these introduced species appears to be associated with moderate water motion.

Rodgers, S. K., N. A. Sims et al. (2000). "Distribution, recruitment, and growth of the black-lip pearl oyster, *Pinctada margaritifera*, in Kane`ohe Bay, O'ahu, Hawai'i." Pac. Sci. 54(1): 31-38.
Stocks of Hawaiian black-lip pearl oysters, *Pinctada margaritifera* (Linnaeus, 1758), appear to have been depleted by overfishing and environmental degradation. Permanent survey transect sites were set up in Kane`ohe Bay in 1989 to monitor changes in the status of stocks. Only 17 pearl oysters were found in 1989. Transects were resurveyed in 1997, and 22 pearl oysters were counted. Most were found on the slopes of patch reefs around the Sampan Channel in 2-6 m depth. Recruitment is low. Standing stock estimated from observed densities on transects in 1997 and the extent of available habitat is about 950 individuals. The size distribution of pearl oysters on transects indicates that they are fished, despite legal protection. Growth of *P. margaritifera* in Kane`ohe Bay is comparable with that in other locations. The prospects for commercial culture of black pearls in Kane`ohe Bay are limited by environmental constraints and the heavy recreational use of the bay.

Romano, S. L. (1988). "Evolutionary game theory applied to interspecific aggression among corals: Are corals really bullies?" Pac. Sci. 42: 131.
The hierarchy of aggression among the five most common reef flat species of coral in Hawai`i was determined by observing interspecific interactions in Kane`ohe Bay, O`ahu. Colonies of *Pocillopora damicornis, Porites compressa, Cyphastrea ocellina, Montipora verrucosa* , and *Fungia scutaria* were paired on the reef flat of Coconut Island in Kane`ohe Bay. *F. scutaria* was found to be the dominant aggressor followed by *C. ocellina* , *P. compressa and M. verrucosa* , and *P. damicornis* . Of the interactions, 87% resulted in unilateral damage by the species of higher rank to the species of lower rank. A coral does have the ability to identify the aggressive rank of another colony with which it comes in contact. This ability is used so as to fight only when there is a very high probability of winning. These observations seem to support the hypothesis that corals have evolved the strategy of a bully for interspecific interactions. Whether this is an evolutionarily stable strategy depends on the relative costs and benefits of a contest.

Rosa, A. E. (1969). " Territoriality and the Establishment of Dominance by means of Visual Cues in *Pomacentrus jenkinsi* (Pisces: Pomacentridae)." Z. Tierpsychol 26: 825-845.
Pomacentrus jenkinsi is a coral reef inhabiting fish which is territorial for its entire life, juvenile as well as adult (male-male) and (female-female) holding feeding territories which are strongly defended against conspecifics and other fish species. Fights between juveniles are displays where there is little or no physical contact between the partners, the fight being won or lost by visual cues afforded by changes in dorsal fin position and eye color, fright motivation being indicated by the raising of the dorsal fin and aggressive motivation by the darkening of the normally yellow eye. The function of territoriality in this species is thought to be a natural selection mechanism by which reproduction can only take place between the strongest and most aggressive of the males and females, since unsuccessful territory holders are not sexually ripe by the time the breeding season starts.

Ross, R. M. (1981). "Experimental evidence for stimulation and inhibition of sex change in the Hawaiian reef fish *Thalassoma duperrey*." Proc. 4th Intern. Coral Reef Symp., Manila 2: 575-580.
The saddleback wrasse, *Thalassoma duperrey*, is a diandric protogynous hermaphrodite. The adults consist of both initial phase (IP) females and males, and terminal phase (TP) males. Females and IP males spawning groups while females and TP males spawn in pairs on the reefs of Kane`ohe Bay.

Ross, R. M. (1982). Sex change in the endemic Hawaiian labrid *Thalassoma duperrey (*Quoy and Gaimard):

a behavioral and ecological analysis. Department of Zoology. Honolulu, Univ. of Hawai`i**:** 171 pp.

A field and laboratory study was conducted in Kane`ohe Bay to determine the factors that cause sex change in the saddleback wrasse, *Thalassoma duperrey*, a diandric protogynous hermaphrodite. Unlike other sequential hermaphrodites that have been studies, this species is non-haremic and non-schooling. The adults consist of both initial phase (IP) females and males, and terminal phase (TP) males. Females and IP males spawning groups while females and TP males spawn in pairs on the reefs of Kane`ohe Bay. The results show that sex change is socially controlled in T. duperrey, depends on stimulation from small conspecifics and is inhibited in the presence of larger conspecific females.

Ross, R. M. (1983). "Annual, semilunar, and diel reproductive rhythms in the Hawaiian labrid *Thalassoma duperrey*." Mar. Bio. 72: 311-318.

Reproduction of the labrid *Thalassoma duperrey* was studied for the population in Kane`ohe Bay, Hawai`i, from 1978 to 1981. Field observations of female reproductive behavior and histological study of the ovaries revealed annual, semilunar, and diel cycles. The percentage of females with ripe ova was greatest in winter and least in summer; moreover, the percentage of females spawning each day in summer was low in comparison to the rest of the year. A semilunar cycle was superimposed on the annual cycle, since the percentage of ripe, spawning females was greatest at new and full moons and least during the first and third quarters. On a daily basis, the percentage of ripe, spawning females was greatest during daytime high tide. The reproductive strategies of this and other species of shallow-water labrids are interpreted as evolutionary responses to both predation pressure and the need for short-range, within-habitat dispersal. A winter reproductive peak probably reduces the loss of pelagic larvae from the reef habitat due to weak oceanic currents. A semilunar reproductive peak on new and full moons probably maximizes short-range, within-habitat dispersal due to strong tidal currents. Spawning on the high tide should maximize the distance between newly spawned eggs and reef planktivores and may be the most effective anti-predator tactic available to daytime broadcast spawners.

Ross, R. M. (1984a). "Anatomical changes associated with sex reversal in the fish *Thalassoma duperrey* (Teleostei: Labridae)." Copeia 1: 245-248.

Few studies clearly show developmental changes in the entire reproductive tract during sex reversal. Here I describe anatomical changes in both the gonads and associated gamete transport systems of *Thalassoma duperrey*, a protogynous labrid abundant throughout the Hawaiian Archipelago. I also discuss the significance of these changes in the context of social organization and the sex change mechanism. Fish were taken from Kane`ohe Bay, O`ahu, Hawai`i between 1978 and 1981.

Ross, R. M. (1984b). "Growth and sexual strategies in the fish *Thalassoma duperrey* (Labridae), a protogynous hermaphrodite." Env. Bio. Fishes 10(4): 253-259.

Adults of the fish *Thalassoma duperrey*, a protogynous hermaphrodite, were collected and growth observed in captivity to study the relationship between growth and reproduction among primary males, females, and secondary males. Sexual maturity is reached at about 60 mm standard length, probably less than 1 year after fertilization. Gonosomatic index in both males and females peaks at about 120 mm, nearly 2 years later. Shortly thereafter females typically change sex, and both primary and secondary males undergo color change. At the same time gonosomatic index falls abruptly and remains low in large fish. The above changes appear to reflect differences in reproductive effort over a lifetime and are interpreted as the optimum strategy given the social and mating system of this fish. Unless they cannot acquire enough food to develop large gonads, small individuals put a much greater proportion of energy into growth than reproduction apparently to minimize the period of low fitness. Intermediate-sized males and females generally invest heavily in gametes, though some retain small gonads. Large individuals (both primary and secondary males) greatly reduce their investment in gametes, probably trading the energy required to maintain reproductive territories for it. This kind of gonad ontogeny involving gonad regression, as in *T. duperrey* and other labrid fishes, is unique among vertebrates. The data consist of gonad weights and indices, as well as histological observations, of *T. duperrey* taken from Kane`ohe Bay, O`ahu, Hawai`i from 1978 to 1981.

Ross, R. M. (1986). Social organization and mating system of the Hawaiian reef fish Th*alassoma duperrey* (Labridae). Second International Conference on Indo-Pacific Fishes. Indo-Pacific fish biology, Tokyo, Ichthyological Society of Japan.

Ross, R. M. (1987). "Sex-change linked growth acceleration in a coral-reef fish, *Thalassoma duperrey*." J. Exp. Zoo. 244: 455-461.

Environmental factors are known to affect the growth rates of fishes through most of their adult life. In the hermaphroditic saddleback wrasse (*Thalassoma duperrey*), the effects of social factors on growth were studied experimentally by subjecting individuals in submerged enclosures to various social environments that induce sex change. The results showed that social factors may either stimulate or inhibit the growth of adult fish. Individuals with one or more pen mates grew better than isolated individuals. Conspecifics stimulated more growth than heterospecifics. In paired fish, larger individuals inhibited the growth of smaller individuals. Growth rates were independent of both the sex and color phase of associates. Placing a tactile barrier between fish did not alter growth rates, but a tactile-visual barrier did. Increasing the space available to a fish did not increase the growth rate. Dominance relationships based on relative size and visual stimuli best explain the results obtained. Since all fish that showed growth acceleration also changed sex, a unitary, hypothalamically mediated, causal system is suggested. From an evolutionary perspective, sex-change linked growth acceleration may reduce the cost of changing sex by shortening the nonreproductive interim in species in which males must be large to compete successfully for multiple matings. Fish were taken from coral reefs in Kane`ohe Bay, O`ahu, Hawai`i, from September 1979 to June 1980.

Ross, R. M., G. S. Losey et al. (1983). "Sex change in a coral-reef fish: dependence of stimulation and inhibition on relative size." Sci. 221: 574-575.
The removal of a single dominant individual has been shown to trigger a sex change in some coral-reef fish. In the saddleback wrasse (*Thalassoma duperrey*), however, female-to-male sex change requires visual stimulation from smaller conspecifics. This change is not dependent on the sex or color of the stimulus fish and can be inhibited by larger conspecifics. On the reef, a female probably changes sex when the relative numbers of larger and smaller conspecifics change within her home range. Fish were taken from coral reefs in Kane`ohe Bay, O`ahu, Hawai`i.

Roth, A. A., C. D. Clausen et al. (1982). "Some effects of light on coral growth." Pac. Sci. 36(1): 65-.
The rate of coral growth under varied light regimes was tested using ^{45}Ca uptake while temperature was held constant. *Pocillopora damicornis* and *Acropora formosa*, respectively, were used in Hawai`i and Enewetak under natural and artificial light conditions. Light intensity and spectral distribution patterns were determined for all experiments. *P. damicornis* were collected from a depth of 6-11 m in Kane`ohe Bay, O`ahu, Hawai`i.

Rowe, M. D. (1971). Some aspects of the feeding behavior of the ctenophore *Pleurobrachia pileus*. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 62 pp.
Oikopleura longicauda and barnacle nauplii seem to be the major food of *Pleurobranchia pileus* in Kane`ohe Bay. Both of these prey animals have contagious distributions in the guts of the ctenophores indicating the presence of nonrandom processes. Three such processes are observed: (1) differences in vertical movements between predator and prey; (2) clumping of predator and prey; and (3) nonrandom feeding by the ctenophores. *Pleurobranchia* regulates its feeding rate by changing the average size of its tentacles. Four types of feeding result from different concentrations of *Artemia salina* nauplii.

Roy, K. J. (1970). Change in bathymetric configuration, Kane`ohe Bay, O`ahu, 1882-1969. Honolulu, University of Hawai`i, Hawai`i Institute of Geophysics**:** 226.
This report contains the results of a detailed bathymetric survey conducted in 1969. The data of this survey are compared to those of surveys done in 1882 and 1927, and changes-in the bathymetry of Kane`ohe Bay are noted. It was determined that the lagoon landward of the barrier reef had shoaled an average of 5.4 feet since 1927.
The composition of the lagoon sediments is characterized, and the results are included in the discussion of sedimentation in Kane`ohe Bay.

Russell, D. J. (1983). "Ecology of the imported red seaweed *Eucheuma striatum* Schmitz on Coconut Island, O`ahu, Hawai`i." Pac. Sci. 37(2): 87-107.
The introduced alga *Eucheuma striatum* Schmitz was studied regarding its spread, control, and ecology in Kane`ohe Bay, O`ahu, Hawai`i. Its distribution in Kane`ohe Bay during May 1976 was nearly the same as when it was originally planted 2 yr earlier. It lacked the ability to disperse over shallow depressions both in the reef and in deep water, and it did not colonize neighboring reefs without the help of man. Depth was the single most important physical factor limiting its dispersal. Data support the conclusion that the population on the reef edge was maintained only by a steady influx of thallus fragments that escaped from enclosed experimental plantings on the reef flat. When the experimental plantings were removed the population could not maintain itself and soon disappeared. *E. striatum* did not compete with native algal macrophytes and appeared to be the basis of a community richer in animal species than adjacent reefs. It provided 10-20 tons/mo of food for

grazing fish, shelter, and a substratum for numerous invertebrates. *E. striatum* did not attach to corals, but it did cause their death by shading.

Russell, D. J. (1992). The ecological invasion of Hawaiian reefs by two marine red algae, *Acanthophora spicifera* (Vahl) Boerg. and *Hypnea musciformis* (Wulfen) J. Ag., and their association with two native species, *Laurencia nidifica* J. Ag. and *Hypnea cervicornis* J. Ag. ICES Mar. Sci. Symp.
Acanthophora spicifera, a red seaweed, which was introduced to Hawai`i in the 1950s, is well established on all the Hawaiian islands except Hawai`i. It has a heterogenous distribution limited primarily by water motion between DIF 10-80 and temperature (25-27□C). Salinity has been less limiting (19-36□/□□). Competition between *Acanthophora* and two native algal species (*Laurencia* spp. and *Hypnea cervicornis*) is discussed. Another introduction, *Hypnea musciformis* entered the *Laurencia* niche in 1977 and has partially displaced *H. cervicornis*. Changes within the *Laurencia* niche due to the introduction of two alien species are discussed.

Russell, D. J. and G. H. Balazs (1994). "Colonization by the alien marine alga *Hypnea musciformis* (Wulfen) J. Ag. (Rhodophyta: Gigartinales) in the Hawaiian Islands and its utilization by the green turtle, *Chelonia mydas* L." Aquatic Bot. 47: 53-60.
In Hawai`i, the alien red algae, *Hypnea musciformis* (Wulfen) J. Ag., was originally planted on reefs in Kane`ohe Bay, O`ahu, in January 1974, but has since spread to many other locations on O`ahu and to other Hawaiian islands. This alga, along with the previously introduced alien seaweed, *Acanthophora spicifera* (Vahl) Boerg., is now being prominently used as a food source by the green turtle (*Chelonia mydas* L.) in the Hawaiian Islands. This is the first known documentation of introduced algae being incorporated into the diet of the green turtle, a species considered endangered world-wide.

Ryan, E. P. (1965). A study of the reproductive biology of the haole crab, *Portunus sanguinolentus* (Herbst) (Brachyura: Portunidae). Department of Zoology. Honolulu, University of Hawai`i**:** 194.
A reproductive study of the crab, *P. sanquinolentus,* including morphology, morphometry and number of sexually mature instars; changes in the gross and histological anatomy of the reproductive systems of the pre-adult and adult instars; functions of parts of the reproductive systems during the reproductive cycles and during copulation; reproductive behavior and determination of site of fertilization and method of ova attachment. The crabs were collected from the southern part of the bay from January 1962 to June 1964.

Ryan, E. P. (1966a). Structure and function of the reproductive system of the crab *Portunus sanquinolentus* (Herbst) (Brachyura: Portunidae) 1. The male system. Proc. Symp. on Crustacea, Mar. Biol. Assoc. India, part II.
A complete gross and histological study of the anatomy of the male reproductive system of *Portunus sanquinolentus*. Crabs were investigated during the molt cycle in pre-adult and the 3 adult instars. Function of each part of the reproductive system was ascertained during the reproductive period and during the process of copulation. Vital staining and the usual histological staining techniques were used to study the systems, experimental methods were used for the remaining studies. Crabs were collected from Kane`ohe Bay, January 1962 to June 1964.

Ryan, E. P. (1966b). Structure and function of the reproductive system of the crab *Portunus sanquinolentus* (Herbst) (Brachyura: Portunidae) II. The female system. Proc. Symp. on Crustacea, Mar. Biol. Assoc. India, part II.
A complete study of the gross and histological anatomy of the female reproductive system of the crab *Portunus sanquinolentus*. Crabs were investigated during the molt and reproductive cycles of the pre-adult and two adult instars. The function of each part of the reproductive system was ascertained during the reproductive cycle and during the process of copulation. The system was studied using vital staining and usual histological techniques; experimental methods were used for studying copulation and ovulation. Captive individuals were reared after breeding to determine the ovarian cycle. Crabs were collected in Kane`ohe Bay in wire traps from January 1962 to June 1964.

Ryan, E. P. (1966c). The morphometry of sexually mature instars in the crab, *Portunus sanquinolentus* (Herbst) (Brachyura: Portunidae). Proc. Symp. on Crustacea, Mar. Biol. Assoc. India, part II.
A study conducted over a two-year period in Kane`ohe Bay to establish the morphometric and morphological criteria for the determination of two sexually mature instars in females and three in males of *Portunus sanquinolentus (Neptunus sanquinolentus)*. Morphometric and morphological changes were ascertained from crabs which molted in captivity. Criteria of sexual maturity in males were verified by breeding experiments. Crabs were collected by traps set in Kane`ohe Bay from January 1962 to June 1964.

Ryan, E. P. (1966d). Pheromone: evidence in a decapod crustacean. Science. 151: 340-341.

A study conducted at the Hawai`i Marine Laboratory on *Portunus sanquinolentus* collected from Kane`ohe Bay involving the possible release of a sex-attractant pheromone in the urine of a premolt female. Experiments indicated that a pheromone in the form of a sex attractant permitted the males to detect the premolt condition of the females. It was also indicated that the pheromone was released through the excretory pores. Origin of the pheromone its chemical nature and the way it is detected by the males remains to be determined.

Sakuda, H. (1986). Estuarine fisheries in Hawai`i. Indo-Pacific Fishery Commission Expert Consult. on Inland Fisheries of the Larger Islands, 4-9 Aug, 1986, Bangkok, FAO, Rome.

Details are given of the fisheries of 3 estuarine habitats typical of Hawai`i: Pearl Harbor, Kane`ohe Bay and Hilo Bay

Sale, P. F. (1969). "A suggested mechanism for habitat selection by the juvenile manini *Acanthurus triostegus sandvicensis* Street." Behavior.

Santavy, D. (1986). A blue pigmented bacterium symbiotic with *Terpios granulosa*, a coral reef sponge. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01): 380-393.

Symbiosis between a blue-pigmented bacterial symbiont and its marine sponge host *Terpios granulosa* Bergquist was examined. Sensitivity to ultraviolet and full spectrum solar radiation indicated a requirement for a cryptic habitat, as occurs on Hawaiian coral reefs. Exposure to 50% UV radiation resulted in mortality of bacterium and, ultimately, sponge cells.

Santerre, M. T. (1974). Effects of temperature and salinity on the early eggs and larvae of the omaka *Caranx mate* (Pisces: Carangidae) in Hawai`i. Department of Oceanography. Honolulu, Univ. of Hawai`i: 163 pp.

Omaka (*Caranx mate*) eggs obtained from the plankton of Kane`ohe Bay and incubated in the laboratory between temperature of 17.2 and 30.1^{o}C and salinities between 20 and 40 ppt showed the following processes to be inversely proportional to temperature: incubation times, durations of the yolk sac stage, times to functional eye and jaw development and times to the attainment of maximum length during the yolk sac stage. Unfed omaka larvae attained the largest size at 25^{o}C. Salinity had very little effect on the time to functional eye and jaw development.

Santerre, M. T. (1976). "Effects of temperature and salinity on the eggs and early larvae of *Caranx mate* (Cuv. & Valenc.) (Pisces: Carangidae) in Hawai`i." J. exp. mar. Biol. Ecol. 21: 51-68.

Eggs and larvae of the carangid fish, *Caranx mate*, were incubated at various temperature (17.2 to 33.1°C) and salinity (10 to 42 ppt) combinations in five experiments. The following rates were directly proportional to temperature: embryonic development, yolk absorption, eye and jaw development, and increase in length. Unfed *C. mate* larvae attained a maximum size at 25°C and 20°C . Eyes and jaws of larvae were functional by the end of the yolk sac stage at all temperature and salinity levels tested. Hatching success and larval survival at the end of the yolk sac stage were generally greater than 50% between 20 and 32°C. Hatching success and larval survival at the end of the yolk sac stage were reduced at salinity combinations. The frequency of morphological abnormalities was also high at extreme temperatures and salinities. The incipient upper thermal TL$_m$ for unfed *C. mate* larvae acclimated to 23.8°C increased from 31.5°C for newly hatched larvae, to 34.2°C for 72 h larvae, but decreased to 32.0°C for starving larvae after the exhaustion of the yolk supply. *C. mate* eggs were collected by surface plankton hauls in the southern sector of Kane`ohe Bay, O`ahu.

Santerre, M. T. and R. C. May (1977). "Some effects of temperature and salinity on laboratory reared eggs and larvae of *Polydactylus sexfilis* (Pisces: Polynemidae)." Aquaculture 10: 341-351.

Effects of temperature and salinity on eggs and yolksac larvae of *Polydactylus sexfilis* (Cuvier and Valenciennes) were examined in laboratory experiments. Data on developmental rates as influenced by temperature are presented. Larval length at 95% yolksac absorption was maximized between 23.8°and 28.6°C. Based on the development of functional eyes and jaws were judged functional. Temperature and salinity effects on hatching success, survival at the end of the yolksac stage, and morphological abnormalities were studied in a 10 x 5 (temperature x salinity) array of treatments. In 34°C sea water, normalized larval survival at the end of the yolksac stage was greater than 50% between temperatures of 21.9 and 28.0°C. Larval survival decreased at lower temperatures and salinities. Proportions of abnormal larvae increased at temperature and salinity extremes, and normal development was maximized between 26 and 34°C. Larvae (74 h after fertilization) were more tolerant to extreme high temperatures than were newly fertilized eggs. Upper salinity tolerance limits of 42-h larvae were greater at 26.2°C than at 23.5 or 29.2°C, and lower salinity was less tolerated at the two extreme temperatures. Based on the results, recommended temperatures and salinities for rearing *P. sexfilis* eggs and early larvae are 24-28°C and 26-34°C.

Sather, B. T. (1965). Studies in the mineral metabolism of the Hawaiian crab, *Podophthalmus* (Fab.) throughout the ecdysis cycle. Department of Zoology. Honolulu, University of Hawai`i: 147.
A study on the metabolism of the Hawaiian crab during the entire molt cycle with records of the concentrations and distributions of the minerals during times of calcification and decalcification. Consideration is given to the controlling factor of the calcification process and the distribution of the factors involved during the calcification process. In regard to the latter problem, the chromium ion is considered. Crabs were collected in Kane`ohe Bay by the use of crabs nets in the southern portion of the Bay between Kane`ohe Stream and the Kane`ohe Bay marina.

Sather, B. T. (1966). "Observations on the molt cycle and growth of the crab, *Podophthalmus vigil* (Fabricus) (Decapoda: Portunidae)." Crustaceana 11: 185-197.
A study conducted at the Hawai`i Marine Laboratory using animals collected from Kane`ohe Bay noting the duration of the molt stages, the frequency of molting in a wild population and the effects of some environmental factors on the frequency of molting as well as growth measurements during molting. Results showed that 12 hours after: ecdysis calcification had begun in the principle layer; 24 hours after: the crabs were sufficiently calcified to commence near-normal activity; 2-3 days after molting: about half of the skeleton was sclerotized and 4-5 days after: the skeleton was completely calcified. Intermolt stage lasted 2 days. Percentage durations of the molt stages of other crabs studied by other authors are given for comparison. It was difficult to determine exactly what temperature inhibited molting as the annual temperature fluctuated only 6.3°C (22.3° - 28.6°C).

Sather, B. T. (1967). "Studies in the calcium and phosphorus metabolism of the crab, *Podophthalmus vigil* (Fabricus)." Pac. Sci. 21(2): 193-209.
A study conducted at the Hawai`i Marine Laboratory with specimens collect in Kane`ohe Bay. The calcium and total phosphorus concentrations of the carapace, mid-gut gland, gills and muscles were followed during the molt cycle. Calcium content was determined by the spectrophotometric analysis of Geyer and Bowie in the ashed samples and by the method of Ferro and H with the blood samples. Phosphorus content in both the ashed and blood samples was determined by the method of Bernhardt, Chess and Roy. The carapace had the greatest inorganic fluctuations. The mid-gut gland and muscle tended to increase in both organic and inorganic matter during premolt, suggesting that these organs may serve as reservoirs for these components.

Sather, B. T. (1969). "A comparative study of amylases and proteinases in some decapod Crustacea." Comp. Biochem. Physiol 28: 371-379.
Amylase, protease and cathepsin activities in midgut gland extracts of six decapod crustaceans were determined. The amylase pH optimum of the crab, *Metapograpsus messor*, was 8.0. The protease and cathepsin pH optima of the portunid crab, *Podophthalmus vigil*, were 7.9 and 6.0, respectively. Comparison of the digestive enzymatic activities revealed that the three omnivores had greater amylase and proteinase activities than did the carnivores. Food preference in two sympatric species, *P. vigil* and *Portunus sanguinolentus*, may be due to difference in catheptic activities. The semiterrestrial and marine decapods were collected from Kane`ohe Bay, O`ahu, Hawai`i; the crayfish were collected from Kane`ohe Stream.

Satoru, T. and E. A. Laws (1989). Periodic blooms of the silicoflagellate *Dictyocha perlaevis* in the subtropical inlet, Kane`ohe Bay, Hawai`i, U.S.A. Red Tides: Biology, Environmental Science, and Toxicology. T. Okaichi, D. M. Anderson and T. Nemoto. Honolulu, Elsevier Science Publishing Co., Inc.: 69-72.
The silicoflagellate *Dictyocha perlaevis* was collected weekly for a period of one year at a station in the subtropical inlet of Kane`ohe Bay, O`ahu, Hawai`i, USA. Cell density was usually less than 5 cells/^{l} with maximum cell density of 47 cells/^{l}. Periodic blooms occurred 11 times during the year. The occurrence of blooms seems to be associated with high nutrient-saturated growth rates as a result of favorable light and temperature conditions or other factors and not to a change in the degree of nutrient limitation.

Scelfo, G. (1985). The effects of visible and ultraviolet solar radiation on a UV absorbing compound and chlorophyll *a* in a Hawaiian zoanthid. Proc. Fifth Inter. Coral Reef Cong., Tahiti.

Methanolic extracts from *Zoanthus pacificus*, a zoanthid living on Hawaiian coral reef flats contain a material absorbing strongly in the UV-B regions (280-340 nm) with an absorption maximum at 320 nm. By analogy to the zoanthid *Palythoa tuberculosa* this material is believed to consist primarily of the mycosporine-like amino acid palythine, which is reputed to have a protective UV-screening function. I investigated the effects of visible and UV solar radiation on the production of palythine and chlorophyll *a* content by transplanting zoanthids from the reef flat to aquariums with controlled light regimes. The 4 experimental light regimes included full intensity sunlight with and without UV, and shaded conditions with and without UV. After one month, palythine concentration had increased dramatically in zoanthids in all light conditions including controls that were handled but immediately replaced to the original field site. This suggests that mechanical stress may stimulate palythine production. UV radiation may be required for continued production, however, as zoanthids shielded from UV apparently decreased in palythine after 2.5 months, while those receiving UV did not. Chlorophyll *a* concentration was affected by visible light intensity, but not by UV. Chlorophyll *a* decreased in full sunlight and increased in the shade, regardless of UV. This study was conducted on Coconut Island, Kane`ohe Bay, O`ahu.

Scelfo, G. (1986). Relationship between solar radiation and pigmentation of the coral *Montipora verrucosa* and its zooxanthellae. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 440-451.

Colonies of *Montipora verrucosa* were transplanted from 3 m and 10 m depths to shallow aquaria (20 cm) and exposed to solar radiation with and without ultraviolet (UV) radiation under full intensity and shaded conditions. *M. verrucosa* from 3 m had much higher concentrations of a UV absorbing compound than the colony from 10 m. The 10 m colony did not survive in full sunlight, while the 3 m colony survived the increased light intensity and UV radiation. A significant increase in the concentration of UV absorbing pigment was evident for all surviving corals and was greater for corals in full sunlight than for those in the shade. Corals exposed to UV radiation had at least double the amount of S320 pigment as corals receiving the same light intensity but without UV.

Schwarz, J. (1998). Late development and acquisition of zooxanthellae in larvae of *Fungia scutaria*. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 113-118.

In this paper, I build on the work of Krupp (1983) by describing several features of late larval development in *Fungia scutaria*, including feeding behavior, timing and mechanisms for acquisition of symbionts, and developmental progression from planula through metamorphosis. Larvae were gathered from *F. scutaria* maintained at HIMB, Coconut Island, Kane`ohe, O`ahu.

Shaklee, J. B. (1984). "Genetic variation and population structure in the damselfish, *Stegastes fasciolatus*, in the Hawaiian Archipelago." Copeia 3: 629-640.

Samples of the Pacific damselfish, *Stegastes fasciolatus*, were collected from localities throughout the Hawaiian Archipelago (Midway, Maro Reef, French Frigate Shoals, O`ahu, and Hawai`i) and subjected to starch gel electrophoretic analysis of 44 enzyme-coding loci. Eight loci were polymorphic. With one exception, all loci at all localities were in Hardy-Weinberg equilibrium. The average heterozygosity across all loci was 0.046 for the species. Allele frequencies at all eight loci were stable over a 12-month period and were remarkably constant throughout the Archipelago - a linear distance of approximately 2,500 km. Furthermore, with the exception of a few very rare alleles, all populations exhibited the same spectrum of alleles at each locus. Whether the localities are analyzed pairwise or as two major groups - 'main' Hawaiian Islands (O`ahu and Hawai`i) vs Northwestern Hawaiian Islands (Midway, Maro Reef, and French Frigate Shoals) - the data provide no evidence of subpopulation differentiation. Indeed, the homogeneity of allele frequencies at the eight polymorphic loci argues strongly for the existence of a single large panmictic population of *Stegastes faciolatus* throughout the Hawaiian Archipelago.

Shaklee, J. B. and P. B. Samollow (1984). "Genetic variation and population structure in a spiny lobster, Panulirus marginatus, in the Hawaiian Archipelago." Fishery Bulletin 82(4): 693-702.

Shashar, N., A. T. Banaszak et al. (1997). "Coral endolithic algae: life in a protected environment." Pac. Sci. 51: 167-173.

Endolithic algae living inside skeletons of living corals are exposed to very low light intensities. Assays carried out on the coral Porites compressa revealed drastic diurnal fluctuations in pH and O sub(2) levels within the skeleton, dominated mainly by coral photosynthesis by day and respiration at night. Enzymatic activity of carbonic anhydrase and catalase, as well as photosynthetic adaptations to low light level and low metabolic activity rates, enable the algae to grow in this unique habitat.

Shashar, N., S. Kinane et al. (1996). "Hydromechanical boundary layers over a coral reef." J. Exp. Mar. Biol. Ecol. 199: 17-28.

Three hydrodynamic boundary layers were measured over a coral reef, dominated by *Porites compressa* and *Montipora verrucosa* corals, in Kane`ohe Bay, Hawai`i. These measurements were used to evaluate the applicability of present models describing boundary layers and to define the range in which processes governed by them takes place. The Diffusion Boundary Layer (DBL), related to diffusion-limited processes such as respiration and photosynthesis, was thicker over *M. verrucosa* than over *P. compressa* (2.00 +- 0.6 and 1.42+-0.4 mm, respectively). The Momentum Boundary Layer (MBL), controlling water movement in the proximity of the sessile organisms, was thicker over *M. verrucosa* than over *P. compressa* as well (97 +- 27 and 58 +- 24 mm, respectively), corresponding to the stronger requirement for water motion by the former, and was thicker by an order of magnitude than the DBL. The Benthic Boundary Layer (BBL), controlling the interactions of the reef with the open sea waters, was found to be more than 1 m thick and was characterized by a roughness height of 31 cm and a shear velocity (u.) of 0.42 cm s-1. The BBL was composed of three distinguished segments, a lower sublayer with slow water motion throughout its height, an inner sublayer up to the height of the coral knolls, and a fully developed outer BBL. This structure of the BBL suggests that: (1) sedimentation at the lower segment of the BBL is contributing to the patchy structure of this reef; and (2) high corals colonies increase sedimentation while reducing water motion and food supply from lower colonies located within the lower and middle segments of the BBL.

Sims, N. A. and D. J. Sarver (1994). "Hatchery culture of the black-lip pearl oyster in Hawai`i--stock re-establishment and expansion of commercial pearl culture throughout the region." J. Shellfish Res. 13: 350.

The establishment of a commercial hatchery for black-lip pearl oysters (*Pinctada margaritifera*) at the OTEC facility in Kona, Hawai`i, has significance for the preservation of threatened populations, as well as opening up commercial pearl culture potential for Hawai`i and other Pacific Islands. The Hawaiian variety of black-lip (P. m. galtsoffi) was over-fished in the past, and is now rare to the point of being protected by the State. Relict stocks in Pearl and Hermes Reef, Kane`ohe Bay, and along the Kona Coast show no signs of recovery. Hatchery culture would allow a stock re-establishment program. Ocean-based pearl farming options are being explored at several sites throughout the Hawaiian Islands. Land-based pearl culture is also being developed at the OTEC plant in Kona. The feasibility of using pathogen-free deep-OTEC water for broodstock maintenance, larval culture and early spat rearing has been proven in trials with Marshall Island pearl oysters. These techniques remove the risks of inadvertent transfer of exotic organisms (pathogenic or benign) and genetic mixing between stocks. Pacific Islands with small quantities of broodstock can now use this system to provide spat for stock re-establishment or development of commercial pearl culture. With this technology, the natural scarcity of pearl oysters in a lagoon is no longer a principal constraint to the development of pearl farming. The Kona facility can operate as a regional hatchery for the central Pacific, obviating the need for expensive construction and operation of pearl oyster hatcheries on each island group.

Skolnick, M. S. (1965). Aggressive behavior of the adult portunid crab, *Portunus sanquinolentus* (Herbst). Department of Zoology. Honolulu, University of Hawai`i.

A study of various aggressive behaviors plus three display patterns - threat, submissive and defense patterns of the crab, *Portunus sanguinolentus*. In the laboratory, hierarchy in behavior was studied using small samples. The crabs were collected in the vicinity of Coconut Island in Kane`ohe Bay.

Results showed these aggressive displays to be visual and therefore occurred during daylight. Dominance-subordinance situations result from these aggressive encounters in the laboratory while these hierarchies are probably temporary in the field. Size is the most important factor in affecting dominance in intra-sexual situations. Size and sex are both important in inter-sexual encounters. Phase of molt-cycle, individual differences and prior experience also function in determining dominance. *P. sanquinolentus* appears to be capable of distinguishing on specifics by visual and tactile senses but itdoes not appear to distinguish between individuals.

Skyring, G. W. (1985). "Anaerobic microbial processes in coral reefs sediments." Proc. Fifth Inter. Coral Reef Cong., Tahiti 3: 421-425.

Microbial anaerobic processes occur in sediments associated with coral reefs even though many appear to be well aerated by physical mixing or bioturbation. Bacterial sulfate reduction, a strictly anaerobic respiration process, is the most easily demonstrated indicator of anaerobic processes in marine sediments. It results in the production of sulfide which has been shown to occur in the sediments of Kane`ohe Bay, Bermuda, Jamaica, Lizard Island and Davies Reef. Sulfate reduction rates in these sediments are low when compared to those for most other marine environments. A maximum of around 8mmol m-2 day-1 was measured for the top 5cm of the sediment from the back lagoon of Davies Reef. In the back reef lagoon, 90% of the sulfate reduction occurred in the top 2cm sediment. Up to 60% of the 35S recovered in the sulfide fractions, occurred in a tin-reducible fraction.

Smith, A. A. C. (1994). The effects of nutrient loading on C:N:P: rations of marine macroalgae in Kane`ohe Bay, Hawai`i. Oceanography. Honolulu, University of Hawai`i.

Smith, C. R. and H. Kukert (1996). "Macrobenthic community structure, secondary production, and rates of bioturbation and sedimentation at the Kane`ohe Bay lagoon floor." Pac. Sci. 50: 211-229.

The Kane'ohe Bay lagoon floor is one of the largest shallow-water, muddy habitats in Hawai'i and is a major repository for sediments and, possibly, pollutants from the Kane'ohe watershed. Nonetheless, macrobenthic community structure, secondary production, and particle-mixing rates at the lagoon floor remain largely unstudied. During 1990-1991, we surveyed macrobenthic community structure at four stations 12 m deep at the lagoon floor and evaluated macrobenthic secondary production, as well as particle mixing and sedimentation, at one representative station. Macrobenthic abundance in the lagoon during our survey was high (44,000-100,000 individuals m-2), with very small deposit-feeding polychaetes dominating the community. This low-diversity assemblage was relatively similar throughout the bay and resembled the communities found in highly depositional environments (e.g., river deltas, and zones of active erosion and redeposition). Macrobenthic secondary production at the representative station was low, with a best estimate of 4.9 g m-2 yr-1 ash-free dry weight (reasonable range 1.2-20 g m-2 yr-1); this appeared to be enough production to support 2% of the annual fish yield in Kane'ohe Bay. Tracer-particle experiments at the representative station, sampled after 7 months and 1 yr, indicated low sediment-mixing rates (diffusive mixing coefficient apprx 0.9 cm-2 yr-1), little size dependence in particle mixing, and relatively high short-term rates of sedimentation (6-7 cm yr-1). After corrections for sediment compaction, these short-term sedimentation rates (2.7-3.7 cm yr-1) are about three-fold higher than longer-term (decadal) sedimentation rates (approx. 1.0 cm yr-1) estimated using Pb-210 geochronology at a nearby site; the discrepancy may be caused by sediment transport from nearby fringing reefs, resuspension of bottom sediments by alpheid shrimp, or interannual variability of sediment flux into the bay. We conclude that the Kane'ohe Bay lagoon harbors a low-diversity, low-productivity macrobenthic assemblage largely structured by high gross sedimentation rates. In addition, we conclude that sand-sized particles entering the bay are rapidly (within months) sequestered below the sediment-water interface, where they remain for at least 1-yr time scales.

Smith, C. R. and G. M. McMurtry (1995). Rates of sedimentation in Kane`ohe Bay lagoon based upon Pb-210 geochronology and Cs-137 penetration depth. Final Report. Honolulu, State of Hawai`i, Department of Land and Natural Resources.

Smith, J. E., C. L. Hunter et al. (In press). "Distribution and reproductive characteristics of nonindigenous and invasive marine algae in Hawai`i." Pac. Sci.

Smith, L. C. (1986). Larval releases in the sponge *Callyspongia diffusa*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 286-291.

Release of larvae from *Callyspongia diffusa* was noted in early August, 1983 at Coconut Island in Kane`ohe Bay, Hawai`i. The larvae swam about a finger bowl propelled by their surface cilia for about 16 h and were found settled on the bottom of the bowl the following day. Histological observations of the larvae forming within the parent sponge were more consistent with that of embryo development than with gemmule formation.

Smith, S., R. E. Brock et al. (1980). Kane`ohe Bay sewage diversion experiment: perspectives on ecosystem responses to nutritional perturbation. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology,**:** 229 pp.

Smith, S. V. (1977). "Kane`ohe Bay: A preliminary report on the responses of a coral reef/estuary ecosystem to relaxation of sewage stress." Proc. 3rd Intern. Coral Reef Symp., Miami 2: 577-583.

Data are in terms of budgets. No time period of sampling indicated. Some data divided into northwest, central and southeast regions of the Bay.

Smith, S. V. (1979). Kane`ohe Bay: nutrient mass balance, sewage diversion, and ecosystem responses. Advances in Marine Environmental Research, Environmental Protection Agency.

Kane`ohe Bay, Hawai`i, is a coral reef/estuary ecosystem presently subjected to stresses from sewage discharge and runoff. The sewage discharge is scheduled to be diverted from the bay. This "relaxation" of sewage stress will be a major ecosystem perturbation: the termination of a chronic stress which has been imposed, with increasing intensity, on the bay over the past two decades. We are treating this sewage diversion event as a controlled experiment designed to ascertain ecosystem responses to such environmental perturbation. The experiment is being performed by means of time-series field monitoring, discrete field studies, and laboratory experiments. The stream runoff imposes short-term, catastrophic stress from fresh water and sediment influx. The sewage accounts for about 90 percent of the land-derived nutrient delivery to the bay, thus imposing an influence which stimulates biological activity. The sediments in the bay have been a major repository for nutrients discharged into the bay; nutrient release from the sediments has been, and will continue to be, a significant process affecting the ecosystem. When the sewage stress is relaxed, planktonic responses to that event will be more rapid than benthic responses; both because the plankton are immediately responsive to the point-source sewage discharge, and because of characteristic high biomass, efficient nutrient cycling, and limited mobility of benthic organisms.

Smith, S. V. (1981). Responses of Kane`ohe Bay, Hawai`i, to relaxation of sewage stress. Estuaries and Nutrients. B. J. a. C. Neilson , L. E., Humana Press**:** 391-410.
Kane`ohe Bay is a subtropical coral reef/estuary complex which was subjected to increasing sewage loading; that sewage was diverted in 1977 and 1978. We have treated the loading and diversion as a controlled, total-ecosystem experiment to evaluate the chemical and biological responses to external subsidy of nutrients. We here consider the bay's response to sewage loading and to its diversion largely in the context of a nitrogen budget. Even the most heavily impacted portion of the bay showed only moderate increases in dissolved nitrogen levels within the water column. Particulate materials including plankton biomass, as well as dissolved inorganic phosphorus, were elevated substantially. The benthos showed increased biomass and metabolic rates, especially of heterotrophs responding to fallout of organic particulate materials. Nutrient recycling within the bay was the major immediate source for the nutrients for the observed rapid metabolic activity. Sewage accounted for approximately 80 percent of the inorganic nitrogen and 90 percent of the inorganic phosphorus delivery to Kane`ohe Bay. Diversion lowered the land-derived inorganic nitrogen and phosphorus input to the bay by 70-80 percent. Virtually all components of the system have responded to this diminished nutrient subsidy, but the water column nutrient washout and biological recovery are predictably occurring more rapidly than the benthos responses.

Smith, S. V., R. W. Buddemeier et al. (1979). "Strontium-calcium thermometry in coral skeletons." Science 204: 404-407.
The strontium to calcium ratio of skeletal aragonite in three genera of reef-building corals varies as a simple function of temperature and the strontium to calcium ratio of the incubation water. The strontium/calcium distribution coefficients of coral aragonite apparently differ from the corresponding coefficient of inorganically precipitated aragonite. With some care, coral skeletons can be used as recording thermometers.

Smith, S. V., K. E. Chave et al. (1973). Atlas of Kane`ohe Bay: A Reef Ecosystem Under Stress. Honolulu, University of Hawai`i, Sea Grant Program**:** 128 pp.
Preliminary report on the results of the first comprehensive marine environmental study of Kane`ohe Bay, conducted 1968-72, during the period when secondary treated sewage in the south bay was near or at its maximum. Sampling include detailed surveys of substratum, reef corals, reef fishes, and benthic algae, and limited surveys or summaries of micromollusks, pelagic and larval fish and general invertebrates.

Smith, S. V. and D. T. O. Kam (1973). Substrate of the bay. Kane`ohe Bay: A Reef Ecosystem Under Stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Sea Grant. UNIHI-SEAGRANT-TR-72-01**:** 23-36.
Description of distribution of primary substrata of Kane`ohe Bay, summarized as mud, sand, hard bottom, live coral, dead coral, and coral rubble, generalized maps of sediment calcium carbonate content, percent aragonite and changes in bay depth 1982-1927 and 1927-69.

Smith, S. V., W. J. Kimmerer et al. (1981). "Kane`ohe Bay Sewage Diversion Experiment: perspectives on ecosystem responses to nutritional perturbation." Pac. Sci. 35: 279-402.
The bay received increasing amounts of sewage from the 1950's through 1977. Most sewage was diverted from the bay in 1977 and early 1978. This investigation, begun in Jan. 1976 and continued through August 1979, described the bay over that period, with particular reference to the responses of the ecosystem diversion. The sewage was a nutritional subsidy. All of the inorganic nitrogen and most

of the inorganic phosphorus introduced into the ecosystem were taken up biologically before being advected from the bay. The major uptake was by phytoplankton, and the internal water-column cycle between dissolved nutrients, phytoplankton, zooplankton, microheterotrophs, and detritus, supported a rate of productivity far exceeding the rate of nutrient loading.

Snidvongs, A. E. (1988). "Effect of nutrient enrichment on the zooxanthellae of a reef coral, *Pocillopora damicornis*." Pac. Sci. 42: 132-133.
Pocillopora damicornis, a symbiotic coral, was kept in the following 4 controlled nutrient regimes for 8 weeks: ambient unfiltered Kane`ohe Bay seawater; nitrogen addition as ammonium chloride to approximately equals 15 mu m above ambient level; phosphorus addition as potassium phosphate (monobasic) to approximately equals 1 mu m above ambient; and both nitrogen and phosphorus addition to the levels of 2 and 3. In the control treatment atomic N:C and P:C ratios of symbiotic zooxanthellae were well below Redfield ratio, suggesting nutrient limitation. Nitrogen enrichment resulted in an increased cellular nitrogen content. When only phosphorus was added, both C and P per cell decreased, suggesting the possibility of smaller cell, and thus, higher cell division rate. Under these experimental conditions, zooxanthellae did not respond to elevated phosphorus by increasing cellular phosphorus content and P:C ratio. Possibly, the in situ availability of phosphorus was not enhanced by the same mechanism as nitrogen.

Soegiarto, A. (1969). Primary productivity of benthic algae in a tropical bay. Botanical Sciences. Honolulu, University of Hawai`i**:** 53.

Soegiarto, A. (1969). Preliminary checklist of marine algae collected from Kane`ohe Bay. Honolulu, Sea Grant Program, University of Hawai`i.
A preliminary report on the algae of Kane`ohe Bay for the Coral Reef Project which was funded by the federal Sea Grant Program. Soegiarto lists seventy-nine species, some of which are rare: *Scinaia hormoides* and *Gibsmithia Hawaiiana, Rosenvingea orientalis* and *Cladosiphon novaecaledoniae*, the latter two algae being new records for Kane`ohe Bay.

Soegiarto, A. (1972). The role of benthic algae in the carbonate budget of the modern reef complex, Kane`ohe Bay. Dept. Botanical Sciences, Univ. of Hawai`i**:** 313.
In the course of this study, 364 stations were occupied in order to assess the role of benthic algal communities in the carbonate production of this bay. A correlation coefficient matrix was constructed for the 68 taxa of algae and other organisms recorded at 5% or more of the stations. The factor analysis performed on the data isolates four factors governing the distribution of the Kane`ohe Bay organisms. They are identified as "reef slope", "high energy environment", "pollution-intolerance" and "pollution-tolerance" factors. Only the last 3 are significantly correlated with the distribution of the benthic algae. The first factor correlates only with the distribution of a few species of corals and fishes. Together, these 4 factors account for only about 42% of the total variance. A *Sargassum* community dominates the high-energy environment, whereas an *Acanthophora-Halophila* community occupies the low energy environment shoreward of the barrier reef.

Soegiarto, A. (1973). Benthic algae in the bay. Kane`ohe Bay: a reef ecosystem under stress. S. V. Smith, K. E. Chave and D. T. O. Kam. Honolulu, University of Hawai`i Sea Grant**:** 67-90.
Brief description of the most common algae species in Kane`ohe Bay in 1968-72 and maps summarizing their distributions.

Sorokin, Y. I. (1972). "Bacteria as food for coral reef fauna." Oceanology 12: 169-77.
his investigation was undertaken to determine the degree to which the microflora of a coral reef and the microflora of the waters above it can serve as a source of food for fauna occupying a marine biocoenosis, such as that in Kane`ohe Bay. Judging by the data presented, the microflora in the water and sediments of the coral biocoenosis may be a principal source of nutrition for most of the fauna of mud-eating and filter-feeding invertebrates. Calculations show that the microflora of a coral reef is an intermediate trophic link by which the energy of primary production and detritus is included in the production process.

Soule, D. F. and J. D. Soule (1968). "Bryozoan fouling organisms from O`ahu, Hawai`i with a new species of *Watersipora*." Bull. S. Calif. Acad. Sci. 67: 203-218.
A study of the bryozoan fouling organisms found on fixed and floating docks, rafts, and boat hulls in Kane`ohe Bay, the Ala Wai Yacht Harbor, the Ala Wai Marine Ltd and from metal test panels and glass slides mounted in screened racks suspended in Kane`ohe Bay. The authors refer to the University of Hawai`i and to the B. P. Bishop Museum collections. Included is a bibliography of fouling organisms of

O`ahu and a key to the fouling bryozoans of O`ahu

Soule, D. F. and J. D. Soule (1987). Phyla Entoprocta and Bryozoa (Ectoprocta). Reef and Shore Fauna of Hawai`i. Section 2:Platyhelmihtes through Phoronida. D. M. Devaney and L. G. Eldredge. Honolulu, Bishop Museum Press. B. P. Museum Spec. Publ. 64(2)**:** 83-166.

Southward, A. J., R. S. Burton et al. (1998). "Invasion of Hawaiian shores by an Atlantic barnacle." Mar. Ecol. Prog. Ser. 165: 119-126.
A largely vacant niche in the upper mid-littoral zone of sheltered Hawaiian shores is now occupied by *Chthamalus proteus* Dando & Southward, 1980 (Crustacea, Cirripedia), otherwise found in the Caribbean, the Gulf of Mexico and Brazil. The identity of the species was established by morphological details and confirmed by allozyme electrophoresis. Previously, chthamaline barnacles have rarely been found fouling hulls of ships; this is the first recorded instance of regular occurrence on ships as well as of remote dispersal in the genus. While the introduction of *C. proteus* apparently has had little impact so far, there is a need to step up monitoring programs so as to prevent rather than simply detect future introductions.

Sparks, A. K. (1963). Survey of the oyster potential of Hawai`i. Honolulu, Hawai`i Depart. Land and Nat. Resources**:** 44.
An investigation of Pearl Harbor and Kane`ohe Bay including a survey of the extent and status of the oyster beds, analysis of the size and age composition of the oysters on the bed, box counts, examination of boxes for evidence of predation, a study of associated fauna, study of the condition index of marketability, species composition and consideration of problems associated with fecal contamination. A secondary phase of the investigation was to consist of a cursory survey of selected shore areas around the islands of O`ahu, Kauai, Hawai`i, Maui and Molokai to determine the suitability of these areas for the stocking of oysters and/or other shellfish such as clams.
Plantings of *Crassostrea virginica* were made in Kane`ohe Bay in 1923, 1924 and 1940. Apparently none of these ventures were successful. The Japanese C. gigas was imported in 1939 to Coconut Island and Mokapu and they are still found in Kane`ohe Bay. The Australian *C. commercialis* was introduced into Kane`ohe Bay in 1929 but the stock died within 6 months of planting. *C. amasa* from Australia was introduced into Coconut Island in 1956. Present studies indicate that the original population has died out.
Preliminary examination of Kane`ohe Bay on March 13, 1963 from the Yacht Club Basin to Coconut Island to Matson's Point and back along Heeia fishpond showed a heavy set of *C. gigas i*n the eastern portion of the bay and scattered individuals elsewhere. No *C. amasa* were seen. The study recommended that *C. virginica* could grow in Kane`ohe Bay. Trans-plantings were made from beds in West Loch to hard bottom areas in the western side of Kane`ohe Bay so that their survival, rate of bacterial loss and condition could be determined. Results were not included in this report.

Stambler, N., N. Popper et al. (1991). "Effects of nutrient enrichment and water motion on the coral *Pocillopora damicornis*." Pac. Sci. 45: 299-307.

Stanton, F. G. (1985). Temporal patterns of spawning in the demersal brooding blackspot sergeant *Abudefduf sordidus* (Pisces, Pomacentridae) from Kane`ohe Bay (Hawai`i). Proc. 5th Intern. Coral Reef Congr., Tahiti.
The spawning activities of the blackspot sergeant were studied for 22 months. Time series analysis of these data indicates that spawning is related to biotic as well as abiotic environmental cycles. An annual seawater temperature cycle regulates the onset and duration of the breeding season. The lack of spawning synchrony between adjacent study sites indicates that temporal cycles of less than 30 days are closely related to biotic factors rather than abiotic factors in the environment.

Stanton, F. G. (1988). "Response to supplemental feeding by a non-breeding wild population of maomao, *Abudefduf abdominalis* (Pisces: Pomacentridae)." Pac. Sci. 42: 133.
Commercial fish food was provided to colonies of maomao (*Abudefduf abdominalis*), testing the hypothesis that supplemental feeding would induce spawning in a non-breeding colony. The study was conducted at (Coconut Island) in Kane`ohe Bay, O`ahu. Daily spawning activities were recorded at experimental and control sites 6 weeks prior to, during, and 6 weeks after the treatment. Samples of liver, gut, gonad, and muscle tissues from fish collected before and after the treatment indicated that the experimental group in the non-breeding colony accumulated more lipids than a control population that was not fed supplemental fish food. Spawning in the non-breeding colony was not induced during the six-week period of supplemental feeding, however when spawning began three weeks after the feeding ended, the experimental colony had more clutches than the control colony. A breeding colony

was also fed additional food and responded immediately with an increase in spawning.

Steen, R. G. (1987). "Evidence for facultative heterotrophy in cultured zooxanthellae." Mar. Biol. 95: 15-23.
Using zooxanthellae (*Symbiodinium* sp.) isolated from the tropical sea anemone *Aiptasia pulchella* collected from Kane`ohe Bay, Hawai`i, the effect of various potential organic substrates on growth in vitro was assessed. Zooxanthellae maintained at 5 to 7 mu E m super(-2) s super(-1) (below compensation irradiance) grew heterotrophically when supplied with 100 mu M glycerol, glycolate, acetate, malate, or propionate, and grew in darkness on 100 mu M propionate. Zooxanthellae exposed to irradiance below compensation were able to utilize sources in the unsupplemented ES medium. Zooxanthellae incubated for 10 wk in unsupplemented ES at 5 to 7 mu E m super(-2) s super(-1) were capable of growth at this low irradiance, but were also capable of net photosynthetic oxygen production at higher irradiances. This suggests that zooxanthellae can be photoautotrophic or facultatively heterotrophic. An estimate for the duration of mitosis (t sub(d)) is made on the basis of growth rate of cultured zooxanthellae in log-phase; this estimate of t sub(d) = 4.88 h is < 1/2 the estimated t sub(d) for zooxanthellae in situ.

Steinhilper, F. A. (1970). Particulate organic matter in Kane'ohe Bay, O'ahu, Hawai'I. Honolulu, University of Hawai`i, Hawai`i Institute of Geophysics**:** 53 pp.
In this study on particulate organic matter, the bay was divided into 2 basins on the basis of circulation and topography and eight stations along the length of the bay were sampled at 5 m intervals. Particulate organic carbon concentrations varied temporally, ranging at the sewer outfall from a high of 686 ug/l to a low of 121 ug/l. Concentrations were constant with depth and decreased with increasing distance from the sewer outfall. Particulate nitrogen displayed the same trends as POC, ranging from 117 ug/l to 27 ug/l at the outfall. A carbon budget was calculated for the southern basin. Circulation and primary production were determined to be important factors in the high organic carbon concentrations in the bay; sewage discharge and runoff were secondary sources. Sewage discharge is indirectly an important source of bay carbon as the effluent's high nutrient content results in high productivity.

Stephens, G. C. (1960). "Uptake of glucose from solution by solitary coral, *Fungia*." Science 131: 1532.
Removal of glucose from seawater by the solitary coral, *Fungia*, was followed with D-glucose C^{l4}, at varying concentrations and rates. The *Fungia* were collected from Kane`ohe Bay. Results showed that the labeled glucose (1 mg/l concentration) was taken up by the coral at a rate of 5.3 +0.68 counts/min. The author concludes that if the naturally occurring carbohydrate in the seawater is utilizable and is taken up at the rate observed for glucose, *Fungia* can obtain sufficient material to account for maintenance metabolism in selected locations.

Stephens, G. C. (1962). "Uptake of organic material by aquatic invertebrates. I. Uptake of glucose by the solitary coral, *Fungia scutaria*." Biol. Bull. 123: 648-659.
A study conducted at the Hawai`i Marine Laboratory using specimens collected from Kane`ohe Bay to determine whether the coral *Fungia scutaria,* could remove glucose from a dilute solution at a significant rate. This was accomplished by adding measured amounts of uniformly labeled glucose C^{14} to a measured volume of seawater and monitoring the radioactivity of the ambient seawater and of suitable extracts. The data supports the conclusion that *Fungia* is capable of removing several small organic molecules of biological significance from a very dilute solution. In addition to glucose, tyrosine, lysine, aspartic acid, glycine and lactate were absorbed.

Stevenson, R. A. (1963). Life history and behavior of *Dascyllus albisella* Gill, a pomacentrid reef fish. Department of Zoology. Honolulu, University of Hawai`i,**:** 221.
A study of the life history and habits of *Dascyllus albisella*, including reproduction, growth and food. The author also tried to associate distribution of the species with physical and biological influences in the environment, including temperature, salinity, water movement and predation. The fish are particularly abundant in Kane`ohe Bay where they occur along the sloping sides of the shallow reef platforms and around the masses of living coral heads found in the deeper portions of the bay. Although the adults are free-living, they are found mainly in the vicinity of the coral, *Porites*.

Stevenson, R. A. (1963). "Behavior of the pomacentrid reef fish *Dascyllus albisella* Gill in relation to the anemone *Marcanthia cookei*." Copeia 1963: 612-614.
Fishes of the genus *Dascyllus* usually are identified as commensal with certain species of coral. However, the Hawaiian endemic, Dascyllus albisella, is occasionally found living with the anemone *Marcanthia cookei*. Aquarium observations show that juvenile fish have a characteristic behavior pattern by which they become acclimated to their anemone host. This behavior is not shown in the

presence of their more common coral head host. The similarity between this behavior pattern and the behavior pattern by which the anemone fish *Amphiprion percula* develops an immunity to the nematocysts of its host shows the intimacy of the association.

Stimson, J. (1990). "Stimulation of fat-body production in the polyps of the coral *Pocillopora damicornis* by the presence of mutualistic crabs of the genus *Trapezia*." Mar. Biol. 106: 211-218.
A mutualism exists between the xanthid crabs of the genus *Trapezia* and their host corals, *Pocillopora damicornis* . It has previously been established that these obligate coral residents benefit the coral hosts by defending them against echinoderm predators and by increasing the survival of polyps located deep between the coral branches. In turn, the corals apparently benefit the crabs by producing lipid-filled structures on which the trapezid crabs feed; these fat bodies may contain some of the lipid which in previous studies of coral metabolism has been termed "excess". It was determined by experiments conducted at the Hawai`i Institute of Marine Biology that the presence of crabs in colonies of *P. damicornis* stimulates the polyps to produce the lipid-filled fat bodies; removal of crabs causes corals to cease producing fat bodies. A structure very similar to the fat bodies of *P. damicornis* has been reported in *Acropora durvillei* . Both of these coral genera ordinarily possess xanthid-crab mutualists.

Stimson, J. (1997). "The annual cycle of density of zooxanthellae in the tissues of field and laboratory-held *Pocillopora damicornis* (Linnaeus)." J. Exp. Mar. Biol. Ecol. 214: 35-48.

Stimson, J., S. Larned et al. (1996). "Seasonal growth of the coral reef macroalga *Dictyosphaeria cavernosa* (Forsskal) Borgesen and the effects of nutrient availability, temperature and herbivory on growth rate." J. Exp. Mar. Biol. Ecol. 196: 53-77.
The green alga *Dictyosphaeria cavernosa* (Forskal) Borgesen competes with corals for space on the slopes of patch and fringing reefs in Kane`ohe bay, O`ahu, Hawai`i. Macroscopic algae rarely occur on pristine coral reef slopes, but are increasingly common at sites of anthropogenic nutrient input and overfishing. A field study of *D. cavernosa* growth rates indicated that, in the absence of grazing, an annual cycle occurs with maximum growth rates in fall and minimum growth rates in spring. This pattern corresponded more closely to annual changes in water temperature than to annual changes in irradiance or water column nutrient concentrations, yet laboratory experiments showed that growth rates do not vary with temperature within the annual range for Kane`ohe bay reef habitats. Enrichment experiments conducted in outdoor laboratory tanks supplied with running seawater indicated that *D. cavernosa* growth is nitrogen-limited at nutrient levels measured in Kane`ohe bay. Inorganic nitrogen and phosphorus levels are significantly higher in enclosed spaces or chambers created by the growth of *D. cavernosa* thalli than in the adjacent water column. It is hypothesized that nutrient regeneration from sediments beneath thalli, and/or excretion by animals inhabiting these chambers contribute to the elevated nutrient levels. Nutrient regeneration rates appear to be temperature dependent, and seasonal changes in nutrient availability beneath thalli may explain the annual growth pattern observed in *D. cavernosa.*

Stimson, J., S. T. Larned et al. (2001). "Effects of herbivory, nutrient levels, and introduced algae on the distribution and abundance of the invasive macroalga *Dictyosphaeria cavernosa* in Kane`ohe Bay, Hawai`i." Coral Reefs 19: 343-357.
Since the 1960s, and possibly earlier, the macroalga *Dictyosphaeria cavernosa* has overgrown and displaced corals on reef slopes and outer reef flats in Kane`ohe Bay, O`ahu. This shift in reef community composition is generally attributed to nutrient enrichment resulting from sewage discharge. Following the diversion of most of the sewage effluent in 1977-1978, it was expected that *D. cavernosa* growth would become nutrient-limited and its abundance would consequently decline, but the alga remains abundant in much of the bay. One explanation for its persistence is that nutrients are once again high enough to support the alga's growth. An alternative explanation is that there has been a reduction in grazing intensity in the bay. In this study we resurveyed the distribution and abundance of *D. cavernosa* at 120 reef slope sites originally surveyed in 1969. We conducted additional surveys to estimate the biomass of herbivores and the areal coverage of *D. cavernosa* and other macroalgae on reef slopes and flats. Field experiments were used to determine spatial and temporal patterns of grazing intensity on and growth rates of *D. cavernosa* and the introduced macroalga *Acanthophora spicifera*. Laboratory experiments were used to examine preferences among herbivores for some of the most abundant macroalgae on Kane`ohe Bay reefs. Twenty years after sewage diversion, *D. cavernosa* cover on reef slopes has decreased substantially in southern Kane`ohe Bay, the site of most of the historical sewage discharge. *D. cavernosa* cover has changed less in other regions, remaining high in the central bay and low in the north bay. *D. cavernosa* thalli protected by grazer exclusion cages sustained positive growth rates on reef slopes and flats throughout the bay. Reduced

nutrient concentrations may have caused a reduction in *D. cavernosa* growth rates, and a consequent reduction in *D. cavernosa* abundance in the south bay shortly after sewage diversion. Measurements of grazing intensity and surveys of herbivorous fish abundance suggest that the continued abundance of *D. cavernosa* is the result of a reduction in grazing intensity. Reduced grazing intensity on D. cavernosa may in turn be the result of a historical reduction in herbivore biomass or the establishment of several introduced macroalgae on reef flats. The introduced species are preferred by herbivorous fishes over *D. cavernosa*, as indicated by preference tests. The hypothesis that reduced grazing pressure on *D. cavernosa* is related to the establishment of introduced species is supported by the observation that *D. cavernosa* cover is highest on reef slopes where the cover of preferred introduced macroalgae on the adjacent outer reef flat is also high. Conversely, *D. cavernosa* cover is low or zero on reef slopes where the cover of introduced macroalgae on the adjacent reef flat is low or zero.

Stimson, J. S. (1978). "Mode and timing of reproduction in some common hermatypic corals in Hawai`i and Enewetak." Mar. Biol. 48(2): 173-184.
Common Hawaiian and Enewetak corals were examined to determine the method and timing of reproduction. Of the 7 Hawaiian species examined for the release of planulae, only 2 have planulated in captivity, *Pocillopora damicornis* and *Cyphastrea ocellina*. Both planulate year-round and both are characteristic of reef flats. Four of the five species which did not planulate were found to contain eggs, but not planulae, when polyps were examined microscopically. These 5 species do not usually occur on reef flats. In previous studies and in this one, coral species which have released planulae are characteristic of shallow-water environments such as reef flats. Most of the 10 species reported on here which failed to planulate in captivity are not commonly found on reef flats. The failure to detect planulation in so many species, particularly those of deeper water, suggests that common hermatypic corals may not all reproduce in the same way, and that mode of reproduction may be related to habitat. Most colonies examined in Hawai`i were obtained from the fringing reef fronting Kapiolani Park, Honolulu, O`ahu, or from patch reefs in northwest Kane`ohe Bay, O`ahu.

Stimson, J. S. (1987). " Location, quantity and rate of change in quantity of lipids in tissue of Hawaiian hermatypic corals." Bull. Mar. Sci. 41: 889-904.
The location, quantity, and rate of change of quantity of lipids were assessed in polyps of six of the major species of Hawaiian reef corals in order to understand how corals use the large quantities of lipid they possess. Lipid occurs in the mesoglea of the column and base of some polyps, in the endoderm of some polyps, in the coelenteron of planulae, in the endoderm of polyps adjacent to eggs, in eggs, and in "fat bodies" that develop from the stomodaeum and which eventually appear loose in the coelenteron of polyps of *Pocillopora* spp. Lipid, as a percentage of dry tissue weight, constitutes between 30 and 40% of tissue in Hawaiian corals collected in shallow water. Inter-species comparisons indicate that there are significant differences in the quantity of lipid in the tissues of the five species tested. Lipid content is high in both planulating and spawning species. Evidence presented here suggests that the large amount of lipid found in shallow water corals constitutes an energy reserve.

Stoddart, J. A. (1983). "Asexual production of planulae in the coral *Pocillopora damicornis*." Mar. Biol. 76: 279-284.
The reproduction of scleractinian corals through planular larvae has traditionally been viewed as a strictly sexual process. Here, the results of an electrophoretic study of a ubiquitous Indo-Pacific coral, *P. damicornis*, show an exact inheritance of parental genotypes by brooded planulae, demonstrating the existence of an asexual mode of production of planular larvae. Comparisons of the genetical structure of a number of populations with structures predicted for sexual reproduction suggest that, although there is probably also a sexual form of reproduction, asexually produced planulae can be of major importance in the maintenance of populations of this species.

Stoddart, J. A. (1986). Biochemical genetics of *Pocillopora damicornis* in Kane`ohe Bay, O`ahu, Hawai`i. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 133-150.
Within and between reef patterns of biochemical genetic variation were assessed for Pocillopora damicornis from eight sites in Kane`ohe Bay. Electrophoretic banding patterns observed for a number of enzymes confirm the exact inheritance patterns of adult allozymes by planulae and suggest that polyploidy may be involved. Phenotypic diversity was low on reefs, which were usually dominated by a single clone comprising 30-60% of individuals. There is little apparent biochemical differentiation associated with asychronous planulation.

Stoddart, J. A. (1988). "Coral populations fringing Islands: larval connections." Aust. J. Mar. Freshwater Res. 39: 109-115.

The ubiquitous Indo-Pacific coral *Pocillopora damicornis* utilizes two modes of larval dispersal; one operates over short distances and involves a brooded, asexually-produced, planula; the second acts over longer distances and involves a sexual propagule. When examined genetically, larval connections between definable populations were weaker between fringing reefs around an island than they were between patch reefs in an embayment of similar dimensions. Differing regimes of water circulation were inferred to explain this pattern. One implication for management is that populations on fringing reefs are more likely to contain singularities than those on patch reefs and will thus contribute more to the total genetic diversity within a species. Growing tips of coral branches were collected from 8 sites within Kane`ohe Bay, O`ahu, Hawai`i.

Stoner, D. S. (1986). The role of fragmentation in the colonial, algal-bearing didemnid ascidian, *Diplosoma similis*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 240-262.

Growth rates of the colonial, algae bearing ascidian *Diplosoma similis* were measured while artificially increasing fragmentation. As hypothesized, genets which fragmented more frequently had faster growth rates than more intact genets. Clone member growth rates also decreased proportionally with size, indicating that fragmentation increases genet growth rates.

Stoner, D. S. (1989a). Life history and population biology of the colonial ascidian *Diplosoma similis*. Depart. of Zoology. Honolulu, University of Hawai`i**:** 172.

This thesis examines two issues related to the ecological and evolutionary consequences of sexual and asexual reproduction in colonial marine invertebrates. The first two chapters explore the extent to which planktonic larval phase limits the distribution and abundance of a colonial ascidian *Diplosoma similis*. The third chapter examines some of the fitness consequences of alterations in the pattern of asexual reproduction by colony fragmentation in *D. similis*. All research was carried out on the fringing reef surrounding Coconut Island in Kane`ohe Bay, Hawai`i.

Stoner, D. S. (1989b). "Fragmentation: A mechanism for the stimulation of genet growth rates in an encrusting colonial ascidian." Bull. Mar. Sci. 45(2): 277-287.

As a result of fragmentation the colonial ascidian, *Diplosoma similis*, grows as a clone of physiologically isolated colonies. This study experimentally tested the hypothesis that one of the advantages of fragmentation is that it stimulates growth of the genetic individual, or genet, by dividing the genet into small colonies which have higher relative growth rates than larger ones. The hypothesis was tested by comparing the growth rates, over a two week period, of different sized colonies derived from 41 presumed genets. The relationship between growth (change in zooid number) and initial size was modeled as a power function, the exponent of which represents the rate of change of the function. The rate of change was empirically determined to be significantly less than one, 0.89 +/- 0.03, indicating that relative growth rates decline with increasing colony size and supporting the hypothesis that fragmentation stimulates genet growth rates. This study was conducted on a reef located in Kane`ohe Bay, O`ahu.

Stoner, D. S. (1992). "Vertical distribution of a colonial ascidian on a coral reef: the roles of larval dispersal and life-history variation." Am. Naturalist 139: 802-824.

Stoner, D. S. B. (1994). "Larvae of a colonial ascidian use a non-contact mode of substratum selection on a coral reef." Mar. Biol. 121: 319-326.

The rate at which larvae successfully recruit into communities of marine benthic invertebrates is partially dependent upon how well larvae avoid benthic predators and settle on appropriate substrata. Therefore, to be able to predict recruitment success, information is needed on how larvae search for settlement sites, whether larvae preferentially settle on certain substrata, and the extent to which there are adequate cues for larvae to find these substrata. This article describes how larvae of the colonial ascidian *Diplosoma similis* find settlement sites on a coral reef. Direct field observations of larva settlement were made on a fringing reef in Kane`ohe bay, O`ahu, Hawai`i, between September 1985 and April 1986. A comparison of the substrata that larvae contacted prior to settlement relative to the percentage cover of these substrata on the study reef suggests that larvae are using a non-contact mode of substratum identification to locate suitable settlement sites. This mode of substratum identification allowed 74% of larvae to evade predation by benthic organisms who would otherwise have eaten larvae if they had been contacted. Of those larvae that evaded predation, 88% subsequently settled on the same two substrata upon which most adults are found (dead coral or the green alga *Dictyosphaeria cavernosa*). This pattern of settlement was probably a result of active selection, since the two substrata cover only 14.4% of the reef's surface and currents had little effect on the direction in which larvae swam. An important contributing factor to the high success rate of larval settlement on suitable substrata was the lack of any temporal decay in substratum preference. It is concluded that for *Diplosoma similis* larval supply is a sufficient predictor of larval settlement rate. However, for marine invertebrates whose larvae are passively dispersed and exhibit a greater temporal decay in substratum preference, larval settlement should generally have a greater dependency on spatial variation in the abundance of benthic predators and suitable substrata.

Straughan, D. (1969). "Intertidal zone formation by *Pomatoleios kraussi* (Annelida: Polychaeta)." Biol. Bull. 136(3): 469-482.
Pomatoleios kraussi forms a well-defined intertidal zone in many areas of its Indo-Pacific distribution (for details of this distribution see Straughan 1967a). However, Straughan (1968) noted that this species settles and survives subtidally, and in artificial habitats (for example water cooling systems) that are continually submerged. Hence the intertidal distribution of *Pomatoleios* is not the result of differential larval settlement. The following study was designed to determine the factors contributing to the formation of an intertidal zone by *Pomatoleios* in Hawai`i. Experimental studies were conducted on the protected side of Coconut Island, Kane`ohe Bay-furthest from the open sea.

Straughan, D. (1969). "Serpulidae (Annelida: Polychaeta) from O`ahu, Hawai`i." Bull. So. Calif. Acad. Sci 68(4): 229-240.
Twelve species from seven genera are recorded from various habitats on the island of O`ahu in the Hawaiian group. Nine have a cosmopolitan tropical distribution, two have an eastern Pacific distribution, and only one has an Indo-Pacific distribution. The Serpulidae key for O`ahu.

Sunn Low Tom & Hara (1976). Kane`ohe Bay urban resources study: Kane`ohe Bay water resources data evaluation. Honolulu, US Army Engineer Div., Pacific Ocean Environmental Resources Section.
This study is part of the Kane`ohe Bay Urban Resources Study that is being conducted under the auspices of the U.S. Army Corps of Engineers. This study is designed to summarize and evaluate the existing data concerning the pertinent physical, chemical and biological aspects of Kane`ohe Bay and its drainage basin in order to gain a sufficient understanding of the interaction of human activity and bay environmental quality to allow the formulation of control measures.

Sunn Low Tom and Hara (1975). Annotated bibliography of Kane`ohe Bay 1969 to 1975. Honolulu, U. S. Army Corps Of Engineers, Pacific Division**:** 54 pp.
This is an annotated bibliography of the literature concerning Kane`ohe Bay from 1969 to 1975, supplementing the previous bibliography by Gordon and Helfrich (1970). Listings are in alphabetical order by authors, with a subject index.

Swerdloff, S. N. (1970). The comparative biology of two Hawaiian species of the damselfish genus *Chromis* (Pomacentridae). Dept. of Zoology. Honolulu, University of Hawai`i.
The damsel fish genus *Chromis* (Pomacentridae) is represented in Hawai`i by four sympatric species. The biologies of two coexisting endemics, *C. ovalis* (Steindachner) and *C. verate*r Jordon and Metz, were investigated to define and compare elements of their respective niches. Over 800 *C. verater* and 500 C. ovalis were collected by spear and poison from seven O`ahu study sites. Approximately 350 hours of SCUBA diving were required for observations and collecting, to depths of 40 m. The Kendall Coefficient of Concordance (W Test) and the Test of Electivity were used to compare diet compositions and food preferences. Embryos and larvae were reared in the laboratory from field-collected zygotes and artificially-fertilized eggs. Niche differentiation was found in length of the spawning season, fecundity, degree of exposure of nest sites, size and age at recruitment to juvenile populations, and vertical distribution of both adults and juveniles. There was no evidence that *C. ovalis* and *C. verater* compete at a critical level. Coexistence may be the result of nonlimited common resources (e.g., food, shelter, spawning sites) and niche differentiation, especially with regard to reproductive parameters and vertical range. Larval mortalities may be sufficient to maintain population densities below critical levels.

Szyper, J. P. (1972). Zooplankton grazing in Kane`ohe Bay, Hawai`i. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 27 pp.
Grazing rates of several abundant zooplankters in Kane`ohe Bay were measured at different concentrations of natural phytoplankton. The concentration by volume of suspended particles, as determined with an electronic particle counter, was used as the estimate of food concentration. The relationship between grazing rate per animal and concentration of particulate food conformed closely

to a hyperbolic model widely used to describe an organism's rate of uptake of food or other needed substrate as a function of the concentration of the substrate. Maximum observed grazing rates in the eutrophic south sector of the bay are near the maximum rates predicted by the model. The concentrations of particles in other areas of the Bay do not appear to be high enough to permit grazing rates to approach their maximum levels. There appears to be no preference by the grazers for particles of a size other than the size most abundant in the environment.

Szyper, J. P. (1976). The role of *Sagitta enflata* in the Southern Kane`ohe Bay ecosystem. Dept. Of Oceanography. Honolulu, Univ. Of Hawai`i**:** 147 pp.

Sagitta enflata dominates the standing stock of macrozooplankton, and of planktonic carnivores in the south bay. During 1973-74, sampling with vertical net hauls showed no horizontal patchiness in the population. The abundance varied temporally, mainly over periods of months. Between 1968-69 and 1973-74, both the stock and the dominance of *Sagitta* in the community increased; both may be related to enrichment of the basin with sewage. Individual *Sagitta* eat an average of 7 prey items per animal per day. Sagitta's predation has little impact on the prey populations, other than *Oikopleura*, which is the main food of larger Sagitta. Despite its abundance and dominance of macroplankton stock, *Sagitta* is only a minor contributor to nutrient regeneration in the south Bay.

Szyper, J. P. (1978). "Feeding rate of the chaetognath *Sagitta enflata* in nature." Estuar. Coast. Mar. Sci. 7: 567-575.

The feeding rate of the chaetognath *Sagitta enflata* in its natural environment, Kane`ohe Bay, Hawai`i, was estimated from the frequency of animals in preserved samples having food in their guts, and from the average digestion times for live animals in the laboratory. The average feeding rate was estimated at 7.4 prey items per *Sagitta* per day; the chaetognath population sampled by 0.33 mm mesh removed about 4800 prey/m3 from the waters of the Bay daily. The prey consisted mainly of; small copepods, too numerous and productive to be much affected by the predation; *Oikopleura*, whose populations could be seriously affected; and Sagitta itself, with a rate of cannibalism about 17% of the population per day.

Szyper, J. P. (1981). "Short term starvation effects on nitrogen and phosphorus excretion by the chaetognath *Sagitta enflata*." Estuar. Coast. Mar. Sci. 13: 691-700.

Freshly captured *Sagitta enflata* exhibited specific excretion rates of ammonium and phosphate that were not significantly related to the size of the individual animals. The degree of crowding in experimental vessels was positively correlated with specific excretion rates of ammonium.

Szyper, J. P., J. Hirota et al. (1974). Nutrient regeneration by the larger net zooplankton. Honolulu, US Army Corps of Engineers, Pacific Div.

Four experiments were performed during Feb. 1974 with mixed zooplankton. Mean specific excretion rates, multiplied by the estimated average standing stocks, give estimates of addition to the bay waters of ammonia, phosphate, dissolved organic N and dissolved organic phosphorus.

Szyper, J. P., J. Hirota et al. (1976). "Nutrient regeneration by the larger net zooplankton in the Southern Basin of Kane`ohe Bay, O`ahu, Hawai`i." Pacific Science 30(4): 363-372.

Four experiments were performed during February 1974 with mixed zooplankton collected with 0.33-mm mesh in the southern basin of Kane`ohe Bay. The mean specific excretion rates multiplied by the estimated average standing stocks of the animals provided estimates of addition to the bay waters of ammonia, phosphate, dissolved organic phosphorus. The specific excretion rates were not significantly affected by the concentrations of animals in experimental vessels, by the estimated concentrations of food in the environment on the days of the experiments, nor by incubation periods of up to 4.5 hours. The rates are comparable to those obtained from zooplankton of this general size in environments that have rather different temperature and food levels, indicating that size-dependent metabolic rates are the major determinant of specific excretion rates. The animals from the net hauls excreted phosphate more slowly and dissolved organic nitrogen more rapidly than did those from the seine catches.

Taguchi, S. (1980). Sedimentation in Kane`ohe Bay, O`ahu, Hawai`i. T. Report. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology.

Taguchi, S. (1982). "Seasonal study of fecal pellets and discarded houses of Appendicularia in a subtropical inlet, Kane`ohe Bay, Hawai`i." Est. Coastal Shelf Sci. 14: 545-555.

Fecal pellets and discarded houses of *Oikopleura longicauda* Vogt were collected every week with sediment traps for a 13-month period in a subtropical inlet, Kane`ohe Bay, Hawai`i. The annual average fecal pellet production rate per animal was 243 +/- 105 pellets per day (95% confidence limits). The annual average house production rate per single *O. longicauda* was 5.3 +/- houses per day. Each house contained 65 +/- pellets. The present study concludes that the high carbon content of fecal pellets and discarded house and their high abundance have significant nutritional values in a subtropical inlet system.

Taguchi, S. and E. A. Laws (1987). "Patterns and causes of temporal variability in the physiological condition of the phytoplankton community in Kane`ohe Bay, Hawai`i." J. of Plankton Res. 9(6): 1143-1157.
Primary production rates, the percentage of photosynthetically fixed carbon allocated to protein, production/biomass (P/B) ratios and water quality parameters were measured on a weekly basis over 1 year in Kane`ohe Bay, Hawai`i. The temporal sequence of virtually all parameters measured, with the exception of phosphate and ammonium concentrations, was significantly non-random (P less than or equal to 0.05). Some of the parameters showed clear evidence of seasonality (e.g. nitrate and silicate concentrations, temperature, irradiance). However, the non-random nature of the temporal sequence in many parameters was typically due to 3- to 4-week periods during which the phytoplankton community composition and physiological state showed little variation. Both the percentage of fixed carbon allocated to protein and P/B ratios were negatively correlated with the phytoplankton size during all seasons, a result which suggests that the smaller cells were growing more rapidly than larger cells in both a relative and an absolute sense. Ammonium concentrations were consistently higher than nitrate concentrations, but of the nutrients measured only nitrate concentration was consistently correlated with per cent protein and P/B ratios. It is suggested the influx of nitrate to the system influences the supply of all forms of nitrogen via recycling within the food web, and the flux of nitrate is positively correlated with nitrate concentration. (DBO)

Taguchi, S. and E. A. Laws (1989). "Biomass and compositional characteristics of Kane`ohe Bay, O`ahu, Hawai`i (USA), phytoplankton inferred from regression analysis." Pac. Sci. 43: 316 331.
Concentrations of chlorophyll a (Chl a), particulate carbon (PC), and particulate nitrogen (PN) measured on weekly basis in the picoplankton and nano-plus-microplankton size fractions over a 2-yr period from 1986 to 1988 at a station near a former sewage outfall in Kane`ohe Bay, O`ahu, Hawai`i, were compared to similar data collected in 1970, 1972, 1974, and 1976-1977 while sewage was being discharged into the bay, and in 1978-1979 immediately after diversion of the sewage. Particulate concentrations showed considerable temporal variability both within and between years. High concentrations were associated with periods of above-average rainfall. Heavy rains that occurred during two successive periods of spring tides produced chl a concentrations of over 40 mg m-3 in January 1988, almost four times the highest concentration measured during the period of sewage discharges. Nutrients from land runoff as well as from decomposition of organisms killed by salinity stress were the apparent cause of this spectacular bloom. The bloom consisted almost entirely of nanoplankton and microplankton, but picoplankton accounted for 45 +- 14% of the Chl a during the remainder of the 1986-1988 study. Phytoplankton C:N ratios were apparently unaffected by diversion of sewage from the bay and averaged within 10% of the Redfield ratio. This result implies that phytoplankton were growing at close to nutrient-saturated rates both before and after the sewage diversion. Nutrient budget calculations indicated that most of the growth has been supported by recycling within the bay. Phytoplankton of C:Chl and N:Chl ratios estimated by regression analyses increased after the sewage diversion, apparently in response to the increase in average irradiance in the water column caused by the decline in seston concentrations. C:N ratios of picoplankton and nano-plus-microplankton under nutrient-saturated conditions were about 4.6 +- 0.3 and 6.2 +- 0.8, respectively; the difference probably reflected the high concentration of nitrogen-containing pigments in some picoplankton.

Taguchi, S. and E. A. Laws (1989). Periodic blooms of the silicoflagellate *Dictyocha perlaevis* in the subtropical inlet, Kane`ohe Bay, Hawai`i, U.S.A. Red Tides, Biology, Environmental Science, and Toxicology. T. Okaichi, D. M. Anderson and T. Nemoto. New York, Amsterdam & London, Elsevier: 69-72.

Taguchi, S., E. A. Laws et al. (1993). "Temporal variability in chlorophyll a and phaeopigment concentrations during incubations in the absence of grazers." Marine Ecol. Prog. Ser. 101: 45-53.
Changes in chlorophyll a (Chl a) and phaeopigment concentrations during 24 h incubations in water prefiltered through 2.0 mu m Nuclepore filters were determined on a weekly basis over a period of 13 mo using water from Kane`ohe Bay, a subtropical inlet in the Hawaiian Islands, USA. In bottles illuminated at a constant irradiance of 4.0 E m2/h, both Chl a concentrations declined at a lower rate in dark bottles than in light bottles. There was no evidence of a change in phaeopigment concentrations in dark bottles. There was no temporal pattern in the exponential decay rates of phaeopigments in light bottles over the course of the 13 mo study, the median value being 0.016 m2/E. There was, however,

evidence of a nonrandom temporal pattern in the Chl a decay constants. Winter values were about twice as large as summer values, a result presumably reflecting changes in the physiology and/or species composition of the phytoplankton community. In about 30% of the incubations phaeopigment concentrations were higher than initial values at intermediate time points, in some cases by as much as a factor of 2 to 3 during the first 4 to 8 h of the incubations.

Taguchi, S., E. A. Laws et al. (1985). "^{14}CO and ^{35}SO incorporation into protein by marine phytoplankton under light-dark cycle conditions." Bull. Mar. Sci. 37: 777.
The effect of light-dark cycles on and $^{35}SO_4$ incorporation into protein was examined with cultures isolated from Kane`ohe Bay, Hawai`i, USA. Both $^{14}CO_2$ and $^{35}SO_4$ were incorporated into protein during both light and dark periods. The incorporation rate showed a diel periodicity and decreased during the dark period. The percent of $^{14}CO_2$ incorporated into protein, however, showed little variation throughout light and dark periods with the coefficient of variation between similar to 15%. Calculated ratios of CO_2 and SO_4 incorporation into protein were 73 plus or minus 13 by weight. The ratios were similar to protein C:S ratios calculated from the amino acid composition of algae.

Tarrant, A. M. (1998). Uptake of estradiol 17□ by *Montipora verrucosa* during an incubation and observations of spawning. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 63-69.
Estradiol-17□ is a steroid essential to reproduction and development in vertebrates and has been reported in many invertebrates. To determine whether corals could absorb estrogens from seawater and to determine the effects of estradiol on spawning, colonies of *Montipora verrucosa* were incubated in aquaria containing estradiol. The concentration of estradiol in a control tank containing no coral remained constant over one week, but estradiol was rapidly removed from tanks containing coral. In the high dose tank, the estradiol concentration dropped from 5□g per l to 0.5□g per l during the first day of the experiment. Spawning among the treatments was variable, emphasizing the need for extended observation and larger sample sizes. More colonies spawned and produced a larger volume of gametes in the low and medium doses relative to the high dose and controls. Future experiments are needed to determine if this observation represents a consistent trend and whether coral reproduction may be affected by estrogenic chemicals in the water column. *M. verrucosa* were collected from the Coconut Island reef flat and nearby patch reefs (Kane`ohe Bay, O`ahu) on June 27 and 28.

Tarrant, A. M., S. Atkinson et al. (1999). "Estrogen and estradiol-17□ concentration in tissue of the scleractinian coral, *Montipora verrucosa*." Elsevier Sci.: 85-92.
Estradiol-17□ is a steroid essential to reproduction and development in vertebrates and has been reported in many invertebrates. To determine whether corals could absorb estrogens from seawater and to determine the effects of estradiol on spawning, colonies of *Montipora verrucosa* were incubated in aquaria containing estradiol. The concentration of estradiol in a control tank containing no coral remained constant over one week, but estradiol was rapidly removed from tanks containing coral. In the high dose tank, the estradiol concentration dropped from 5□g per l to 0.5□g per l during the first day of the experiment. Spawning among the treatments was variable, emphasizing the need for extended observation and larger sample sizes. More colonies spawned and produced a larger volume of gametes in the low and medium doses relative to the high dose and controls. Future experiments are needed to determine if this observation represents a consistent trend and whether coral reproduction may be affected by estrogenic chemicals in the water column. *M. verrucosa* were collected from the Coconut Island reef flat and nearby patch reefs (Kane`ohe Bay, O`ahu) on June 27 and 28.

Taylor, J. B. (1975). Planktonic prosobranch veligers of Kane`ohe Bay. Dept. of Zoology. Honolulu, Univ. of Hawai`i**:** 599 pp.
More than 200 species of planktonic prosobranch veligers have been described, their temporal and spatial distribution in the plankton established, the growth patterns of their juveniles examined and the capacity of veligers of *Crucibulum spinosum* to withstand heat and detergent stress quantified. It was found that diversity of species increases from the inner bay to the outer reef areas; abundance decreases from the southeastern to the northwestern region. Ecological factors which may restrict species of veligers to defined areas are discussed. Pre-settlement planktonic veligers are described for the first time for the following families: Neritidae, Phenacolepadedae, Janthinindae, Thaididae, Mitridae, Conidae and Terebridae.

Te, F. T. (1991). "Effects of two petroleum products on *Pocillopora damicornis* planulae." Pac. Sci. 45(3): 290-298.

Pocillopora damicornis planulae were exposed to different concentrations of benzene and gasoline:oil mixtures to determine the lethal concentrations and biological responses of the coral larvae. This study found that corallite formation was significantly influenced by the different concentrations of the test compound, but no clear correlation between concentration of the test compound and rate of corallite formation was ascertained. Mortality was minimal in most of the test concentrations utilized in the experiments. Planulae were gathered from 10 coral heads collected from Kane`ohe Bay, O`ahu on 18 June 1989.

Tester, A. C. (1951). "The distribution of eggs and larvae of the anchovy, *Stolephorus purpureus* Fowler in Kane`ohe Bay, O`ahu, Hawai`i, with consideration of the sampling problem." Pac. Sci. 5: 321-346.
The spatial distribution, as well as sampling efficiency, of nehu eggs and larvae at 23 stations throughout Kane`ohe Bay was examined. Heterogeneity was found between large and small nets towed simultaneously and between the two replicates taken at each station. Spawning takes place throughout the year. The presence of seasonal patterns remain to be determined. Eggs and larvae are generally more abundant in the southern sector of the bay and least abundant in the north sector. Eggs were not randomly distributed between stations within sectors; this distribution pattern may be due to circulation patterns, with eggs being held in eddies. From length frequency distribution of larvae, it is estimated that growth is approximately 1.5 mm/day. This suggests a rapid recruitment to the fishery and a rapid overturn in the population.

Tester, A. L. (1955). "Variation in egg and larva production of the anchovy *Stolephorus purpureus* Fowler, in Kane`ohe Bay, O`ahu during 1950-1952." Pac. Sci. 9: 31-41.
The anchovy or nehu is used as baitfish for the skipjack tuna. Populations on O`ahu located in Pearl Harbor, Honolulu Harbor, Ala Wai Canal and Kane`ohe Bay appear to fluctuate both seasonally and annually. This study investigates, with the population in Kane`ohe Bay, one possible cause of this fluctuation: a variation in egg and larva production. Spawning, as indicated by egg and larvae catch, occurs erratically throughout the year with a summer maximum and a winter minimum. Sampling showed a large decrease in numbers between the eggs and larva stage. Several explanations are advanced and the author concludes that the sampling is not adequate to trace the pulses of spawning from the egg to the larval stages.

Tester, A. L. (1963). "The role of olfaction in shark predation." Pac. Sci. 27: 145-170.
The role of olfaction in several shark species from Enewetak and 3 species from Kane`ohe Bay are examined with regards to locating prey species. Natural food extracts were used to determine their relative attractiveness to penned sharks at both locations. Both normal and blinded sharks were tested. Tests conducted with human blood elicited a moderate to strong attraction with ambient concentrations estimated at .1 to .01 parts per million of seawater. Human urine and sweat elicited either no attraction or repulsion. In experiments using water passed through a separate live grouper enclosure, sharks were attracted to disturbed and dead grouper water but not to quiescent or control water. Similar results were obtained with mullet water.

Tester, A. L. and R. W. Hiatt (1952). "Variation in the vertebral number of the anchovy (*Stolephorus purpureus*) in Hawaiian waters." Pac. Sci. 6: 59-70.
A study of the variation in vertebral number of the nehu in an attempt to determine whether one or several populations of this valuable baitfish exist in Hawaiian waters. Kane`ohe Bay was one of the collection sites. The study showed that vertebral data gave some support to the above hypothesis, but not as much as might have been desired for its adoption as a basis for regulation of the fishery. The existence of a separate population was shown in the Ala Wai Canal only. For the other areas, the difference in mean vertebral count between localities could have a risen in random sampling from one statistically complex biological population.

Tester, A. L. and M. Takata (1953). Contribution to the biology of the aholehole, a potential baitfish. Honolulu, Industrial Research Advisory Council.
The final report of an investigation (1952-1953) of the essential features of the life history and behavior of the aholehole with respect to the possibility of its pond cultivation and use as an auxiliary baitfish for tuna fishing. Studies were conducted on one of the abundant populations in Kane`ohe Bay, O`ahu.

Tester, A. L. and S. M. Trefz (1954). "The food of the aholehole, *Kuhlia sandvicensis* (Steindacher) in Hawaiian waters." Pac. Sci. . 8: 3-10.
Study done in connection with a general investigation of the life history of the species to ascertain whether or not it could be raised in ponds. Twenty-two samples ascertained whether or not it could be raised in ponds. Twenty-two samples comprising 202 fish were taken from various places around

O`ahu, Kualoa Point in Kane`ohe Bay being one of the areas of collection. The fish were weighed, measured and analyzed for stomach contents.

There are slight differences in food of small and large, fresh and salt water forms, but generally the aholehole might be described as omnivorous with a preference for motile animal forms. Algae are rarely eaten. From a study of natural foods, crustaceans seem to serve as an ideal bait in angling. Both vegetable material such as bread and poi and animal material such as ground fish and shrimp may be used to chum aholehole to the surface. The author does not conclude whether these findings make it possible to rear aholehole in tanks.

Testerman, J. K. (1970). Contribution of symbiotic algae to the oxygen supply and survival of *Placobranchus ocellatus* (Abstr.). Kane`ohe, Univ. of Hawai`i, Hawai`i Inst. Mar. Biology.
A study of the oxygen supply and survival of *Placobranchus ocellatus* occurring commonly in Kane`ohe Bay. The saccoglossan derives respiratory benefit from symbiotic algae lining the inside surface of the parapodia and the dorsum. Specimens maintained in the light consistently outlived those kept in the dark whose oxygen tension was reduced by continuously bubbling nitrogen through the water. Their activity in their normal environment was noted to be light-dependent, the animal being strongly photopositive.

Thomas, F. I. M. and M. J. Atkinson (1997). "Ammonium uptake by coral reefs: effects of water velocity and surface roughness on mass transfer." Limnol. Oceanogr. 42: 881-8.

Thomas, J. D. (1997). "Systematics, ecology and phylogeny of the Anamaxidae (Crustacea: Amphipoda)." Rec. Australian Museum 49: 35-98.
Thirteen new species and one new genus, including *Anamaxis moana* from Kane`ohe Bay, are described in the commensal amphipod family Anamaxidae, bring the total to 33 species in three genera.

Thomas, J. D. (1997). "Systematics, ecology and phylogeny of the Anamixidae (Crustacea: Amphipoda)." Rec. Australian Museum 49: 35-98.

Thomson, D. A. (1963). A histological study and bioassay of the toxic stress secretion of the boxfish, *Ostracion lentiginosus*. Department of Zoology. Honolulu, University of Hawai`i.
A study concerning the extraction purification and chemical nature of the ichthyotoxin secreted by the boxfish, *Ostracion lentiginosus* and a histological study investigating the structure of the various secretary cells. A comparative histological study on the secretary cells of the cowfish, *Lactoria fornasini*, is also reported. The fish were collected in traps in Kane`ohe Bay.

Titgen, R. H. (1987). "New decapod records from the Hawaiian Islands (Crustacea, Decapoda)." Pac. Sci. 41: 141-147.
Twenty-two new species records, nine new generic records, and two new familial records are reported for the Hawaiian Islands. Most represent widely distributed Pacific or Indo-Pacific species, though one is an undescribed species of gnathophyllid shrimp and three are also known to occur in the Atlantic Ocean.

Titgen, R. H. (1989). "Gnathophyllid shrimp of the Hawaiian Islands, with the description of a new species of *Gnathophyllum* (Decapoda, Gnathophyllidae)." Crustaceana 56(2): 200-210.
The small caridean family Gnathophyllidae, is represented in the Hawaiian Islands by five species in four genera. Two species, *Gnathophylloides mineri* and *Gnathophyllum americanum* are circumtropical in distribution, and a third species, *Hymenocera picta*, is widely distributed throughout the tropical Pacific. Of the remaining two species, *Levicaris mammillata* is known from the Hawaiian Islands, Ogasawara Islands and Ryukyu Islands (Fujino & Takeda, 1977), and a new species, described herein, is known only from the Hawaiian Islands.

Tomlinson, J. T. (1963). "*Lithoglyptes hirsutus* (Cirripedia: Acrothoracica) a new burrowing barnacle from Hawai`i." Pac. Sci. 17: 299-301.
Samples of *Psammocora verrilli* Vaughan and *Porites compressa* Dana revealed this new species of acrothoracican burrowing barnacles, the first known representative of this group to be reported from Hawai`i. The corals were collected in Kane`ohe Bay.

Tomlinson, J. T. (1969). "The burrowing barnacles (Cirripedia: Order Acrothoracica)." U. S. Nat. Mus. Bull. 296: 1-162.
A systematic study of the burrowing barnacles in the order Acrothoracica within the crustacean

subclass Cirripedia. The author traveled around the world visiting museums and institutions with acrothoracican collections and has noted where the specimens he describes may be found. The Hawai`i Institute of Marine Biology was one of the institutions visited. Collections in this area included: *Weltneria hirsuta* (Tomlinson) in *Psammocora verrilli* from a depth of 3-6 feet in Sand Bar Reef and in *Porites compressa* on the NE side of Checker Reef, Kane`ohe Bay, O`ahu.

Townsley, S. J. (1950). Adult and larval stomatopod crustaceans occurring in Hawaiian waters. Department of Zoology. Honolulu, University of Hawai`i**:** 95.
A systematic study of the stomatopods occurring in Hawaiian waters. The author includes keys to the genera and species of Hawaiian Squillidae and keys to the genera of larval Hawaiian stomatopods as well as descriptions of the various larval stages of the five major genera. One male and two females of *Squilla boops* were found in the stomach of a black skipjack caught off Moku Manu Island off the mouth of Kane`ohe Bay.

Townsley, S. J. (1953). "Adult and larval stomatopod crustaceans occurring in Hawaiian waters." Pac. Sci. 7: 399-437.
Larval stages of the stomatopod rank second in importance as a food source for tuna and other pelagic fishes. In order to assess objectively whether the larval stomatopod stages were found over reefs are important in attracting the neritic species inshore, a descriptive study of the species involved is required. This is a descriptive study of both the larval and adult stomatopods found in Hawaiian waters so they may be both qualitatively and quantitatively analyzed in the plankton and stomach of pelagic fishes. Keys to both adult and larval Squillidae are included in this paper. *Pseudosquilla ciliata* (Fabricus) was found on the reef flat of Kane`ohe Bay.

Trench, R. K. and R. J. Blank (1987). "*Symbiodinium microadriaticum* Freudenthal, *S. goreauii* sp. nov., *S. kawagutii* sp. nov. and *S. pilosum* sp. nov.: gymnodinioid dinoflagellate symbionts of marine invertebrates." J. Phycol. 23: 469-481.

Trujillo, E. L. (1973). Distribution of crabs in Kane`ohe Bay, Hawai`i. Department of Zoology. Honolulu, Univ. of Hawai`i.
The geographic distribution of five species of portunid crabs, along with one calappid species, was studied in Kane`ohe Bay between June 1972 and April 1973. Salinity and physical parameters, including water turbidity, temperature, depth, and bottom type, were measured and analyzed as factors determining the distribution of the crab species.

Tseng, W. (1968). The factors influencing diurnal changes of microzooplankton in Kane`ohe Bay, O`ahu. Keelung, Taiwan, Taiwan Fish. Inst.**:** 1--13.
General preliminary survey of the abundance of zooplankton in Kane`ohe Bay, with abundance of microzooplankton related to changes in environmental factors, including tidal current, temperature, salinity and oxygen.

Tseu, W. S. L. (1953). "Seasonal variations in the physical ecology of the ponds at the Hawai`i Marine Laboratory and the adjacent waters of Kane`ohe Bay, O`ahu." Pacific Science 7(3): 278-290.

Tullis, R. E. (1968). Relationship between *Stylifera linckiae* and its host, *Linckia multiflora*. Department of Zoology. Honolulu, University of Hawai`i.
The relationship between the prosobranch gastropod, *Stylifera linckiae* Sarasin and the starfish, *Linckia multiflora* is reviewed. Studies were done on the interaction between the symbiont and its host, the life cycle of the symbiont and the biochemical interactions occurring during the relationship. Specimens of parasitized and non-parasitized *L. multiflora* were collected off the shallow reefs in Kane`ohe Bay.

Tusov, J. (1967). The influence of environmental factors on the growth of the colonial hydroid, *Bougainvillia* sp. Department of Zoology. Honolulu, University of Hawai`i.
A study to extend the methods of previous investigators to the culturing of a marine hydroid under controlled conditions and to determine how changes in the environment affect the growth rate. A clone of *Bougainvillia* sp. was collected on November 1966 at the Hawai`i Marine Lab in Kane`ohe Bay. A vigorous growth of *Bougainvillia* sp. was attained using previously developed culture methods. The culture required a high concentration of seawater and a high absolute concentration of ions for good growth. A change in growth form was noted when colonies were cultured at high temperatures.

Tusov, J. and L. V. Davis (1971). Influence of environmental factors on the growth of *Bougainvillia* sp.

Experimental Coelenterate Biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 52-65.

A study to extend the methods of previous investigators to the culturing of a marine hydroid under controlled conditions and to determine how changes in the environment affect the growth rate. A clone of *Bougainvillia* sp. was collected on November 1966 at the Hawai`i Marine Lab in Kane`ohe Bay. A vigorous growth of *Bougainvillia* sp. was attained using previously developed culture methods. The culture required a high concentration of seawater and a high absolute concentration of ions for good growth. A change in growth form was noted when colonies were cultured at high temperatures.

Tyler, W. A. (1988). "Spawning patterns in the Hawaiian sergeant, *Abudefduf abdominalis* (Family: Pomacentridae)." Pac. Sci. 42: 136.

The reproductive behavior of two populations of the Hawaiian sergeant or maomao, Abudefduf abdominalis, have been studied on two patch reefs in Kane`ohe Bay, O`ahu. Estimates of the spawning data for each clutch were made by subtracting the age of each developmental stage from the sampling date. Using autocorrelation and spectral analysis procedures, periods of 1 and approximately 5 days were consistently observed in the portions of continuous time series data analyzed for both populations. Social factors may play an important role in the periodicity of spawning behavior in A. abdominalis. Females may synchronize spawning within a couple of days of each other during each spawning cycle. With numerous nests active simultaneously within aggregations on the reef, egg predators may be hampered by the "cumulative" defense (overlapping defended areas around nests) of nesting males within a given area, thus increasing the probability of egg survival in aggregations.

Tyler, W. A. (1989). "Optimal colony size in the Hawaiian Sergeant, *Abudefduf abdominalis* (Pisces: Pomacentridae)." Pac. Sci. 43: 204.

The colonial nesting behavior of a coral reef fish, *Abudefduf abdominalis* (Family Pomacentridae) was examined on two patch reefs in Kane`ohe Bay, O`ahu, Hawai`i. Males prepare and defend demersal nest sites, court females, and then guard nests, containing up to six clutches of eggs, from egg predators. Males may be found nesting as solitary individuals or in colonies of from 2 to 30 individuals. Nest loss is a decreasing function of colony size. The number of clutches spawned in intermediate-sized colonies is significantly greater than that in either small or large colonies, as is the number of nests containing three or more clutches. Solitary males and those in small colonies have significantly more egg predators approaching the nest site and chase more egg predators than do males nesting in larger colonies. Males in small colonies also spend less time caring for their eggs than do males in larger colonies. These results indicate that colonies of intermediate size may be optimal for reproduction in this population.

Tyler, W. A. (1995). "The adaptive significance of colonial nesting in a coral-reef fish." Anim. Behav. 49: 949-966.

Tyler, W. A. and R. C. Fitzhardinge (1989). "Comparison of impact of two disturbances on coral assemblages." Pac. Sci. 43: 204-205.

We have investigated the impact of two disturbances on a coral assemblage dominated by *Montipora verrucosa* and P*orites compressa*. The first disturbance occurred when large quantities of drift algae were blown onto the leeward side of Coconut Island, O`ahu, Hawai`i, in November 1986. Algae remained on the reef for over 2 months, gradually decomposing. Corals were killed within a 40-m-wide stretch of reef. The second disturbance, a freshwater kill that occurred in January 1988, affected Coconut Island and other fringing and patch reefs in Kane`ohe Bay. Both disturbances resulted in a change in the relative abundance of *P. compressa* and *M. verrucosa* . Previous field observations and experiments and immunological studies indicate that *M. verrucosa* can outcompete *P. compressa*. The early survival of *M. verrucosa* , however, is so poor that recruitment rates of this species are lower than those of *P. compressa* . We propose that in the absence of disturbances such as the two we have investigated, *M. verrucosa* and not *P. compressa* might be the most abundant coral within Kane`ohe Bay.

Tyler, W. A. and F. G. Stanton (1995). "Potential influence of food abundance on spawning patterns in a damselfish, *Abudefduf abdominalis*." Bull. Mar. Sci. 57: 610-623.

Temporal spawning patterns in coral-reef fishes are thought to be influenced by a variety of environmental factors including predation on offspring, current and light patterns, colonial nesting and costs of parental care. Although food availability is known to limit growth and reproduction in some pomacentrids, its effect on spawning patterns is not understood. Two populations of the Hawaiian sergeant, *Abudefduf abdominalis*, in Kane`ohe Bay, Hawai`i, exhibited variable spawning patterns over

a 5-year study ranging from patterns synchronized with lunar and semi-lunar cycles when spawning activity was relatively low, to acyclic spawning patterns when spawning activity was high. Stream discharge into Kane`ohe Bay and spawning activity increased over the study period. Reproductive activity was positively correlated with stream discharge on both study reefs. A preliminary feeding experiment suggests food of adults is limited in Kane`ohe Bay and that food availability may influence reproductive patterns. These results suggest that variations in food abundance can affect population-level spawning patterns and may partly account for intraspecific variability in spawning patterns observed in damselfishes

Uchida, R. N. (1977). "The fishery for nehu, *Stolephorus purpureus*, a live bait used for skipjack tuna, *Katsuwonus pelamis,* fishing in Hawai`i." Circ., U.S. Dep. Commer., Natl. Oceanic and Atmos. Adm., Natl. Mar. Fish. Serv 408: 57-62.
With increasing interest in the baitfish resources and their capacity to support local skipjack tuna, *Katsuwonus pelamis*, fisheries, their distribution and relative abundance need to be evaluated. This paper describes the trends in production of nehu, *Stolephorus purpureus*, an anchovy used as live bait in the fishery for skipjack tuna in Hawaiian waters. Kane`ohe Bay and Pearly Harbor, two of the most important baiting sites in the Hawaiian Islands, produce 71% of the bait. Another important site on O`ahu, particularly for night baiting, is Kalihi-Keehi Lagoon. Day baiting produced 79% whereas night baiting produced 21% of the State's nehu catch. Catches and baiting effort showed a downward trend in the day fishery and an upward trend in the night fishery in 1961-65. In 1966-72, however, catches and baiting effort increased steadily in the day fishery whereas they declined in the night fishery.

Uchida, T. (1970). "Occurrence of a rhizistome medusa, *Cassiopea mertensi* Brandt from the Hawaiian Islands." Annotat. Zool. Jap. 43: 102-104.

Ulbrick, M. L. (1969). "Studies on *Crucibulum spinosum* (Sowerby)." Proc. Malac. Soc. Lond. 38: 431-438.
A study of certain aspects of the biology of *Crucibulum spinosum* - shell shape, growth and movement, habitat, mating behaviour and feeding mechanisms. Most of the specimens used in this study were found on pieces of dead coral or basalt rocks dredged from the sand and rock bottom at 15-25 feet in Kane`ohe Bay. The only other described habitat for *C. spinosum* is in southern California.

Ulbrick, M. L. (1970). Studies on *Crucibulum spinosum* (Sowerby) (Abstr.). Kane`ohe, Univ. of Hawai`i, Hawai`i Inst. Mar. Biology.

Utinomi, H. p. and S. L. (1960). "On the world wide dispersal of a Hawaiian barnacle, *Balanus amphitrite hawaiiensis* Brock." Pac. Sci. 14: 43-50.
A paper presenting the argument that the Atlantic barnacle, *Balanus amphitrite* var*. denticulata* Brock and the Pacific barnacle, *Balanus amphitrite hawaiiensis* Brock are identical with each other and possibly with other forms or subspecies. The distribution of these related forms is presented. *B. amphitrite hawaiiensis* was reported from Kane`ohe Bay by Edmondson and Ingram, 1939 and Edmondson, 1949.

Van Heukelem, W. (1966). Some aspects of the ecology and ethology of *Octopus cyanea* Gray. Department of Zoology. Honolulu, University of Hawai`i**:** 104.
A study of the description and classification of the behavior of the octopus, *Octopus cyanea*, in terms of the ecological significance or the survival value of the behavior to the species. In the course of the work, data was obtained on the ecology of the species which is included also. All investigations were carried out in the field or in the lab on Coconut Island, Kane`ohe Bay. Behaviors studied were the predatory sequence which was found to consist of 5 steps; natural aquarium behaviors; defense mechanisms; courtship and copulation behaviors; and their ritualized fighting behaviors.

Van Heukelem, W. F. (1973). "Growth and Life Span of *Octopus cyanea* (Mollusca: Cephalopoda)." J. Zool., Lond. 169: 299-315.
The growth of *Octopus cyanea* was followed from 67 to 6500 g in captivity in an *ad libitum* diet of live crabs. Females spawning in captivity always die after their eggs hatch. Males may mate many times with several different females but do not appear to outlive females. The species spawns throughout the year; the time of spawning is probably determined by the age of the female. Males stop growing after suckers at the edge of the web enlarge and gradually lose weight until their death, about two or three months after maximum sucker enlargement. The life-span of *O. cyanea* appears to be between 12 and 15 months from settlement. A method of marking animals by branding is described which gives lifetime scars making it possible to study the growth of individual animals released in the field.

Van Weel, P. B. (1955). "The problem of smooth muscle." Publ. Staz. Zool. Napoli 27: 10-16.

The maintenance of tonus and the plasticity of smooth muscle are considered in the light of the theories of Jordan and of Postma. In experiments on holothurian muscle the author shows that the mechanical properties are largely uninfluenced by nervous block (curare and magnesium chloride) though the nervous influence is responsible for increased tonus. Plasticity effects recorded for *Opheodesoma* tend to support Jordan's concept of the muscle rather than that of Postma

Vandermeulen, J. H. (1974). "Studies on reef corals. II. Fine structure of planktonic planula larva of *Pocillopora damicornis*, with emphasis on the aboral epidermis." Mar. Biol. 27: 239-49.

Tissue and cellular organization of the planula larva of the reef coral *P. damicornis* gathered in Kane`ohe Bay are detailed ultrastructurally. Emphasis is placed on fine structure of the aboral (presumptive calicoblast epidermis). The presettling exploratory behavior of the coral larva is discussed. There is no evidence in the gastrodermis or epidermis of the planktonic larva for presettling accumulation of calcareous skeletal material. Vesicles containing a highly oriented fibrous material may represent sites of skeletal organic-matrix precusor buildup.

Vandermeulen, J. H. (1975). "Studies on reef corals. III. Fine structural changes of calicoblast cells in *Pocillopora damicornis* during settling and calcification." Mar. Biol. 31: 69-77.

This study presents ultrastructural detail of the calicoblast epidermis of larval and adult stages of the reef coral *Pocillopora damicornis.* The discussion is focused upon relating the outstanding observations of this study to epithelial metamorphosis, desmoidal processes, and calcification. The coral specimens used were collected in Kane`ohe Bay.

Vandermeulen, J. H., N. D. Davis et al. (1972). "The effect of inhibitors of photosynthesis on zooxanthellae in corals and other marine invertebrates." Mar. Biol. 16: 185-191.

Monuron (CMU), Diuron (DCMU), and methyl viologen were used as photosynthesis inhibitors on intact algal-marine invertebrate symbiotic associations, most of which were collected in Kane`ohe Bay. Observations indicated that CMU and DCMU are potential useful tools for investigation of symbiotic associations. Also suggested was that light-enhanced calcification is largely photosynthesis dependent and probably not dependent on some other photobiological effect.

Vandermeulen, J. H. and N. Watanabe (1973). "Studies on reef corals. I. Skeleton formation by newly settled planula larva of *Pocillopora damicornis*." Mar. Biol. 23: 47-57.

Observations were made on sequential skeletal growth stages of newly settled planula larvae, gathered from the reefs of Kane`ohe Bay during the first 22 days following settling onto glass microscope slides. Fusion of the primary calcareous elements results in the formation of the larval basal disc within 48 to 72 hours. With transmission electron microscopy, this disc is found to differ from subsequent adult calcification in (1) considerably lesser degree of mineralization; (2) smaller crystal size; (3) more random orientation of the crystals; and (4) the presence of trace amounts of calcite in addition to aragonite. The basal disc with its septal rudiments constitutes a true larval skeleton, differing in morphology, microarchitecture, and crystal type from the fibrous growth characterizing the adult skeleton.

Vaughan, T. W. (1907). "Recent Madreporaria of the Hawaiian Islands and Laysan." U. S. National Museum Bull. 59: 1-421.

The classical work on the Hawaiian Islands corals. A full taxonomic account of the Madreporaria collected by the U. S. Bureau of Fisheries Albatross expedition of 1902. A number of new species are described.

Vine, P. J. (1972a). "Spirorbinae (Polychaeta, Serpulidae) of the Hawaiian Chain. Part 1, new species." Pac. Sci 26(2): 140-149.

Tubeworms of the subfamily Spirorbinae occur throughout the world. However, up to this study, no previous taxonomic study has been made on those from the Hawaiian Islands. Three new species out of thirteen Spirorbinae are described from Hawai`i. One is from Coconut Island, Kane`ohe Bay, O`ahu.

Vine, P. J., J. H. Bailey-Brock et al. (1972b). "Spirorbinae (Polychaeta, Serpulidae) of the Hawaiian Chain. Part 2, Hawaiian Spirorbinae." Pac. Sci 26(2): 150-182.

Von Franzisket, L. (1968). "Zur Okologie der Fadenalgen im Skelett lebender Riffkorallen." Zool. Jb. Physiol. 74: 246-253.

A study of the coral-algae complex of the filamentous alga, *Ostreobium*, enmeshed in the skeleton of living reef corals in Kane`ohe Bay. The amount of light intensity at several distances below the coral surface was measured and this was correlated with maximum photosynthesis and respiration. Based on small biomass and low photosynthetic production, it was concluded that the algae did not contribute significantly to the primary production of the reef.

Wainwright, S. A. (1963). "Skeletal organization in the coral, *Pocillopora damicornis*." Quart. J. Micr. Sci. 104(2): 169-183.
A study presenting data and inferences on the major chemical constituents of the skeleton of *P. damicornis* collected from the reefs of *Porites compressa* in Kane`ohe Bay and describing the unit shapes and sizes, orientation and physical relationships of these skeletons. The skeleton was found to contain at least 99.9% by weight aragonite, present as submicroscopic crystals in spheric arrangements. The organic component of the skeleton comprises 0.01 to 0.1% of the total weight and has 3 microscopic constituents - 1. filaments of lime-boring algae, 2. a dispersed network of fibers l u in diameter and 3. a transparent, milky, regionally birefringent matrix of chitin. The chitin was observed to be a spongework of fibrils of average diameter 20 mp. The chitin fibrils were inferred to be randomly oriented in the plane of the skeletogenic epithelium perpendicular to the direction of growth of the long axes of the aragonite crystals.

Walsh, G. E. (1967). An ecological study of a Hawaiian Mangrove Swamp. Estuaries. G. H. Lauff. Washington D. C., AAAS. Publ. No. 83.
A study of an ecological analysis and integration of the physical, chemical and biological aspects of the Heeia mangrove swamp in the Kane`ohe Bay watershed area. Data includes diurnal, monthly and seasonal data on physical and chemical factors such as dissolved nitrate, phosphate, oxygen and salinity and a discussion on the physiological adaptations and food interrelationships of the fauna.

Walsh, G. E. and R. L. Bowers (1971). "A review of Hawaiian zoanthids with descriptions of three new species." Zoo. J. Linn. Soc. 50(2): 161-180.
This paper gives descriptions of zoanthids collected from coral reefs and shores of the Hawaiian Islands between June 1965 and June 1967. *Isaurus elongatus* Verrill (1928) and *Palythoa tuberculosa* Esper (1791) are redescribed and *Zoanthus vestitus* Verrill (1928) is reclassified as *Palythoa vestitus*. *Zoanthus confertus* Verrill (1928) and *Z. nitidus* Verrill (1928) are combined under the new species name *Zoanthus pacificus*. New species described are *P. psammophillia*, *P. toxica*, and *Z. kealakekuansis*. A list of zoanthid species from the south-western Pacific Ocean is given.

Walters, C. K. (1967). Nest guarding behavior of the male maomao, *Abudefduf abdominalis* (Quoy and Gaimard). Department of Zoology. Honolulu, Univ. of Hawai`i: 55 pp.
Abudefduf abdominalis demonstrates active parental care in guarding its deposited egg masses. The protection, fanning and removal of diseased eggs is carried out solely by the male. Parental nest care, appetititive behavior, freeding behavior, nest defense and mating behavior were seen as the major activities during the parental care phase of the spawning cycle, with different activities being more frequent at the various stages of the nest maturity. The location of the nest altered the frequency of the movements as well as the sequence in which they occur. A flow pattern was quantitatively established for the parental care phase, deviating occasionally due to various internal and external factors.

Wass, R. C. (1967). Removal and repopulation of the fishes on an isolated patch coral reef in Kane`ohe Bay, O`ahu, Hawai`i. Zoology. Honolulu, University of Hawai`i: 77.
A study in which an entire community of fish on an isolated patch reef was studied, standing crop determined species classified as herbivore, carnivore or omnivore and % composition of each tropic category in the total biomass was calculated and compared with previous studies. Recolonization of the experimental reef was studied to determine which species repopulated first, whether they were mainly adults and/or juveniles and the time interval involved. The patch reef studied was in Kane`ohe Bay - 210 27' 58" N longitude1570 48' 55" W latitude.
Results showed that the standing crop of fishes on the experimental reef was 1.117 lbs/acre. Of this biomass, 1.3% were herbivores, 26.4% carnivores and 72.3% omnivores. The adults and sub-adults of most reef fishes showed migratory tendencies. Scarids were the dominating re-populating fishes observed during this study. Repopulation required more than 241 days to achieve complete equilibrium. The visual census technique is valuable in determining the relative abundance of reef fishes, provided the investigator is aware of the limitations of the technique.

Watari, L. T. (1973). "Growth rate of a carangid fish, the omaka *Caranx mate*, in Hawai`i." Trans. Amer. Fish Soc. 102: 617-20.

A study of growth rate was initiated to ascertain the time to marketable size and the feasibility for aquaculture of the Hawaiian carangid, *Caranx mate*, a species that is numerous and readily available seasonally in Kane`ohe Bay. The growth rate calculated for larval *C. mate* was 18 mm per month; of juveniles, 7.5 mm per month; and of adults, 2.3 mm per month. marketable size is reached in approximately seven months.

Watson, M. (1969). Some aspects of the pharmacology, chemistry, and biology of the mid-gut gland toxins in some Hawaiian sea hares. Department of Zoology. Honolulu, University of Hawai`i,**:** 241.
A study of two toxic extracts, termed the 'ether-soluble toxin' and the 'water-soluble toxin', obtained from the mid-gut gland of four species of Hawaiian sea hares (Mollusca: Gastropoda: Aplysiidae). Both toxins were extracted from the homogenized mid-gut glands. Both toxins were found stable to short term temperature changes up to and including 90 deg C, as well as to recurrent freezing and thawing over a period of 2 years. Both were effective at low to moderate pH levels and were inactivated above pH 8. Neither toxin was orally toxic to mice, but they displayed potent intravenous and intreperitoneal effects. These effects are discussed and a possible mechanism of action of the water-soluble toxin at receptor site(s) is put forward. Specimens were caught by snorkeling at several places around O`ahu. Kane`ohe Bay was one area of collection. *Aplysia pulmonica* Gould 1852, was found on the reef flats directly facing the yacht harbor. They showed seasonal appearances with peak abundance in mid-October in 1966 and 1967, but not in 1968.

Watson, W. (1974). Diel changes in the vertical distribution of some common fish larvae in southern Kane`ohe Bay, O`ahu, Hawai`i. Department of Oceanography. Honolulu, Univ. of Hawai`i.
Nine series of vertically stratified zooplankton tows were made with a closing net at a single station in southern Kane`ohe Bay between 31 August 1973 and 11 April 1974. Sampling periods occupied from 12 to 36 hours, with tows usually taken at about three-meter intervals between the surface and a maximum depth of ten meters. A total of 21,254 fish larvae of 49 kinds was collected, the six most abundant species being *Foa brachyrammus Omobranchus elongatus Callionymus decoratus, Caranx mate, Stolephorus purpureus,* and *Abudefduf abdominalis.* The observed patterns are analogous to those shown for fish larva in the open ocean on scales of from 50 m to 200 m. It is proposed that Kane`ohe Bay represents a vertically compressed ocean with respect to the distribution of fish larvae.

Watson, W. and J. M. Leis (1974). Ichthyoplankton of Kane`ohe Bay, Hawai`i. A one-year study of fish eggs and larvae, Sea Grant Technical Report**:** 178.
A one-year survey of ichthyoplankton yielded 43 types of pelagic fish eggs and 38,505 larvae of 175 types. The tows were made in the Sampan Channel and in south Kane`ohe Bay. The catches did not reflect abundance of adult fishes in Kane`ohe Bay: larvae encountered in large numbers were from pelagic bay species, which spawn pelagic eggs, and reef species, which spawn demersal eggs. Statistically significant relationships were found.between egg abundance, surface water temperature, and day length. The results of this study are also discussed in regard to spawning, seasonal variations, and stresses induced by pollution and fishing.

Webber, H. H. (1970). Tolerance to environmental stresses and distribution of *Nerita picea* (Gastropoda: Neritidae) (Abstr.). Kane`ohe, Univ. of Hawai`i, Haw. Inst. Mar. Biology.
A study of population densities of *Nerita picea* on two habitats located on the sea wall adjacent to HIMB, Coconut Island in Kane`ohe Bay. Population density was found to be higher on the protected habitat (up to 200 /m^2) than on the exposed side (10/m^2). Movement during the tidal cycle, resistance to desiccation and temperature tolerance was studied in *Nerita* and compared in these respects to *Littorina scabra* which also inhabits exposed areas. The author proposes that a functional difference between *Littorina* and *Nerita* permits *Littorina* to maintain a greater population density in exposed habitats. *Littorina* has a mucus thread by which it remains attached to the substrate when it withdraws into its shell under adverse conditions. *Nerita* does not have as strong a mucus thread and so it can be readily dislodged.

Wei, S. L. and R. E. Young (1989). "Development of symbiotic bacterial bioluminescence in a nearshore cephalopod, *Euprymna scolopes*." Mar. Biol. 103: 541-546.

Weil, S. M. (1979). The effect of temperature and light on the stable isotopic composition of reef coral skeletons. Depart. of Oceanography. Honolulu, Univ. of Hawai`i**:** 102.
The reef corals *Pocillopora damicornis* and *Montipora verrucosa* were cultured under various controlled temperatures and light condition at Ulupau Head microcosm facility. The skeletal carbonate deposited under different experimental regimes was analyzed for ^{13}C and ^{18}O. Coral skeletal values varied with light dose and correlated with changes in zooxanthelllar pigment. The delta^{13}C value of

skeletal aragonite seems to be controlled by oxidation of photosynthetically produce organic matter.

Weil, S. M., R. W. Buddemeier et al. (1981). "The stable isotopic composition of coral skeletons: control by environmental variables." Geochemica et Cosmochimica 45: 1147-1153.
The reef corals *Pocillopora damicornis* and *Montipora verrucosa* were cultured under various controlled temperature and light conditions. The corals were analyzed for growth rate, tissue pigment content and skeletal ^{13}C and ^{18}O. Coral skeletal gamma ^{13}C values varied with light dose and correlated with changes in zooxantheller pigment. The gamma 13 C values of skeletal aragonite seem to be modified by oxidation of photosynthetically produced organic matter. Functionally significant relationships between coral skeletal gamma ^{18}O values and temperature have been determined. The temperature coefficients of the gamma ^{18}O values [-4.4 deg. C(%)$^{-1}$] are similar to the first order coefficient in the equilibrium paleotemperature equation, but the gamma ^{18}O values have taxonomically consistent offsets from equilibrium. The offsets may be attributed to the coral metabolism with slight but statistically significant differences between the two genera. Environmental and metabolic variables other than temperature have little or no effect on skeletal gamma ^{18}O.

Wetherall, J. A. (1977). "Catch statistics and abundance of nehu, *Stolephorus purpureus*, in Kane`ohe Bay." Circ., U.S. Dep. Commer., Natl. Oceanic and Atmos. Adm., Natl. Mar. Fish. Res. 408: 114-118.
Catch and nominal effort statistics from the Kane`ohe Bay day-baiting fishery for nehu, *Stolephorus purpureus*, were used to explore hypotheses concerning two sources of variation in baiting success: (1)nehu stock abundance, and (2)abiotic environmental variables. Baiting success was found to be positively correlated with streamflow in a major tributary to Kane`ohe Bay, but was unrelated to nominal baiting effort. However, the assumptions underpinning the analyses cannot be accepted with confidence, because the available nominal effort data do not provide a good measure of effective baiting effort. A definitive understanding of nehu stock dynamics will require changes in data collection practices of the Hawai`i Division of Fish and Game. In particular, detailed information on catch per set of the bait seine and on size composition of the nehu stock and catch are needed.

Whipple, J. A. (1966). The comparative ecology of the Hawaiian *Littorina* Ferussac (Mollusca: Gastropoda). Department of Zoology. Honolulu, University of Hawai`i**:** 296.
A study concerned with two species of *Littorina, L. pintado and L. picta,* which are the most abundant of the five species found in Hawai`i. The study includes their systematics, life historyg substratum, distribution, density and abundance as well as their ecology.

White, J. K. F. (1980). Distribution, recruitment and development of the borer community in dead coral on shallow Hawaiian reefs. Depart. of Zoology. Honolulu, Univ. of Hawai`i**:** 223 pp.
Twenty seven species of known and suspected coral skeletal borers were identified from dead corals collected from shallow Hawaiian reefs. In comparison to inventories of the borer communities collected in other tropical areas Hawaiian corals had an abundance of polychaetes, fewer species of sipunculids and acrothoracican barnacles and far fwere boring sponges. Polychaetes were responsible for the majority of the bioerosion of dead corals collected from Kane`ohe Bay in 1977.

Wiersma, C. A. C. and A. Bush (1963). "On the movements of the eyestalks of crabs, particularly of *Calappa hepatica* (L.)." Koninkl. Nederl. Akademie van Werenschappen Amsterdam Proc. Ser. C, 66: 13-17.
A study conducted at the Waikiki laboratory on specimens collected around Coconut Island, Kane`ohe Bay. The crabs were operated on and stimulated in various ways with the resulting eye movements being noted. Although *C hepatica* is regarded to be more primitive in comparison with other crabs, the specialization of the eye appears to be very advanced. The eyes are very well protected and no control adjustments are necessary to compensate for changes in the orientation of visual fields between the withdrawn and extended positions of the eye.

Wiersma, C. A. G. and S. H. Ripley (1952). "Innervation patterns of crustacean limbs." Physiologia Comparata et Oecologia 2: 391-405.
A study of the innervation patterns in the limbs of Palinura and Anomura in the hopes of making a generalized pattern of innervation within these groups. Comparative work was done also on the Decapod Natantia and Stomatopoda. The crabs were collected in Kane`ohe Bay and the laboratory work was done at Coconut Island.

The results for each crustacean group agreed with previously reported work except for one or two points. The differences in musculature and innervation in the legs of the Decapod crustacea support the division of this group into Natantia and Reptantia, with a subdivision of the latter into 4 tribes: Palinura, Astacura, Anomoura and Brachyura as opposed to the other classifications which have been used.

Wilkes, C. (1845). Narrative of the U. S. Exploring Expedition During the Years of 1838, 1839, 1840, 1841 and 1842, Vol. IV. Philadelphia, Lea and Blanchard.

The account of the U. S. Exploring Expedition to the Hawaiian Islands, 1838 to 1842. In volume four, p. 76-84, Wilkes makes reference to Kane`ohe--the condition of the land, the mission station, the harbor of Waialai, and the king's fish ponds.

Williams, S. L. and R. C. Carpenter (1998). "Effects of unidirectional and oscillatory water flow on nitrogen fixation (acetylene reduction) in coral reef algal turfs, Kane`ohe Bay, Hawai`i." J. Exp. Mar. Biol. Ecol. 226: 293-316.

Rates of acetylene reduction (nitrogenase activity) by algal turf communities from Kane`ohe Bay, O`ahu, Hawai`i, were measured as a function of increasing water flow speeds under unidirectional and oscillatory flow regimes in an enclosed incubation chamber. Water flow speeds, shear stress, and turbulence intensities were measured with thermistor probes in the chamber and over the turfs in the field. The thickness of the boundary layer varied significantly and linearly with bulk water flow speeds in the field. Although the boundary layer in the chamber also decreased with increasing flow speeds, turbulence intensity and flow speeds in the chamber were mostly lower than those typically measured in the field. Rates of acetylene reduction were positively related to water flow speed. Oscillatory water flow, which increased turbulence intensity five times, resulted in a significant increase in acetylene reduction compared to unidirectional flow. Even at the lowest mean flow speeds measured in the field (< 0.1 m s-1), mean rates of acetylene reduction (27 nmol ethylene cm-2 h-1 +- 11 SD) were high under oscillatory flow. Equivalent high rates under unidirectional flow were not achieved until flow speed was more than doubled. The slope of log-log linear regressions of acetylene reduction versus flow speed was 0.5 for both oscillatory and unidirectional regimes. This result suggests that acetylene reduction rates in the chamber were controlled by mass transfer of a rate-controlling solute, such as acetylene or oxygen (inhibitory to nitrogenase), through a laminar diffusion boundary layer. Because coral reefs exist in areas of very low nitrogen availability, nitrogen fixation is fundamentally important for coral reef primary production and biogeochemistry. Yet, current understanding of nitrogen fixation on coral reefs has been derived primarily from measurements made under unnatural conditions of no or low water flow. This study lends support to the importance of water flow as a major control of the metabolism of organisms occupying coral reefs.

Williams, V. R. (1980). Growth and reproduction of the Marquesan sardine (*Sardinella marquesensis*) in Hawai`i. Dept of Oceanography. Honolulu, Univ. of Hawai`i: 53.

Holding experiments showed that the smallest regular increments found on the sagittae of *Sardinella marquesensis* are formed daily. Based on this finding the ages of 106 sardines, ranging from 17 mm to 122 mm S. L. were determined. Observations of juvenile sardines in the field and the seasonal changes in the gonad/somatic weight ratio indicated that spawning occurred throughout the year but probably peaks during the summer months. It is possible that the sardines spawn repeatedly but frequency, timing, and location remain unknown. Sardines for sex ratio data and prelim. studies on fecundity and gonad/somatic weight ratio were collected in the southern part of Kane`ohe Bay, O`ahu, at night (sardines appeared in catches between 1975-76).

Williams, V. R. and T. A. Clarke (1983). "Reproduction, growth, and other aspects of the biology of the gold spot herring, *Herklotsichthys quadrimaculatus* (Clupeidae), a recent introduction to Hawai`i." Fish. Bull. 81(3): 587-597.

The gold spot herring, *Herklotsichthys quadrimaculatus*, was introduced to Hawai`i by unknown means probably in the early 1970s and apparently spread and increased in abundance very rapidly. On the island of O`ahu, it has been regularly present in inshore areas since 1976 and has been most abundant during late spring to early fall. Among adult fishes sampled, females slightly outnumbered males in seine collections by day in shallow water, but males predominated in nighttime collections from deeper water. Both sexes began to mature at 75-80 mm SL and females carried distinct size groups of nearly mature ova by 90 mm SL. Gonad to somatic weight ratios from both sexes indicated a spring-to-fall spawning season with a midsummer peak. Batch fecundity of females was 1,100-6,300. There was no direct evidence of multiple spawning, but secondary size groups of small ova were observed in some females which also carried a distinct batch of larger ova. Holding experiments showed that juveniles deposit daily growth increments on sagittae. Age estimates from increment counts of fish 17-121 mm long indicated that herring metamorphose at about 1 month, mature at 5-6 months, and probably live no more than 1 year. The reproductive life span of females appears long enough to ripen more than one batch of ova. *H. quadrimaculatus* were collected in Kane`ohe Bay on the island of O`ahu.

Wilson, J. (1998). The effect of temperature on settlement patterns of *Pocillopora damicornis* in Hawai'i. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 95-103.

This study examined the effect of temperatures on patterns of settlement of *Pocillopora damicornis* in Hawai`i in July 1997. Four temperatures were used 22, 25, 28 and 31°C. Settlement was highly variable within and among treatments but was lower at 22°C compared to 28°C. *P. damicornis* larvae settled cryptically on the undersurface of tiles in all treatments. In lower water temperature treatments, a larger proportion of free swimming larvae remained in the water column. This indicates that at lower water temperatures, dispersal rather than settlement of *P. damicornis* larvae is favored. Settlement of larvae may also be affected by microhabitat differences in water motion, or settlement cues on the surfaces of settlement substrata. These effects may be more important than temperature in the settlement of coral larvae resulting in the large variances within temperature treatments observed in this study. Coral planulae were obtained from colonies which had been collected from the reef flat around Coconut Island, Kane`ohe Bay, Hawai`i.

Wilson, J. and J. Schwarz (1998). Caloric content of symbiotic and aposymbiotic larvae of *Fungia scutaria*. Reproduction in reef corals. E. F. Cox, D. A. Krupp and P. L. Jokiel. Kane`ohe, O`ahu, HIMB, UH**:** 47-54.

A preliminary study of the caloric content of symbiotic and aposymbiotic larvae of the solitary coral *Fungia scutaria* was conducted in 1997. *Fungia scutaria* larvae were obtained during the full moon spawning in July 1997 from corals collected in Kane`ohe Bay, Hawai`i. A proportion of these larvae were infected with zooxanthellae three days after spawning. Samples of symbiotic and aposymbiotic larvae were harvested prior to infection with zooxanthellae and at 36 to 108 hours post infection. Symbiotic larvae had a higher caloric content per mg ash free dry weight (AFDW) than aposymbiotic larvae. In apsymbiotic larvae, the caloric content per mg AFDW decreased over time, whereas for symbiotic larvae, caloric content increased between 36 and 108 hours after infection. However, in this study, symbiotic larvae were always smaller which resulted in lower caloric values per individual larvae compared to aposymbiotic larvae. This may have been due to natural variability in larval size or to differences in activity or metabolism between the two groups. These studies indicate the potential for symbiosis to contribute to the energy budgets of *F. scutaria* larvae although further studies are needed to more accurately determine the role of symbiosis in the larval ecology of corals.

Wilson, W. F. (1922). With Lord Byron at the Sandwich Islands in 1825, Being Extracts from the Diary of James Macrae, Scottish Botanist. Honolulu, W. F. Wilson.

Extracts from the diary of James Macrae, botanist on Byron's voyage to Hawai`i in 1824-1826 compiled by William F. Wilson. The diary is now in the possession of the Royal Horticultural Society, London; and the herbarium is either in Kew or in the British Museum in London, This is one of the earlier accounts of visiting the islands--the author not only describes the scenery, but also the culture and makes special note of the flora of the islands. On one of his trips around O`ahu, Macrae visted Kane`ohe. Here, the natives cultured noni or *Morinda citrifolia* for the sake of its fruits as a yellow color for tapa and cloths. Macrae noted that Kane`ohe Bay was open, exposed and "full of rocks in many places above water which renders it unsafe for vessels to anchor. It is full of fish."

Woo, M. (1999). Ecological impacts and interactions of the introduced red algae *Kappaphycus striatum* in Kane'ohe Bay, O`ahu. Department of Botany. Honolulu, University of Hawai`i.

The introduction anbd consequent spread of the red algae *Kappaphycus striatum*, has become a management concern and has led to studies that examine ecological impacts and interactions of the algae. To determine if herbivory plays a role in the abundance of *K. stiatum*, predator exclosures wereplaced in areas of high and low algal abundance to estimate diferences in grazing intensity. It was observed that, in areas of high *K. striatum*, abundance there was no significant difference in growth between the caged and uncaged treatment, suggesting that grazing intensity is low and unable to affect algal biomass. In an area of low macroalgal abundance, however, differences in growth rates between uncaged and caaged treatments were significant. Growth rates were negative in uncaged treatments, suggesting that grazing intensity was high. This higher grazing intensity may be due to a larger grazing popluation or to lack of alternative food sources. Additional studies to assess the ability of the algae to reproduce vegetatively, as well as a qualitative assessment of the possible impact of algal overgrowth on live coral, will allow estimation of further spread, habitat alteration and ecological impact.

Woo, M., C. Smith et al. (1999). "Ecological interactions and impacts of *Kappaphycus striatum* in Kane'ohe Bay, a tropical reef." Proc. 1st Nat. Conf Marine Bioinvasions, MIT, Cambridge 1: 186-192.

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Wood, W. F. (1989). "Photoadaptive responses of the tropical red alga *Eucheuma striatum* Schmitz (Gigartinales) to ultra-violet radiation." Aquat. Bot. 33: 41-51.
The attenuation of ultra-violet radiation (UV) is described for the waters of Kane`ohe Bay, Hawai`i. The attenuation rates for UV varied with water turbidity and were similar, or greater, than that for photosynthetically active radiation. High concentrations of UV-absorbing compounds were detected in the red alga *Eucheuma striatum* Schmitz, growing in natural populations in the bay. The concentration of these compounds was shown to vary with self-shading and to respond to experimental manipulations of natural sunlight. Under unfiltered, natural, UV-containing sunlight photopigment destruction occurred and the concentration of UV-absorbing substances increased. Photopigment destruction did not occur, nor was there an increase in UV-absorbing substance, when the UV component of sunlight was selectively removed by UV filters. It is suggested that the production of UV-absorbing substances by *E. striatum* is an acclimative response to the ambient UV climate at the depth at which the plant grows.

Woodbury, D. (1946). Builders for Battle - How the Pacific Naval Air Bases Were Constructed. N. Y., E. P. Dutton and Co., Ltd.
The story of the construction of the Pacific Naval Air Bases before World War II. On p. 78-91, the author tells the story of the dredging operations and the building of the Kane`ohe Naval Marine Base on Mokapu Peninsula. In a period of a month, they removed 175,000 cubic yards of coral and deposited it on the flat land where the station is now located. Seven million dollars were spent on building Kane`ohe Base, more than half what Congress had allotted to the whole Pacific group. It doesn't say exactly where they were dredging, but it mentions working in 10-25 foot seas and heavy surge; so it must have been outside the reef area.

Worcester, W. S. (1969). Some aspects of the ecology of *Lingula* (Brachiopoda) in Kane`ohe Bay, Hawai`i. Oceanography, University of Hawai`i, Manoa**:** 49.
This study, extending from June 1967 to February 1969, deals with the distribution, limiting factors, interspecific interactions, feeding, growth and other aspects of the life history of *Lingula reevi*i in the south Bay. The main objective was to understand the ecological position of *L. reevi* in respect to limiting factors, interspecific interactions, distributional pattern and growth, and to use this information as an aid to understanding the ancient environments in which *Lingula* is found as a fossil. Results showed that the distributional pattern was dependent on substrate, predators, food supply and clam diggers and to be intraspecifically independent. There was no preferred shell orientation; a good adaptation to sediment instability; and a preference to salinities between 20 and 35%. Portunid crabs appeared to be the important predators and their predatory effect may account for the absence of the brachiopod in the deeper parts of the bay. Although *L. reevi* and the clam *Tapes philippinarum* co-occur, their niches appeared to be separate. The sex ratio of *L. reevi* is 1:1 and spawning occurs year round. Growth was found dependent on food supply and shell length was found to decrease linearly with increasing size. Longevity is estimated to be 5-8 years. The brachiopod is not considered to be an important member of the Kane`ohe Bay ecosystem. Fossilization of *L. reevi* is probably not occurring in Kane`ohe Bay.

Work, T. M., G. H. Balazs et al. (1998). "Morphological and cytochemical characteristics of blood cells from Hawaiian green turtles." Am. J. Veterinary Res. 59: 1252-1257.
To identify and characterize blood cells from free-ranging Hawaiian green turtles, *Chelonia mydas*. Sample Population-26 green turtles from Puako on the island of Hawai`i and Kane`ohe Bay on the island of O`ahu. Procedure-Blood was examined, using light and electron microscopy and cytochemical stains that included benzidine peroxidase, chloroacetate esterase, alpha naphthyl butyrate esterase, acid phosphatase, Sudan black B, periodic acid-Schiff, and toluidine blue. Results-6

types of WBC were identified: lymphocytes, monocytes, thrombocytes, heterophils, basophils, and eosinophils (small and large). Morphologic characteristics of mononuclear cells and most granulocytes were similar to those of cells from other reptiles except that green turtles have both large and small eosinophils. Conclusions-Our classification of green turtle blood cells clarifies improper nomenclature reported previously and provides a reference for future hematologic studies in this species

Wright, N. (1986). Aspects of reproduction and planula development in the reef coral *Cyphastrea ocellina*. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 179-192.

Yamamoto, M. and M. Yoshida (1978). "Fine structure of the ocelli of a synaptid holothurian, *Opheodesoma spectabilis*, and the effects of light and darkness." Zoomorphologie 90: 1-17.
The ocellus of a synaptid holothurian, *Opheodesoma spectabilis*, is composed of sensory and supportive cells and underlain by numerous bundles of tentacular nerve fibers. Pigment cells in the tentacular nerve envelope the ocellus. A sensory cell is divided into three parts: an apical part from which a single cilicum and numerous microvilli arise, a slender middle part, and an enlarged basal part that contains an oval nucleus and gives rise to an axon. The sonemes in the cilia show varying degrees of remodeling. The following changes result from exposure to light: the microvilli become shorter and irregularly arranged; plasmalemmal invaginations engulf the microvilli; coated vesicles of varying appearances and membranous fragments become abundant; microtubules are less evident in the apical part; and small flat vesicles appear along the plasma membrane in the middle part. The evolution of photosensory cells and membrane turnover are discussed. *O. spectabilis* were collected in the neighborhood of HIMB on Coconut Island, O`ahu, Hawai`i.

Yamashita, D. T. (1951). The embryological and larval development of the nehu, an engraulid baitfish of the Hawaiian Islands. Department of Zoology. Honolulu, University of Hawai`i.
A study of the physical and biological factors affecting the supply of the nehu in the Ala Wai Canal and in Kane`ohe Bay in order to exploit the population to secure the maximum sustained yield.
The development of the nehu eggs was divided into 8 stages of morphological differentiation from early cleavage to hatching. The development of the nehu larvae is also described. Field experiments showed the time of spawning, the duration of incubation period, the development of eggs under varying temperature conditions and the growth of larvae. There was found to be a significant difference in both the size of the nehu eggs and the newly hatched larvae between Ala Wai Canal and Kane`ohe Bay: 1.18 mm 1.35 mm (egg length) and 1.87 mm - 2.12 mm (newly hatched larval length). In both areas, nehu spawn throughout the year with erratic day to day fluctuations. Rearing experiments failed, so larval growth rate was estimated by correlating lab and field observations.

Yamazato, K. (1966). Calcification in a solitary coral, *Fungia scutaria* Lamarck, in relation to environmental factors. Department of Zoology. Honolulu, University of Hawai`i.
A study concerned with the role of zooxanthellae in calcification of corals which was broken into two phases: analyzing the effects of some environmental factors on the rate of calcium uptake by *F. scutaria*; and obtaining a clear picture of the uptake and release of phosphorus by the same animal under varying conditions. *Fungia scutaria* and *Porites compressa* were collected from a coral reef flat on the southern coast of Kane`ohe Bay, O`ahu. The author concluded that the zooxanthellae accelerated calcification in corals under various environmental conditions, and the adverse effects of environment on calcium uptake is reduced by the presence of zooxanthellae in the coral tissue. This effect of the presence of zooxanthellae is achieved through 2 processes - the removal of C02 from the C02-CO3 system and the removal of-phosphorus compounds, a possible inhibitor of calcification, from the site of $CaCO_3$ deposition.

Yap, W. G. (1974). Population biology of the little-neck clam, *Tapes philippinarum*, in Kane`ohe Bay, Hawai`i. Dept. of Oceanography. Honolulu, Univ. of Hawai`i**:** 66 pp.
The stock of Japanese littleneck clam in O`ahu started with their introduction in 1920. The clams grew exceptionally well in Kalihi Basin and Pearl Harbor, but not in Kane`ohe Bay. The clams have since disappeared except in Kane`ohe Bay, where extensive populations were recorded. Heavy harvesting in the Bay during a succession of open seasons from 1965 to 1968 probably triggered their decline. The only remaining clam bed in the Bay was studied. The following objectives of this study are to 1) determine whether the bed is declining or recovering and 2) assess the amount of predation by crabs and its role as a potential regulatory factor.

Yap, W. G. (1977). "Population biology of the Japanese littleneck clam, *Tapes philippinarum*, in Kane`ohe

Bay, O`ahu, Hawaiian Islands." Pacific Science 31(3): 223-244.
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Yarnall, J. L. (1969). "Aspects of the behavior of *Octopus cyanea* Gray." Anim. Behav. 17(4): 747-754.
The behavior of *Octopus cyanea* was observed in two reef ponds on Coconut Island for a period of 60 days. Crepuscular activity pattern was noted to peak at 0600 and 1800 hours local time. Hunting trips may extend up to 50 meters and may last one hour. The feeding method was noted to be speculative rather than objective. *-0. cyanea* was concluded to be a major predator on crabs and an important member of the coral reef community.

Yarnall, J. L. (1970). Aspects of the behavior of *Octopus cyanea* Gray (Abstr.). Kane`ohe, Univ. of Hawai`i, Haw. Inst. Mar. Biology.
The behavior of *Octopus cyanea* was observed in two reef ponds on Coconut Island for a period of 60 days. Crepuscular activity pattern was noted to peak at 0600 and 1800 hours local time. Hunting trips may extend up to 50 meters and may last one hour. The feeding method was noted to be speculative rather than objective. *-0. cyanea* was concluded to be a major predator on crabs and an important member of the coral reef community.

York, R. H. (1986). Isolation and culture of symbiotic algae. Coral Reef Population Biology. P. L. Jokiel, R. H. Richmond and R. A. Rogers, University of Hawai`i, Hawai`i Institute of Marine Biology, Kane`ohe. HIMB Tech. Rept. No. 37 (Sea Grant Cooperative Rept. UNIHI-SEAGRANT-CR-86-01)**:** 486-487.

Young, S. D. (1969). Studies on the skeletal organic material in hermatypic corals, with emphasis on *Pocillopora meandrina*. Department of Biology. Los Angeles, Univ. of California.
Dissertation on the skeletal organic material in hermatypic corals, especially in *Pocillopora meandrina*. The amino acid composition of the matrix of the 14 species from the suborders Astrococoeniina, Fungiina, Faviina and Dendrophylliina are described; the distribution of C14 in skeleton and tissue of corals incubated with $Na_2C^{14}0_3$ is described; and the results of experiments testing the hypothesis that matrix formation is necessary for deposition of calcium carbonate is discussed. Specimens from Kane`ohe Bay were used in the study. Results indicated that all corals examined have a similar amino acid composition. Glucosamine is present in varying proportions, but the origin of this compound is uncertain. Experiments showed that the deposition of a new matrix is necessary for the deposition of calcium carbonate.

Young, S. D. (1971a). "Organic material from scleractinian coral skeletons-I. Variation in composition between several species." Comp. Biochem. Phy. 40B: 113-120.
The proportions of amino acids and glucosamine obtained after hydrolysis of matrices in fourteen coral species representing the suborders Astrocoeniina, Fungiina, Faviina and Dendrophylliina are presented and discussed in this report. Corals used in this study were collected from Kane`ohe Bay, O`ahu, Hawai`i or from Eniwetok Atoll.

Young, S. D. (1971b). Organic matrices associated with $CaCO_3$ skeletons of several species of hermatypic corals. Experimental coelenterate biology. H. M. Lenhoff, L. Muscatine and L. V. Davis. Honolulu, Univ. Hawai`i Press**:** 260-264.
In this paper the results of analyses of organic matrices from some Hawaiian corals are compare the data with similar data for the matrices of mollusc shells and brachipod shells. The possible influence of the organic matrix on coral calcification is discussed.

Young, S. D. (1973). "Calcification and synthesis of skeletal organic material in the coral, *Pocillopora damicornis* (L.) (Astrocoeniidae, Scleractinia)." Comp. Biochem. Physiol. 44A: 669-672.
Corals were incubated with $Na_{\square}{}^{I\square}CO_{\square}$ in the presence of puromycin to study organic material production and calcification. A significant coefficient of correlation (+0.63) was found between organic material synthesis and the deposition of calcium carbonate. The effect of puromycin was not significant. These data suggest an interaction, before or during deposition, of skeletal organic material and mineral carbonate.

Young, S. D., J. D. O'Connor et al. (1971). "Organic material from scleractinian coral skeletons-II. Incorporation of ^{14}C into protein, chitin and lipid." Comp. Biochem. Phy. 40B: 945-958.

It is possible to use the fixation of ^{14}C by zooxanthellae, ant the transfer of labelled photosynthate to the coral to label the organic material of the skeleton. This has been done in the present study to aid in the identification of the relative proportions of the major organic components of the skeleton and to explore the avenues of their synthesis. Specimens of *Pocillopora damicornis* were collected from Kane`ohe Bay, O`ahu, Hawai`i.

Youngbluth, M. J. (1968). "Aspects of the ecology and ethology of the cleaning fish *Labroides phthirophagus* Randall." Z. Tierpsychol. 25: 915-932.

A study of the endemic Hawaiian cleaning wrasse, *L. phthirophagus*, to quantify aspects of its behavior and ecology. Research was done in Kane`ohe Bay by skin and SCUBA diving. Ecological studies included a study of the density and distribution around a patch reefs, an analysis of the diet, an estimate of the rate of cleaning and a study of depopulation of the species from selected patch reefs. Aquarium observations provided information on cleaning behavior, the sequence and frequency of the fixed motor patterns of this behavior, the relationship between the inspecting and feeding of different areas of the host fish and the relationship between the amount of time inspecting a host fish and the frequency of feeding. Reproductive behavior was observed in the field from March 1965 to March 1966.

Ziemann, D. (1970). The horizontal distribution of zooplankton in Kane`ohe Bay, O`ahu, Hawai`i. Kane`ohe, University of Hawai`i, Hawai`i Institute of Marine Biology**:** 56.

Samples were taken with the Longhurst-Hardy plankton sampler in the bay during 1969 to study the horizontal distribution of the zooplankton. The Bay was divided into six different regions, and samples were taken in each region. The distributions of the zooplankton were analysed by computer for deviations from randomness, and these deviations were compared between regions. It was found that two different types of distributions were present. First, some of the animals had distributions that did not deviate from randomness. Second, most of the animals were found to have distributions that did deviate from randomness. The distributions were of two types. Several of the animals found in the southern sector were found to be associated with 2 bathymetric features, a patch reef and a relatively isolated cove. The associations of these animals with the bathymetric features is suggested as being of an active nature. The remaining distributions showed a pattern of deviation from randomness which was attributed to the effect of mixing of different water masses during the tidal exchange of water between the bay and the ocean.

Zimmerman, S. T. (1969). The transformation of energy by *Lucifer chacei (*Borradaile) Bowman (Crustacea, Decapoda). Department of Zoololgy. Honolulu, University of Hawai`i**:** 66.

A laboratory study of energy transformations by the pelagic decapod, *Lucifer chacei*. Three stages were studied: the zoea-protozoea stage, the combined early and late schizopod stage and the combined adult stages. Respiration was measured using a micro Winkler technique. Assimilation was determined using S^{35}. Dry weight, ash content, calorific values were determined for each stage. The number of calories/hour ingested, assimilated, and respired were determined for each stage and an energy flow diagram was constructed. The animals were collected in Kane`ohe Bay.

APPENDIX B

Listing of Marine Organisms Reported for All Studies in Kane`ohe Bay

ALGAE
Division CYANOPHYTA
Order CYANOPHYTA
Family OSCILLATORIACEAE
Lynbya majuscula **Gomont**
1959 Banner, 1959
1959 Helfrich and Banner, 1960
1968 Soegiarto, 1969
1978 AECOS, 1982
1982 AECOS, 1982
2000 Present study
Division CHLOROPHYTA
Order ULVALES
Family MONOSTOMOATACEAE
Monostroma oxyspermum **(Kutzing)**
1964 Gilbert, 1965
Family ULVACEAE
Enteromorpha intestinalis **(L.) Link**
1968 Soegiarto, 1969
Ulva fasciata **Delisle**
1968 Soegiarto, 1969
1970 Henderson et al., 1976
1976 Grovhoug and Rastetter, 1980
1976 Brock, 1976
1982 AECOS, 1982
Ulva lactuca **Linn.**
1968 Soegiarto, 1969
1972 Franzisket, 1973
1973 Franzisket, 1974
Ulva reticulata **Forsskal**
1979 AECOS, 1982
1982 AECOS, 1982
Order CLADOPHORALES
Family ANADYLOMENACEAE
Microdictyon setchellianum **M.Howe**
2000 Present study
Family BOODLEAECEAE
Boodlea composita **(Harv.) Brand**
2000 Present study
Family VALONIACEAE
Valonia aegagropila **C. Agardh**
1968 Soegiarto, 1969
1982 AECOS, 1982
Valonia ventricosa**? J. Ag.**
2000 Present study
Venticaria ventricosa **(J.Agardh) Olsen & West**
2000 Present study
Family SIPHONOCLADACEAE
Dictyosphaeria cavernosa **(Forsskal) Boergesen**
1933 Howe, 1939
1967 Cook, 1971
1968 Soegiarto, 1969
1972 Banner, 1974
1973 Environmental Consultants Inc., 1973
1975 Environmental Consultants Inc., 1975
1976 Brock, 1976
1977 Environmental Consultants Inc., 1977
1977 Lewis, 1980
1978 AECOS, 1982
1982 AECOS, 1982
1984 Maragos, 1985
1985 Stoner, 1986
1985 Alino, 1986
1985 Hunter and Kehoe, 1986

- 1991 Coles and Ruddy, 1995
- 1993 Larned and Stimson, 1996
- 1994 Stimson et al., 1996
- 1994 Hunter and Evans, 1995
- 1994 Marine Research Consultants, 1994
- 1995 Larned and Atkinson, 1997
- 1995 Larned, 1998
- 2000 Present study

Dictyosphaeria versluysii **Web. V. Bosse**

- 1968 Soegiarto, 1969
- 1970 Banner and Bailey, 1970
- 1972 Soegiarto, 1973
- 1975 Henderson and Smith, 1978
- 1976 Brock, 1976
- 1977 Lewis, 1980
- 1978 AECOS, 1982
- 1982 AECOS, 1982
- 2000 Present study

Order BRYOPSIDALES

- Family BRYOPSIDACEAE
  - ***Pseudobryopsis oahuensis***
    - 2000 Present study
- Family CODIACEAE
  - ***Codium arabicum*** **Kutzing**
    - 1968 Soegiarto, 1969
    - 1978 AECOS, 1982
    - 1982 AECOS, 1982
  - ***Codium edule*** **Silva**
    - 1968 Soegiarto, 1969
    - 2000 Present study
- Family CAULERPACEAE
  - ***Caulerpa ambigua*** **Okamura**
    - 1961 Gilbert, 1962
    - 1968 Soegiarto, 1969
    - 1976 Brock, 1976
  - ***Caulerpa racemosa*** **(Forsskal) J.Agardh**
    - 1995 Larned, 1998
    - 2000 Present study
  - ***Caulerpa sertularioides*** **(Gmelin) Howe**
    - 1968 Soegiarto, 1969
    - 1995 Larned, 1998
    - 2000 Present study
  - ***Caulerpa taxifolia*** **(Vahl) C. Ag.**
    - 2000 Present study
  - ***Caulerpa verticillata*** **J.Agardh**
    - 2000 Present study
  - ***Caulerpella ambigua*** **(Okamura)**
    - 2000 Present study
- Family HALIMEDACEAE
  - ***Halimeda discoidea*** **Decaisne**
    - 1979 AECOS, 1982
    - 1982 AECOS, 1982
    - 1990 Inouye and Crosby, 1991
    - 2000 Present study
  - ***Halimeda opuntia*** **(L.) J.V.Lamour**
    - 2000 Present study
  - ***Halimeda*** **sp.**
    - 2000 Present study
- Family UDOTEACEAE
  - ***Rhipidosiphon javensis*** **Montagne**
    - 2000 Present study

Order DASYCLADALES

- Family DASYCLADALCEAE
  - ***Bornetella sphaerica*** **(Zanardini) Solms-Laubach**

1968 Soegiarto, 1969
2000 Present study

Neomeris annulata **Dickie**
1968 Soegiarto, 1969

Neomeris van-bossae **Dickie**
1982 AECOS, 1982

Order PRASIOLALES

Family PRASIOLACEAE

Cladophora sericea **(Huds.) Kütz**
2000 Present study

Cladophora vagabunda **(L.) van den Hoek**
2000 Present study

Cladophoropsis membranacea **(C.Agardh) Børgesen**
2000 Present study

Cladophoropsis **sp.**
2000 Present study

Division PHAEOPHYTA

Order ECTOCARPALES

Family ECTOCARPACEAE

Ectocarpus indicus **J. Agardh**
1968 Soegiarto, 1969
1980 Hixon and Brostoff, 1983
1983 Hixon and Brostoff, 1985

Family RALFSIACEAE

Ralfsia occidentalis **Hollenberg**
1982 AECOS, 1982
1993 Russell and Balasz, 1994

Order CHORDARIALES

Family CHORDARIACEAE

Cladosiphon novaecaledonia
1968 Soegiarto, 1969
1972 Soegiarto, 1973

Order SCYTOSIPHONALES

Family SCYTOSIPHONACEAE

Colpomenia sinuosa **(Roth) Derbs and Soller**
1968 Soegiarto, 1969

Hydroclathrus clathratus **(Bory) M. A. Howe**
1962 Matthews and Townsley, 1964
1968 Soegiarto, 1969
2000 Present study

Rosenvigea intricate **(J.Agardh) Børgesen**
2000 Present study

Rosenvigea orientalis **(J. Ag.) Boerg.**
1968 Soegiarto, 1969

Order SPHACELARIALES

Family SPHACELARIACEAE

Sphacelaria novae-hollandiae **Sond**
2000 Present study

Order DICTYOTALES

Family DICTYOTACEAE

Dictyopteris australis **Sonder**
1968 Soegiarto, 1969
1972 Soegiarto, 1973
1979 AECOS, 1982

Dictyopteris plagiogramma **(Montagne) Vickers**
1968 Soegiarto, 1969

Dictyota acutiloba **J. Agardh**
1933 Howe, 1934
1968 Soegiarto, 1969
1979 AECOS, 1982
1982 AECOS, 1982
2000 Present study

Dictyota ceylanica
2000 Present study

***Dictyota divaricata* Lamouroux**
1982 AECOS, 1982
***Dictyota friabilis* Setch**
2000 Present study
***Dictyota sandvicensis* Kutzing**
1982 AECOS, 1982
2000 Present study
***Padina australis* Hauck**
2000 Present study
***Padina commersoni* Bory**
1933 Howe, 1934
***Padina japonica* Boergesen**
1972 Soegiarto, 1973
1979 AECOS, 1982
1982 AECOS, 1982
1990 Inouye and Crosby, 1991
2000 Present study
***Padina* sp.**
2000 Present study
***Spatoglossum solierii* (J. Ag.) Kutzing**
1968 Soegiarto, 1969
***Zonaria hawaiiensis* Doty and Newhouse**
1968 Soegiarto, 1969
Order FUCALES
Family SARGASSACEAE
***Sargassum echinocarpum* J. Agardh**
1929 Neal, 1930
1933 Howe, 1934
1933 Howe, 1934
1968 Soegiarto, 1969
1972 Soegiarto, 1973
1979 AECOS, 1982
1981 Morrisey, 1985
1982 AECOS, 1982
1995 Larned, 1998
2000 Present study
***Sargassum obtusifolium* J. Agardh**
1964 Berrill, 1965
1982 AECOS, 1982 (as *S. obtusifrons*)
2000 Present study
***Sargassum polyphyllum* Grun.**
1968 Soegiarto, 1969 (as *S. polyphyllum fissifolium*)
1982 AECOS, 1982
2000 Present study
***Turbinaria ornata* (Turner) J. Agardh**
1933 Howe, 1934
1968 Soegiarto, 1969
1979 AECOS, 1982
2000 Present study
Division RHODOPHYTA
Order NEMALIALES
Family NEMALIACEAE
***Trichoglea subnuda* Howe, 1934**
1933 Howe, 1934
1968 Soegiarto, 1969
Family BONNEMAISONIACEAE
***Asparagopsis taxiformis* (Delisle) Coll. and Harvey**
1933 Howe, 1934
1968 Soegiarto, 1969 (as *A. sanfordania*?)
Family GALAXAURACEAE
***Galaxaura cylindica* (Ell. And Soland.) Kjellm**
1968 Soegiarto, 1969
***Galaxaura subverticillata* Kjellm**
2000 Present study

- ***Scinaia hormoides* Setchell**
  - 1968 Soegiarto, 1969

Order GELIDIALES

- Family GELIDIACEAE
  - ***Pterocladiella capillacea* (J.F.Gmel.) Santel. & Hommers.**
    - 2000 Present study
- Family GELIDIELLACEAE
  - ***Gelidiella machrisiana* E.Y.Dawson**
    - 2000 Present study

Order CORALLINALES

- Family CORALLINACEAE
  - ***Amphiroa fragilissma* (L.) Lamouroux**
    - 1968 Soegiarto, 1969
  - ***Amphiroa* sp.**
    - 2000 Present study
  - ***Hydrolithon reinboldii* (Web. -van Bosse & Foslie) Foslie**
    - 1968 Soegiarto, 1969 (as *Gonolithon reinboldii*)
    - 1972 Soegiarto, 1973
    - 1980 Hixon and Brostoff, 1983
    - 1982 AECOS, 1982
    - 1983 Hixon and Brostoff, 1985
    - 2000 Present study
  - ***Jania micarthrodia* J.V.Lamour.**
    - 2000 Present study
  - ***Lithophyllum* sp.**
    - 2000 Present study
  - ***Porolithon gardineria* (Foslie) Foslie**
    - 1979 AECOS, 1982
    - 2000 Present study
  - ***Porolithon onkodes* (Heydrich) Foslie**
    - 1968 Reese, 1969
    - 1970 Henderson et al., 1976
    - 1972 Soegiarto, 1973
    - 1977 Lewis, 1980
    - 1979 AECOS, 1982
    - 2000 Present study
  - ***Porolithon* sp.**
    - 1990 Inouye and Crosby, 1991
- Family SPOROLITHACEAE
  - ***Sporolithon erythraeum* (Rothpletz) Kylin**
    - 2000 Present study

Order CRYPTONEMIALES

- Family DUMONTIACEAE
  - ***Dudresnaya hawaiiensis* Lee.**
    - 1962 Lee, 1963
  - ***Gibbsmithia hawaiiensis* Doty**
    - 1968 Soegiarto, 1969
- Family RHIZOPHYLLIDACEAE
  - ***Desmia portieria* (Lyngbye) Silva**
    - 2000 Present study
  - ***Portieria hornemannii* (Lyngb.) P.C.Silva**
    - 2000 Present study
- Family HALYMENIACEAE
  - ***Grateloupia filicina* (Wulfen) C. Agardh**
    - 1905 Reed, 1906
- Family KALLYMENIACEAE
  - ***Kallymenia sessilis* Okamura**
    - 2000 Present study

Order GIGARTINALES

- Family SOLIERIACEAE
  - ***Eucheuma denticulum* (Burm) Col and Herv.** **Introduced**
    - 1933 Howe, 1934
    - 1968 Soegiarto, 1969
    - 2000 Present study

Kappaphycus alvarezii **Doty** **Introduced**
1989 Glen and Doty, 1990
1991 Glen and Doty, 1992
1995 Larned, 1998
1996 Rodgers and Cox, 1999
1996 Rodgers, 1997
2000 Present study
Kappaphycus **sp.**
2000 Present study
Kappaphycus striatum **(Schmitz) Doty** **Introduced**
1974 Russell, 1983 (as *Eucheuma striatum*)
1988 Wood, 1989 (as *Eucheuma striatum*)
1989 Glen and Doty, 1990
1990 Glen and Doty, 1991
1991 Glen and Doty, 1992
1996 Rodgers and Cox, 1999
1996 Rodgers, 1997
2000 Present study
Family HYPNEACEAE
Hypnea cervicornis **J. Agardh**
1979 AECOS, 1982
1991 Russell, 1992
Hypnea chordacea **Kütz.**
2000 Present study
Hypnea musciformis **(Wulfen) J. Agardh** **Introduced**
1989 Glen and Doty, 1990
1991 Russell, 1992
2000 Present study
Hypnea nidifica **J. Agardh**
1933 Howe, 1934
1979 AECOS, 1982
1991 Glen and Doty, 1992
Hypnea pannosa **J.Agardh**
2000 Present study
Hypnea **sp.**
2000 Present study
Hypnea spinella **(C.Agardh) Kütz.**
2000 Present study
Hypneocolax stellaris **Børgesen**
2000 Present study
Order GRACILARIALES
Family GRACILARIACEAE
Gracilaria bursapastoris **(Gmelin) Silva**
1979 AECOS, 1982
1982 AECOS, 1982
Gracilaria conferoides **(L.) Greville**
1968 Soegiarto, 1969
Gracilaria coronopfolia **J. Agardh**
1979 AECOS, 1982
2000 Present study
Gracilaria parvispora **I.A.Abbott**
2000 Present study
Gracilaria salicornia **(C. Agardh, 1820)** **Introduced**
1995 Larned, 1998
1996 Rodgers and Cox, 1999
1996 Rodgers, 1997
2000 Present study
Order AHNFELTIALES
Family GIGARTINACEAE
Chondrocanthus acicularis **(Roth) Fredericq**
2000 Present study
Order RHODYMENIALES
Family RHODYMENIACEAE
Botryocladia skottsbergi **(Børgesen) Levring**

2000 Present study

Chrysymenia okamurae **Yamada & Segawa**

2000 Present study

Family CHAMPIACEAE

Champia parvula **(C. Agardh) Harvey**

1968 Soegiarto, 1969

2000 Present study

Family LOMENTARIACEAE

Lomentaria hakodatensis **Yendo**

2000 Present study

Order CERAMIALES

Family CERAMIACEAE

Aglaothamnion **sp.**

2000 Present study

Anontrichium tenue **(C.Agardh) Nägeli**

2000 Present study

Antithamnion antillanum **Børgesen**

2000 Present study

Centroceras clavulatum **(C. Agardh) Montagne**

1980 Hixon and Brostoff, 1983

1983 Hixon and Brostoff, 1985

2000 Present study

Ceramium clarionensis **Setchell and Gardner**

2000 Present study

Ceramium fimbriatum **Setchell and Gardner**

1968 Soegiarto, 1969

Ceramium flaccidum **Ardissone**

2000 Present study

Ceramium **sp.**

2000 Present study

Diplothamnion jolyi **van den Hoek**

2000 Present study

Falkenbergia hillebrandii **(Ardiss.) Falkenb.**

2000 Present study

Griffithsia heteromorpha **Kütz**

2000 Present study

Griffithsia **sp.**

2000 Present study

Griffithsia tenuis **C. Agardh**

1968 Soegiarto, 1969

Polysiphonia apiculata **Hollenberg, 1968**

1980 Brostoff, 1985

Polysiphonia delicatula **Hollenberg, 1968**

1967 Hollenberg, 1968

Polysiphonia flabellulata **Harvey**

1967 Hollenberg, 1968

1967 Hollenberg, 1968

Polysiphonia flaccidissima **Hollenberg**

1961 Menez, 1962

Polysiphonia homoia **Setchell and Gardner,**

1963 Menez, 1964

Polysiphonia howei **Hollenberg**

1967 Hollenberg, 1968

Polysiphonia mollis **Hooker and Harvey**

1967 Hollenberg, 1968

1967 Hollenberg, 1968

Polysiphonia rhizoidea **Menez**

1983 Hixon and Brostoff, 1985

Polysiphonia **sp.**

2000 Present study

Polysiphonia tepdia **Hollenberg**

1961 Menez, 1962

Polysiphonia tongatensis **Harvey**

1963 Menez, 1964

Spyridia filamentosa **(Wulfen) Harv.**
2000 Present study
Wrangelia elegantissima **R.E.Norris**
2000 Present study
Family DELESSERIACEAE
Martensia fragilis **Harv.**
2000 Present study
Neomartensia flabelliformis
2000 Present study
Taenioma perpusillum **J. Agardh (J. Agardh)**
1980 Hixon and Brostoff, 1983
1983 Hixon and Brostoff, 1985
2000 Present study
Family DASYACEAE
Heterosiphonia crispella **(C.Agardh) M.J.Wynne**
2000 Present study
Family RHODOMELACEAE
Acanthophora spicifera **(Vahl) Boerg** **Introduced**
1956 Kohn, 1959
1956 Doty, 1961
1967 Hollenberg, 1968
1968 Soegiarto, 1969
1970 Henderson et al., 1976
1972 Soegiarto, 1973
1976 Brock, 1976
1976 Brock, 1976
1977 Bowers, 1977
1979 AECOS, 1982
1981 Morrisey, 1985
1981 Jokiel and Morrisey, 1986
1982 AECOS, 1982
1983 Hixon and Brostoff, 1985
1991 Russell, 1992
1994 Marine Research Consultants, 1994
2000 Present study
Amansia glomerata **C. Agardh**
1980 Brostoff, 1985
Chondria simpliciuscula **Weber Bosse**
2000 Present study
Chondria tenuissima **(Good and Woodw.)**
1933 Howe, 1934
1968 Soegiarto, 1969
1968 Soegiarto, 1969
1993 Russell and Balasz, 1994
Herposiphonia crassa **Hollenb**
2000 Present study
Herposiphonia nuda **Hollenb**
2000 Present study
Herposiphonia parca **Setchell**
1980 Brostoff, 1985
2000 Present study
Herposiphonia **sp.**
2000 Present study
Laurencia nidifica **C. Agardh**
1982 AECOS, 1982
1991 Russell, 1992
Laurencia **sp.**
2000 Present study
Laurencia yamadana **Howe**
1952 Matthews, 1953b
2000 Present study
Neosiphonia **sp.**
2000 Present study
Tolypiocladia glomerulata **(C. Agardh) Schmitz**

1980 Hixon and Brostoff, 1983
1983 Hixon and Brostoff, 1985
2000 Present study
***Ululania stellata* Apt & Schlech**
2000 Present study

VASUCLAR PLANTS
Division MAGNOLIOPHYTA
Order HYDROCHARITALES
Family HYDROCHARITACEAE
***Halophila australis* Doty and Stone, 1966**
1965 Doty and Stone, 1966
2000 Present study
***Halophila hawaiana* Doty and Stone, 1966**
1965 Doty and Stone, 1966
1985 Herbert, 1986b
1985 Herbert, 1986a
2000 Present study
Order RHIZOPHORALES
Family RHIZOPHORACEAE
***Rhizophora mangle* Linn.** **Introduced**
1961 Walsh, 1967
1990 Marine Research Consultants, 1990
1997 Allen, 1998
2000 Present study

INVERTEBRATES
Phylum CILIOPHORA
Class POLYHYMENOPHOREA
Subclass SPIROTRICHA
Order COLIPHORIDA
Family FOLLICULINIDAE
***Eufollinica lignicola* (Faure-Fremiet, 1936)**
1961 Matthews, 1963
***Lagotia simplex* Dons**
1952 Matthews, 1953b
***Metafolliculina andrewsi* (Giard, 1883)**
Cryptogenic
1952 Matthews, 1953b
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
***Mirofolliculina limnoriae* (Giard, 1883)** **Introduced**
1961 Matthews, 1963
***Parafolliculina violaceae* (Giard, 1888)**
Cryptogenic
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
Class SPOROZOA
Subclass GREGARINIDA
Order EUGREGARINIDA
Family CEPHALOIDOPHORIDAE
***Cephaloidophora carpilodei* Ball, 1963**
1961 Ball, 1963
***Cephaloidophora pinguis* Ball, 1963**
1961 Ball, 1963
Phylum PORIFERA
Class CALCAREA
Subclass CALCINEA
Order CLATHRINIDA
Family LEUCETTIDAE
***Leucetta solida* Schmidt, 1862**
1947 de Laubenfels, 1950
Subclass CALCARONEA
Order LEUCOSOLENIIDA
Family GRANTIIDAE

***Leuconia kaiana* de Laubenfels, 1951**
1976 Brock, 1976
Family HETEROPIIDAE
***Heteropia glomerosa* (Bowerbank, 1873)**
Cryptogenic
2000 Present study
Class DEMOSPONGIAE
Subclass HOMOSCLEROMORPHA
Order HOMOSCLEROPHORIDA
Family PLAKINIDAE
***Plakortis simplex* Schultz, 1880**
1947 de Laubenfels, 1950
1948 BPBM-C 121
***Plakortis* sp.**
2000 Present study
Subclass TETRACTINOMORPHA
Order ASTROPHORIDA
Family ANCORINIDAE
***Zaplethea digonoxea* de Laubenfels, 1950**
1947 de Laubenfels, 1950
Order HADROMERIDA
Family CHONDRILLIDAE
***Chondrosia* sp.**
2000 Present study
Family CLIONIDAE
***Cliona vastifica* Hancock, 1849**
Cryptogenic
1947 de Laubenfels, 1950
1965 Bergquist, 1967
1975 Environmental Consultants Inc., 1975
1976 Brock, 1976
Family SPIRASTRELLIDAE
***Spheciospongia vagabunda* (Ridley, 1884)**
1960 BPBM-C 291 (as Spirastrella keankaha)
1965 Bergquist, 1967 (as Spirastrella vagabunda)
2000 Present study
Family SUBERITIDAE
***Suberites zeteki* de Laubenfels, 1936** **Introduced**
1947 BPBM-C 117
1947 de Laubenfels, 1950 (as Terpios zeteki)
1960 BPBM-C 298
1976 Grovhoug and Rastetter, 1980 (as Terpios zeteki)
2000 Present study
***Terpios granulosa* Bergquist, 1967**
1965 Bergquist, 1967
1970 Henderson et al., 1976
1985 Santavy, 1986
Family TETHYIDAE
***Tethya diploderma* Schmidt, 1870**
1947 BPBM-C 119
1947 de Laubenfels, 1950
***Tethya* sp.**
2000 Present study
Family TIMEIDAE
***Diplastrella spiniglobata* (Carter, 1879)**
1965 Bergquist, 1967
Subclass CERACTINOMORPHA
Order POECILOSCLERIDA
Suborder MICROCIONINA
Family MICROCIONIDAE
***Clathria procera* (Ridley, 1884)**
Cryptogenic
1965 Bergquist, 1967
***Clathria* sp.**

1960 BPBM-C 289
1960 BPBM-C 290
1960 BPBM-C 304
***Clathria* sp. (orange)**
2000 Present study
***Clathria* sp. (red)**
2000 Present study
Family RASPAILIIDAE
***Eurypon nigra* Bergquist, 1967**
1965 Bergquist, 1967
Suborder MYXILLINA
Family COELOSPHAERIDAE
***Lissodendoryx Hawaiiana* (de Laubenfels, 1950)**
1947 BPBM-C 106 (as *Damiriana Hawaiiana*)
1947 de Laubenfels, 1950 (as *Damiriana Hawaiiana*)
1960 BPBM-C 296 (as *Damiriana Hawaiiana*)
1960 BPBM-C 297 (as *Damiriana Hawaiiana*)
1960 BPBM-C 306 (as *Damiriana Hawaiiana*)
1960 BPBM-C 300 (as *Damiriana Hawaiiana*)
1960 BPBM-C 301 (as *Damiriana Hawaiiana*)
1961 BPBM-C 308 (as *Damiriana Hawaiiana*)
1961 BPBM-C 191 (as *Damiriana Hawaiiana*)
1971 BPBM-C 361 (as *Damiriana Hawaiiana*)
1978 Caspers, 1980 (as *Damiriana Hawaiiana*)
1979 AECOS, 1982 (as *Damiriana Hawaiiana*)
1983 Caspers, 1985 (as *Damiriana Hawaiiana*)
2000 Present study
Family CRELLIDAE
***Naniupi ula* de Laubenfels, 1950**
1947 de Laubenfels, 1950
1948 BPBM-C 110
2000 Present study
Family MYXILLIDAE
***Myxilla rosacea* (Lieberkuhn, 1859)**
1947 BPBM-C 109
1947 de Laubenfels, 1950
1956 de Laubenfels, 1957
Family PHORIOSPONGIIDAE
***Strongylacidon Kane`ohe* (de Laubenfels, 1950)**
1947 de Laubenfels, 1950 (as *Xytosiphum Kane`ohe*)
1948 BPBM-C 104
2000 Present study
Family TEDANIIDAE
***Tedania macrodactyla* (Lamarck, 1814)**
1947 BPBM-C 112
1965 Bergquist, 1967
***Tedania reticulata* Thiele, 1903**
Cryptogenic
none BPBM-C 319 (as *Tedania ignis*)
1947 de Laubenfels, 1950 (as *T. ignis*)
1960 BPBM-C 318 (as *T. ignis*)
1965 Bergquist, 1967 (as *T. ignis*)
1965 Banner, 1968 (as *T. ignis*)
1976 Brock, 1976 (as *T. ignis*)
1979 Jokiel, 1980 (as *T. ignis*)
***Tedania* sp.**
2000 Present study
Family DESMACIDIDAE
***Iotrochota protea* (de Laubenfels, 1950)**
1947 BPBM-C 111
1947 de Laubenfels, 1950 (as *Hiattrochota proteus*)
2000 Present study
Suborder MYCALINA
Family DESMACELLIDAE

***Biemna* sp.**
Cryptogenic
2000 Present study
Family MYCALIDAE
***Mycale armata* Thiele, 1903** **Introduced**
2000 Present study
***Mycale cecilia* de Laubenfels, 1936** **Introduced**
1947 BPBM-C 114
1947 de Laubenfels, 1950
1960 BPBM-C 292
1979 Jokiel, 1980
2000 Present study
***Mycale* sp.3**
2000 Present study
***Mycale* sp.4**
2000 Present study
***Mycale* sp.5**
2000 Present study
***Stylinos* sp.**
2000 Present study
***Zygomycale parishii* (Bowerbank, 1875)** **Introduced**
none BPBM-C 314
1947 BPBM-C 115
1947 de Laubenfels, 1950
1960 BPBM-C 295
1960 BPBM-C 294
1960 BPBM-C 293
1960 BPBM-C 316
1960 BPBM-C 315
1960 BPBM-C 317
1961 BPBM-C 190
1961 BPBM-C 203
1961 BPBM-C 189
1965 Bergquist, 1967
1965 Banner, 1968
1971 BPBM-C 362
1976 Brock, 1976
1979 Jokiel, 1980
2000 Present study
Order HALICHONDRIDA
Family AXINELLIDAE
***Hymerhabdia* sp.**
2000 Present study
Family HALICHONDRIIDAE
***Axinyssa* sp.**
2000 Present study
***Halichondria coerulea* Bergquist, 1967**
Cryptogenic
1965 Bergquist, 1967
1976 Brock, 1976
***Halichondria melanadocia* de Laubenfels, 1936** **Introduced**
1965 Bergquist, 1967
1976 Brock, 1976
2000 Present study
***Halichondria* sp.**
none BPBM-C 271
1961 BPBM-C 192
1966 Gupta, 1967 (as *Halichondria magnicanulosa*)
2000 Present study
***Hymeniacidon chlorida* (de Laubenfels, 1950)**
1947 BPBM-C 116 (as *Hymeniacidon chloris*)
1947 de Laubenfels, 1950 (as *Hymeniacidon chloris*)
1960 BPBM-C 338 (as *Hymeniacidon chloris*)
Order HAPLOSCLERIDA

Family CALLYSPONGIIDAE
Callyspongia diffusa **(Ridley, 1884)**
Cryptogenic
1947 BPBM-C 105
1947 de Laubenfels, 1950
1978 Hildemann et al., 1979
1979 Jokiel, 1980
1979 Hildemann et al., 1980
1979 Johnston et al., 1981
1981 Jokiel et al., 1982
1981 Bigger et al., 1982
1982 Bigger et al., 1983
1982 Johnston and Hildemann, 1983
1985 Smith, 1986
2000 Present study
Callyspongia **sp.**
2000 Present study
Family CHALINIDAE
Adocia **sp.**
none BPBM-C 270
1960 BPBM-C 302
1960 BPBM-C 303
Adocia **sp. (orange)**
2000 Present study
Chalinidae n.sp. (purple)
Cryptogenic
2000 Present study
Haliclona **cf.** ***permollis*** **(Bowerbank, 1866)**
2000 Present study
Haliclona **sp.**
2000 Present study
Sigmadocia caerulea **Hechtel, 1965** **Introduced**
2000 Present study
Toxadocia **sp.**
2000 Present study
Toxadocia violacea **de Laubenfels, 1950**
none BPBM-C 310
none BPBM-C 309
1947 BPBM-C 107 (as *Toxadocia mokuoloea*)
1947 BPBM-C 108
1947 de Laubenfels, 1950
1947 de Laubenfels, 1950 (as *Kane`ohea poni*)
1947 de Laubenfels, 1950 (as *Neoadocia mokuoloea*)
1948 BPBM-C 113 (as *Kane`ohea poni*)
1960 BPBM-C 312
1960 BPBM-C 299
1961 BPBM-C 193 (as *Toxadocia mokuoloea*)
1961 BPBM-C 311
1965 Banner, 1968
1976 Brock, 1976
1979 AECOS, 1982
1982 Bigger et al., 1983
Toxiclona **sp.**
Cryptogenic
2000 Present study
Toxochalina **sp.1**
2000 Present study
Toxochalina **sp.2**
2000 Present study
Family NIPHATIDAE
Gelliodes fibrosa **(Wilson, 1925)** **Introduced**
2000 Present study
Gelliodes **sp.**
2000 Present study

***Gellius* sp.1**
2000 Present study
***Gellius* sp.2**
2000 Present study
Order DICTYOCERATIDA
Family SPONGIIDAE
***Spongia oceania* de Laubenfels, 1950**
1947 de Laubenfels, 1950
Order DENDROCERATIDA
Family DYSIDEIDAE
***Dysidea arenaria* Bergquist, 1965**
Cryptogenic
2000 Present study
***Dysidea avara* (Schmidt, 1862)**
Cryptogenic
1947 de Laubenfels, 1950
1948 BPBM-C 101
1960 BPBM-C 305
2000 Present study
***Dysidea* cf. *herbacea* (Keller, 1889)**
1976 Brock, 1976
Dysidea* cf. *etheria **Introduced**
2000 Present study
***Dysidea* sp.1**
2000 Present study
***Dysidea* sp.2**
2000 Present study
***Dysidea* sp.3**
2000 Present study
Family DARWINELLIDAE
***Aplysilla* sp.**
2000 Present study
***Pleraplysilla hyalina* de Laubenfels, 1950**
1947 de Laubenfels, 1950
1948 BPBM-C 102
Family DICTYODENDRILLIDAE
***Dictyodendrilla* sp.**
2000 Present study
Order VERONGIDA
Family DRUINELLIDAE
***Druinella purpurea* (Carter, 1880)**
none BPBM-C 327 (as *Psammaplysilla* sp.)
1947 de Laubenfels, 1950 (as *Hexadella pleochromata*)
1948 BPBM-C 103 (as *Hexadella pleochromata*)
1965 Bergquist, 1967 (as *Psammaplysilla purpurea*)
1966 BPBM-C 326 (as *Psammaplysilla purpurea*)
1966 BPBM-C 325 (as *Psammaplysilla purpurea*)
Phylum CNIDARIA
Class HYDROZOA
Order HYDROIDA
Family AGALOPHENIIDAE
***Lytocarpia niger* (Nutting, 1905)**
2000 Present study
Family BOUGAINVILLIIDAE
***Bougainvillia muscus* (Allman, 1863)** **Introduced**
1970 Cooke, 1977 (as *B. ramosa*)
1975 Grovhoug, 1976 (as *B. ramosa*)
***Bougainvillia* sp.**
1966 Tusov, 1967
1967 Tusov and Davis, 1971
1972 BPBM-D 457
***Garveia humilis* (Verrill, 1928)**
Introduced
1973 Environmental Consultants Inc., 1973 (as *Epiphellia humilis*)

    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
- Family CAMPANULARIIDAE
  - ***Campanularia* sp.**
    - 2000 Present study
  - ***Clytia hemisphaerica* (Linnaeus, 1767)** **Introduced**
    - 1970 Cooke, 1977
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
  - ***Clytia latitheca* Millard and Bouillon, 1973**
    Cryptogenic
    - 2000 Present study
  - ***Obelia bidentata* Clarke, 1875** **Introduced**
    - 2000 Present study
  - ***Obelia dichotoma* (Linnaeus, 1758)** **Introduced**
    - 1970 Cooke, 1977
    - 1972 BPBM-D 458
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 2000 Present study
- Family CLAVIDAE
  - ***Cordylophora caspia* (Pallas, 1771)** **Introduced**
    - 1967 Powers, 1971 (as *C. lacustris*)
  - ***Turritopsis nutricula* McCrady, 1856** **Introduced**
    - 1972 BPBM-D 456
    - 1972 Cooke, 1977
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 2000 Present study
- Family HALECIIDAE
  - ***Halecium* sp.**
    - 1963 BPBM-D 349
    - 2000 Present study
- Family HALOPTERIDIDAE
  - ***Antennella secundaria* (Gmelin, 1791)**
    Cryptogenic
    - 2000 Present study
- Family HALOCORDYLIDAE
  - ***Pennaria disticha* (Goldfuss, 1820)** **Introduced**
    - 1932 Edmondson, 1933a (as *Pennaria* sp.)
    - 1934 Edmondson, 1935 (as *Pennaria tiarella*)
    - 1935 Edmondson and Ingram, 1939 (as *Pennaria tiarella*)
    - 1937 Boone, 1938 (as *Corydendrium splendidum*)
    - 1938 Ingram, 1939 (as *Pennaria* sp.)
    - 1965 Banner, 1968 (as *Pennaria tiarella*)
    - 1967 Rees, 1971 (as *Pennaria tiarella*)
    - 1967 Pardy, 1971 (as *Pennaria tiarella*)
    - 1967 Pardy and Lenhoff, 1968 (as *Pennaria tiarella*)
    - 1967 Mariscal and Lenhoff, 1969 (as *Pennaria tiarella*)
    - 1967 Mariscal, 1971b (as *Pennaria tiarella*)
    - 1967 Rees et al., 1970 (as *Pennaria* sp.)
    - 1970 Cooke, 1977 (as *Halocordyle disticha*)
    - 1973 Environmental Consultants Inc., 1973 (as *Pennaria tiarella*)
    - 2000 Present study
  - ***Pennaria* sp.**
    - 1927 BPBM-D 182
    - 1935 BPBM-D 532
    - 1936 BPBM-D 216
    - 1939 BPBM-D 230
- Family KIRCHENPAUERIIDAE
  - ***Ventromma halecioides* (Alder, 1859)**
    Cryptogenic
    - 2000 Present study
- Family LAFOEIDAE

Anthohebella parasitica
Cryptogenic
2000 Present study
Family PLUMULARIIDAE
***Halopteris polymorpha* (Billard, 1913)**
Cryptogenic
2000 Present study
***Halopteris* sp.**
2000 Present study
***Lytocarpus phoeniceus* (Busk)**
1904 Nutting,1905
Plumularia diaphana
1972 BPBM-D 459
***Plumularia floridana* (Nutting, 1905)**
Cryptogenic
2000 Present study
***Plumularia setacea* (Linnaeus, 1758)**
Cryptogenic
1970 Cooke, 1977
***Plumularia strictocarpa* Pictect, 1893**
Cryptogenic
2000 Present study
Family SERTULARIIDAE
***Dynamena cornicina* McCrady, 1858**
Cryptogenic
1970 Cooke, 1977
***Dynamena crisioides* Lamouroux, 1824**
Cryptogenic
2000 Present study
***Sertularella areyi* Nutting, 1904**
Cryptogenic
2000 Present study
***Sertularella diaphana* (Allman, 1885)**
Cryptogenic
1970 Cooke, 1977
***Sertularella tongensis* Stechow, 1919**
Cryptogenic
2000 Present study
***Sertularia ligulata* Thornely, 1904**
Cryptogenic
2000 Present study
***Sertularia* sp.**
2000 Present study
***Tridentata humpferi* Broch, 1914**
Cryptogenic
2000 Present study
***Tridentata turbinata* (Lamouroux, 1816)**
Cryptogenic
1970 Cooke, 1977 (as *Sertularia ligulata*)
Family SOLANDERIIDAE
***Solanderia minima* (Hickson, 1903)**
none BPBM-D 519
Family SYNTHECIIDAE
***Synthecium megathecum* (Billard, 1924)** **Introduced**
1970 Cooke, 1977 (as *S. tubitheca*)
2000 Present study
Order SIPHONOPHORA
Family PHYSALIIDAE
***Physalia physalia* (Linnaeus, 1758)**
1967 Powers, 1971 (as *P. utriculus*)
Order CHONDROPHORA
Family VELELLIDAE
***Velella velella* Linnaeus, 1758**
1971 BPBM-D 453 (as *Velella* sp.)

- Class ANTHOZOA
  - Subclass OCTOCORALLIA
    - Order CLAVULACEA
      - Family CLAVULARIIDAE
        - ***Carijoa riisei* (Duchassaing & Michelotti, 1860)** **Introduced**
          - 2000 Present study
    - Order ALCYONACEA
      - Family ALCYONIIDAE
        - ***Sinularia abrupta* Tixier-Durivault, 1970**
          - 2000 Present study
      - Family XENIIDAE
        - ***Anthelia edmondsoni* (Verrill, 1928)**
          - 2000 Present study
        - ***Sarcothelia* n. sp.**
        - **Cryptogenic**
          - 2000 Present study
  - Subclass HEXACORALLIA
    - Order ACTINIARIA
      - Family ACTINIIDAE
        - ***Anthopleura nigrescens* (Verrill, 1928)**
          - 1929 Edmondson, 1930 (as *Tealiopsis nigrescens*)
          - 1967 Powers, 1971
        - ***Anthopleura* sp.**
          - none BPBM-D 796
          - 1960 BPBM-D 797
        - ***Gyractis excavata* Boveri, 1893**
          - 1973 Dunn, 1974 (as *Actiniogeton sesere*)
      - Family AIPTASIIDAE
        - ***Aiptasia pulchella* Carlgren, 1943**
          - 1967 Murdock and Lenhoff, 1968
          - 1967 Powers, 1971 (as *Aiptasia* sp.)
          - 1967 Gosline, 1971
          - 1967 Reed, 1971 (as *Aiptasia* sp.)
          - 1967 Mariscal, 1971b
          - 1967 Cook, 1971
          - 1967 Murdock, 1971
          - 1967 Mariscal and Lenhoff, 1969
          - 1967 Gosline and Lenhoff, 1968
          - 1970 Henderson et al., 1976
          - 1975 Henderson and Smith, 1978
          - 1976 Brock, 1976 (as *Aiptasia* sp.)
          - 1976 Grovhoug and Rastetter, 1980 (as *Aiptasia* sp.)
          - 1977 Lewis, 1980
          - 1982 AECOS, 1982
          - 1985 Steen, 1987
          - 1997 Muscatine et. al., 1998
          - 2000 Present study
      - Family BOLOCEROIDIDAE
        - ***Boloceroides mcmurrichi* (Kwietniewski, 1898)**
          - 1965 Josephson and March, 1966 (as *Boloceroides* sp.)
          - 1967 Lindstedt, 1971 (as *Boloceroides lilae*)
          - 1967 Lindstedt et al., 1971 (as *Boloceroides* sp.)
          - 1967 Mariscal, 1971b (as *Boloceroides lilae*)
          - 1967 Powers, 1971 (as *Boloceroides lilae*)
          - 1967 Mariscal and Lenhoff, 1969 (as *Boloceroides lilae*)
          - 1968 Guinther, 1970 (as *Boloceroides lilae*)
          - 1970 Henderson et al., 1976
          - 1975 Henderson and Smith, 1978 (as *Boloceroides* sp.)
          - 1981 Lawn and Ross, 1982
          - 1997 Muscatine et. al., 1998
        - ***Bunodeopsis medusoides* (Fowler, 1888)**
          - 1970 Henderson et al., 1976
      - Family DIADUMENIDAE
        - ***Diadumene lineata* (Verrill, 1869)** **Introduced**

1999 Zabin, pers. comm.
Family ISOPHELLIIDAE
***Telmatactis decora* (Hemprich & Ehrenberg, 1834)**
1964 Bowers, 1965 (as *Sagartia longa*)
Family PHYMANTHIDAE
***Heteranthus verruculatus* Klunzinger, 1877**
1970 Cuttress, 1977
Family STICHODACTYLIDAE
***Antheopsis papillosa* (Kwietniewski, 1898)**
1961 Stevenson, 1963 (as *Marcanthia cookei*)
1965 Banner, 1968 (as *Radianthus cookei*)
***Heteractis malu* (Haddon & Shachleton, 1893)**
1967 Mariscal and Lenhoff, 1969 (as *Maracanthea cookei*)
1967 Powers, 1971 (as *Macranthea cookei*)
1967 Mariscal, 1971b (as *Maracanthea cookei*)
1968 Guinther, 1970 (as *Maracanthea cookei*)
1970 Henderson et al., 1976 (as *Radianthus cookei*)
1974 Foster, 1975 (as *Radianthus papillosa*)
1977 Lewis, 1980 (as *Radianthus cookei*)
Order SCLERACTINIA
Family ACROPORIDAE
***Montipora capitata* (Dana, 1846)**
2000 Present study
***Montipora dilatata* Studer, 1901**
none BPBM-SC 2788
1963 BPBM-SC 470
1968 BPBM-SC 1377
1970 Maragos, 1972
1983 Heyward and Stoddart, 1985
1983 Hodgson, 1986
1983 Hodgson, 1985b
1985 Heyward, 1986
***Montipora flabellata* Studer, 1902**
none BPBM-SC 2642
1914 MacKaye, 1915
1968 BPBM-SC 1378
1970 Maragos, 1972
1975 Henderson et al., 1976
1977 Lewis, 1980
1985 Heyward, 1986
2000 Present study
***Montipora patula* Verrill, 1864**
none BPBM-SC 2848
1932 BPBM-SC 2333
1968 BPBM-SC 1382
1968 BPBM-SC 1380
1968 BPBM-SC 1383
1970 Maragos, 1972
1971 Holthus et al., 1986
1975 Henderson et al., 1976
1977 Bowers, 1977
1977 Lewis, 1980
1994 Marine Research Consultants, 1994
2000 Present study
***Montipora* sp.**
none BPBM-SC 2739
1932 BPBM-SC 2338
1932 BPBM-SC 2337
1932 BPBM-SC 2336
1932 BPBM-SC 2353
1932 BPBM-SC 2335
1932 BPBM-SC 2339
***Montipora studeri* Vaughan, 1907**
1985 Heyward, 1986

***Montipora verrilli* Vaughan, 1907**

none	BPBM-SC 2819
1902	Vaughan, 1907
1932	Galtsoff, 1933
1967	Young, 1971b
1967	Young, 1971a
1970	Maragos, 1972
1975	Henderson et al., 1976
1985	Heyward, 1986

***Montipora verrucosa* (Lamarck,1816)**

1902	Vaughan, 1907
1904	BPBM-SC 182
1904	BPBM-SC 183
1904	BPBM-SC 186
1904	BPBM-SC 184
1904	BPBM-SC 185
1904	BPBM-SC 187
1914	MacKaye, 1915
1932	Galtsoff, 1933
1963	BPBM-SC 467
1963	BPBM-SC 471
1965	Banner, 1968
1968	BPBM-SC 1381
1968	Franzisket, 1969
1969	Franzisket, 1970
1969	Johannes et al., 1972
1970	Maragos, 1972
1970	Cox, 1971
1971	Holthus et al.1986
1971	Coles and Jokiel, 1977
1971	Coles, 1992
1971	Coles and Jokiel, 1978
1971	Coles, 1973
1972	Banner, 1974
1972	Maragos, 1974
1972	Lamberts, 1973
1972	Franzisket, 1973
1972	Maragos, 1973
1973	Franzisket, 1974
1973	Environmental Consultants Inc., 1973
1973	Jokiel and Townsley, 1974
1975	Henderson et al., 1976 (as M. verrocosa)
1975	Environmental Consultants Inc., 1975
1975	Houck et al., 1977
1975	Jokiel and Coles, 1977
1976	Brock, 1976
1977	Environmental Consultants Inc., 1977
1977	Lewis, 1980
1977	Smith et al., 1979
1977	Polacheck, 1978
1977	Bowers, 1977
1977	Jokiel, 1978
1978	Weil, 1979
1979	AECOS, 1982
1979	Johnston et al., 1981
1979	Weil, 1981
1981	Cox, 1982
1982	Kinzie and Hunter, 1987
1982	Jokiel et al., 1983
1982	Alino, 1983
1983	Hodgson, 1986
1983	Fitzhardinge, 1986
1983	Cox, 1986
1983	Hodgson, 1985b

1983 Fitzhardinge, 1988
1983 Heyward and Stoddart, 1985
1983 Fitzhardinge, 1993
1983 Cox, 1983
1985 Heyward, 1986
1985 Howard et al., 1986
1985 Hunter and Kehoe, 1986
1985 Kitalong, 1986a
1985 Kitalong, 1986b
1985 Scelfo, 1986
1985 Scelfo, 1986
1986 Trench and Blank, 1987
1987 Tyler and Fitzhardinge, 1989
1989 Cox, 1992
1989 Grottoli, 1999
1990 Stanton, 1992
1991 Stanton, 1992
1991 Coles and Ruddy, 1995
1992 Kinzie, 1993
1994 Shashar et al., 1996
1994 Marine Research Consultants, 1994
1994 Shashar et al., 1996
1997 Field, 1998
1997 Bassim, 1998b
1997 Kolinski, 1998
1997 Cox and Ward, 1998
1997 Mate et al, 1998
1997 Bassim, 1998a
1997 Tarrant, 1998
1998 Kuffner, 1999

Family AGARICIIDAE

***Leptoseris incrustans* (Quelch, 1886)**
1968 BPBM-SC 1376
1970 Maragos, 1972

***Leptoseris papyracea* (Dana, 1846)**
1970 Maragos, 1972 (as *L. digitata*)

***Leptoseris* sp.**
none BPBM-SC 2617

***Pavona duerdeni* Vaughan, 1907**
none BPBM-SC 2878
1932 Galtsoff, 1933
1968 BPBM-SC 1385
1970 Maragos, 1972 (as *P. explanulata*)
1975 Henderson et al., 1976 (as *P. explanulata*)
1997 Mate, 1998 (as *P. explanulata*)

***Pavona* sp.**
none BPBM-SC 2790

***Pavona varians* Verrill, 1864**
none BPBM-SC 2663
1902 Vaughan, 1907
1914 MacKaye, 1915
1967 Young, 1971b
1968 BPBM-SC 1392
1968 BPBM-SC 1387
1968 BPBM-SC 1388
1968 BPBM-SC 1386
1970 Maragos, 1972
1972 Lamberts, 1973
1972 Banner, 1974
1975 Houck et al., 1977 (as *P. clavus*)
1975 Henderson et al., 1976
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1982 AECOS, 1982

- 1997 Muscatine et. al., 1998
- 1997 Mate, 1998
- 2000 Present study

- Family DENDROPHYLLIIDAE
  - ***Tubastraea coccinea* Lesson, 1829**
    - none BPBM-SC 2691
    - 1963 BPBM-SC 468 (as *Tubastrea aurea*)
    - 2000 Present study
  - ***Tubastraea* sp.**
    - 1932 BPBM-SC 2346
    - 1932 BPBM-SC 2347
- Family FAVIIDAE
  - ***Cyphastrea ocellina* (Dana, 1846)**
    - none BPBM-SC 662
    - 1902 Vaughan, 1907
    - 1914 MacKaye, 1915
    - 1932 BPBM-SC 2340
    - 1932 BPBM-SC 2354
    - 1932 Edmondson, 1933c
    - 1944 Edmondson, 1946
    - 1967 Mariscal and Lenhoff, 1969
    - 1967 Mariscal, 1971b
    - 1967 Mariscal, 1971a
    - 1967 Young, 1971a
    - 1967 Young, 1971b
    - 1967 Mariscal and Lenhoff, 1968
    - 1968 BPBM-SC 1369
    - 1968 BPBM-SC 1370
    - 1970 Maragos, 1972
    - 1971 Holthus et al., 1986
    - 1971 Maragos et al, 1985
    - 1972 Lamberts, 1973
    - 1972 Stimson, 1978
    - 1972 Banner, 1974
    - 1973 Environmental Consultants Inc., 1973
    - 1975 Houck, 1977
    - 1975 Henderson et al., 1976
    - 1976 Brock, 1976
    - 1976 Redalje, 1976
    - 1977 Bowers, 1977
    - 1983 Hodgson, 1985b
    - 1983 Fitzhardinge, 1993
    - 1983 Hodgson, 1986
    - 1983 Fitzhardinge, 1986
    - 1985 Wright, 1986
    - 1985 Alino, 1986
    - 1986 Romano, 1988
    - 2000 Present study
  - ***Leptastrea bottae* Milne Edwards & Haime, 1849**
    - none BPBM-SC 2675
    - 1902 Vaughan, 1907 (as *Leptastrea agassiz*)
    - 1914 MacKaye, 1915 (as *Leptastrea agassiz*)
    - 1967 Mariscal, 1971a
    - 1968 BPBM-SC 1374
    - 1970 Maragos, 1972
    - 1972 Banner, 1974
  - ***Leptastrea purpurea* Dana, 1846**
    - none BPBM-SC 2798
    - 1914 MacKaye, 1915 (as *Favia hawaiiensis*)
    - 1932 Edmondson, 1933c (as *Favia hawaiiensis*)
    - 1970 Maragos, 1972 (as *Favia hawaiiensis*)
    - 2000 Present study
- Family FUNGIIDAE
  - ***Cycloseris* sp.**

none	BPBM-SC 2608
***Cycloseris vaughani* (Boschma, 1923)**	
1970	Maragos, 1972
***Fungia scutaria* Lamarck, 1801**	
none	BPBM-SC 2695
1902	Vaughan, 1907
1904	BPBM-SC 409 (as *Fungia scutaria* var. *dentigera*)
1914	MacKaye, 1915
1932	Edmondson, 1933a
1932	Galtsoff, 1933
1959	Stephens, 1960
1961	Stephens, 1962
1963	BPBM-SC 473
1963	Bosch, 1967
1963	Bosch, 1965
1965	Banner, 1968
1965	Yamazato, 1966
1967	Powers, 1971
1967	Reed, 1971
1967	Mariscal, 1971a
1967	Mariscal, 1971b
1967	Pearse, 1971
1967	Mariscal and Lenhoff, 1969
1967	Mariscal and Lenhoff, 1968
1968	BPBM-SC 1372
1968	BPBM-SC 1371
1968	Guinther, 1986
1968	Franzisket, 1969
1969	Coles and Strathmann, 1973
1969	Franzisket, 1970
1969	Johannes et al., 1972
1970	Maragos, 1972
1970	Young, 1971a
1970	Young, 1971b
1971	Coles, 1973
1971	Coles and Jokiel, 1977
1972	Maragos, 1973
1972	Franzisket, 1973
1972	Lamberts, 1973
1972	Banner, 1974
1973	Environmental Consultants Inc., 1973
1973	Franzisket, 1974
1974	Franzisket, 1975
1975	Jokiel and Cowden, 1976
1975	Jokiel and Coles, 1977
1975	Henderson et al., 1976 (as *F. scuteria*)
1976	Brock, 1976
1976	D'Elia, 1977
1977	Lewis, 1980
1977	Bowers, 1977
1981	Krupp, 1983
1981	Krupp, 1984
1981	Krupp, 1981
1983	Hodgson, 1986
1983	Chadwick, 1988
1983	Hodgson, 1985b
1983	Chadwick, 1986
1984	Krupp, 1985
1985	Alino, 1986
1986	Romano, 1988
1992	BPBM-SC 3940
1997	Muscatine et. al., 1998
1997	Schwarz, 1998
1997	Wilson and Schwarz, 1998

1997	Bassim, 1998b
1997	Palaki, 1998
2000	Present study

***Fungia* sp.**

1932	BPBM-SC 2351
1932	BPBM-SC 2350
1932	BPBM-SC 2349
1932	BPBM-SC 2352
1932	BPBM-SC 2348

Family POCILLOPORIDAE

***Pocillopora damicornis* (Linnaeus, 1758)**

none	BPBM-SC 2705
1914	MacKaye, 1915 (as *Pocillopora cespitosa*)
1932	Galtsoff, 1933
1944	Edmondson, 1946
1955	BPBM-SC 557 (as *Pocillopora damicornis laysanensis*)
1960	Wainwright, 1963
1963	BPBM-SC 469
1964	Barry, 1965
1965	Castro, 1966 (as *Pocillopora cespitosa*)
1965	Banner, 1968 (as *Pocillopora cespitosa*)
1967	Mariscal and Lenhoff, 1968
1967	Clausen, 1971
1967	Clausen, 1972
1967	Young, 1971b
1967	Reed, 1971b
1967	Reed, 1971a
1967	Mariscal, 1971b
1967	Disalvo, 1971a
1967	Clausen and Roth, 1975
1967	Young et al., 1971
1967	Powers, 1971
1967	Young, 1971a
1967	Mariscal, 1971a
1968	Muscatine and Cernichiari, 1969
1969	Harrigan, 1972
1970	Young, 1973
1970	Maragos, 1972
1970	Henderson et al., 1976
1971	Holthus et al., 1986
1971	Vandermeulen et al., 1972
1971	Maragos et al, 1985
1971	Coles, 1973
1971	Coles, 1992
1971	Coles and Jokiel, 1977
1972	Maragos, 1973
1972	Vandermeulen and Watanabe, 1973
1972	Banner, 1974
1972	Lamberts, 1974
1972	Franzisket, 1973
1972	Lamberts, 1973
1973	Vandermeulen, 1974
1973	Environmental Consultants Inc., 1973
1974	Vandermeulen, 1975
1975	Houck et al, 1977
1976	Jokiel and Coles, 1977
1976	D'Elia, 1977
1976	Brock, 1976
1977	Environmental Consultants Inc., 1977
1977	Bowers, 1977
1977	Stimson, 1978
1977	Jokiel and Guinther, 1978
1977	Smith et al., 1979
1977	Polacheck, 1978

1977	Muscatine and D'Elia, 1978
1977	Lewis, 1980
1978	Weil, 1979
1979	Kinzie et al., 1984
1979	AECOS, 1982
1979	Weil et al, 1981
1980	Jokiel, 1985a
1980	Richmond and Jokiel, 1984
1980	Richmond, 1983
1980	Hidaka, 1981
1981	Roth et al., 1982
1981	Stoddart, 1983
1981	Jokiel, 1985b
1981	Jokiel and Morrisey, 1986
1982	Richmond, 1987
1982	AECOS, 1982
1983	Fitzhardinge, 1986
1983	Glynn and Krupp, 1986
1983	Hodgson, 1985b
1983	Stimson, 1997
1983	Fitzhardinge, 1988
1983	Fitzhardinge, 1993
1984	Jokiel et al., 1985
1984	Hodgson, 1985a
1984	Richmond, 1985b
1984	Richmond, 1985
1984	Richmond, 1985a
1985	Stoddart, 1986
1985	Richmond, 1986
1985	Richmond, 1987
1985	Chavez, 1986
1985	Alino, 1986
1985	Holloran, 1986b
1985	Holloran, 1986a
1985	Hidaka, 1986
1985	Kitalong, 1986a
1985	Hunter and Kehoe, 1986
1985	Esquivel, 1986a
1985	Kitalong, 1986b
1986	Snidvongs, 1988
1986	Romano, 1988
1987	Stoddart, 1988
1988	Stimson, 1990
1989	Te, 1991
1989	Stambler et al, 1991
1989	Stambler et al., 1991
1989	Goh, 1991
1991	Coles and Ruddy, 1995
1992	Snidvongs and Kinzie, 1994
1993	Lesser et al., 1994
1994	Marine Research Consultants, 1994
1995	Lesser and Lewis, 1996
1995	Jokiel et al., 1997
1997	Cox and Ward, 1998
1997	Wilson, 1998
1997	Levy, 1998
1997	Jokiel, 1998
1997	Kuffner, 1998
1997	Kosaki, 1999
1997	Kuffner, 1998
1997	Palaki, 1998
1997	Zakai, 1998
2000	Present study

Pocillopora eydouxi Milne Edwards & Haime, 1849

none BPBM-SC 2672
1955 BPBM-SC 558 (as *Pocillopora modumanensis*)
1970 Maragos, 1972
2000 Present study

***Pocillopora lingulata* Dana, 1846**
none BPBM-SC 2704
1914 MacKaye, 1915
1932 Galtsoff, 1933
1964 Barry, 1965
1965 Banner, 1968
1965 Castro, 1966
1968 BPBM-SC 1393
1970 Maragos, 1972
1972 Banner, 1974

***Pocillopora meandrina* Dana, 1846**
1914 MacKaye, 1915
1928 Edmondson, 1929 (as *P. meandrina* var. *nobilis*)
1964 Barry, 1965 (as *P. meandrina* var. *nobilis*)
1965 Castro, 1966 (as *P. meandrina* var. *nobilis*)
1965 Banner, 1968
1965 Castro, 1966
1967 Mariscal and Lenhoff, 1969 (as *P. elegans*)
1967 Reed, 1971
1967 Mariscal, 1971b
1967 Mariscal, 1971a
1968 BPBM-SC 1394 (as *Pocillopora meandrina* var. *nobilis*)
1968 Young, 1969
1968 Franzisket, 1969 (as *P. elegans*)
1969 Franzisket, 1970 (as *P. elegans*)
1970 Maragos, 1972
1970 Young, 1971a
1972 Banner, 1974
1972 Maragos, 1973
1972 Lamberts, 1973
1975 Henderson et al., 1976
1977 Environmental Consultants Inc., 1977
1977 Bowers, 1977
1977 Polacheck, 1978
1979 AECOS, 1982
1983 Glynn and Krupp, 1986
1989 Gochfeld, 1991
1989 Acevedo, 1991
1990 Cox, 1991
1992 Danilowicz, 1997
2000 Present study

***Pocillopora molokensis* Vaughan, 1907**
none BPBM-SC 3926
1970 Maragos, 1972

Family PORITIDAE

***Porites* (*Synaraea*) *irregularis* Verrill, 1864**
none BPBM-SC 2858

***Porites brighami* Vaughan, 1907**
none BPBM-SC 2620
1970 Maragos, 1972

***Porites compressa* Dana, 1846**
none BPBM-SC 2710
1902 Vaughan, 1907
1914 MacKaye, 1915
1932 BPBM-SC 2329
1932 Edmondson, 1933a
1960 Wainwright, 1963
1963 BPBM-SC 472
1964 Barry, 1965
1965 Banner, 1968

1965	Yamazato, 1966
1967	Reed, 1971
1967	Young, 1971a
1967	Young, 1971b
1967	Mariscal, 1971a
1967	Mariscal and Lenhoff, 1969
1967	Clausen, 1972
1968	BPBM-SC 1396
1968	BPBM-SC 1397
1968	BPBM-SC 1395
1968	Tomlinson, 1969
1968	Franzisket, 1969
1969	Franzisket, 1970
1969	Johannes et al., 1972
1970	Johannes and Tepley, 1974
1970	Henderson et al., 1976
1970	Young, 1971b
1970	Maragos, 1972
1970	Young, 1971a
1971	Coles, 1973
1971	Coles and Jokiel, 1977
1971	Holthus et al., 1986
1971	Coles, 1992
1971	Maragos et al, 1985
1972	Maragos, 1973
1972	Banner, 1974
1972	Maragos, 1974
1972	Lamberts, 1973
1975	Environmental Consultants Inc., 1975
1976	Brock, 1976
1976	D'Elia, 1977
1977	Bowers, 1977
1977	Polacheck, 1978
1977	Environmental Consultants Inc., 1977
1977	Smith et al., 1979
1977	Lewis, 1980
1979	AECOS, 1982
1979	AECOS, 1982
1982	AECOS, 1982
1982	AECOS, 1982
1983	Cox, 1983
1983	Hodgson, 1986
1983	Jokiel, 1986
1983	Kitalong, 1986b
1983	Kitalong, 1986a
1983	Fitzhardinge, 1986
1983	Fitzhardinge, 1988
1983	Glynn and Krupp, 1986
1983	Fitzhardinge, 1993
1983	Cox, 1986
1984	Hunter, 1985
1985	Esquivel, 1986b
1985	Alino, 1986
1985	Hunter and Kehoe, 1986
1986	Romano, 1988
1987	Hunter, 1988
1988	Fitzhardinge and Bailey-Brock, 1989
1989	Aeby, 1991
1989	Grottoli, 1999
1990	Cox, 1991
1990	Haramaty, 1991
1991	Coles and Ruddy, 1995
1994	Shashar et al., 1996
1994	Shashar et al., 1996

1994	Shashar et al., 1997
1994	Marine Research Consultants, 1994
1997	Muscatine et. al., 1998
1997	Neves, 2000
1997	Neves, 1998
1998	Kufner, 1999
2000	Present study

***Porites duerdeni* Vaughan, 1907**

1902	Vaughan, 1907
1914	MacKaye, 1915
1965	Banner, 1968

***Porites evermanni* Vaughan, 1907**

none	BPBM-SC 2740
1902	Vaughan, 1907
1914	MacKaye, 1915
1965	Banner, 1968
1967	Neves, 1998
1970	Maragos, 1972
1997	Neves, 2000

***Porites lobata* Dana, 1846**

1902	Vaughan, 1907
1914	MacKaye, 1915
1932	Galtsoff, 1933
1964	Barry, 1965
1967	DiSalvo, 1971b
1967	Reed, 1971
1968	BPBM-SC 1398
1970	Johannes and Tepley, 1974
1970	Maragos, 1972
1971	Holthus et al., 1986 (as *P. lichen*)
1972	Banner, 1974
1972	Maragos, 1973
1975	Houck et al., 1977
1975	Henderson et al., 1976
1977	Smith et al., 1979
1988	Jokiel et al., 1993
1989	Grottoli, 1999
1997	Neves, 1998
1997	Neves, 2000
1997	Field, 1998
2000	Present study

***Porites pukoensis* Vaughan, 1907**

1970	Maragos, 1972

***Porites* sp.**

1932	BPBM-SC 2563
1932	BPBM-SC 2328
1932	BPBM-SC 2327

Family SIDASTREIDAE

***Coscinaraea wellsi* Veron & Pichon, 1979**

1970	Maragos, 1972 (as *Coscinaraea ostreaeformis*)

***Psammocora* sp.**

none	BPBM-SC 2694
1968	BPBM-SC 1401

***Psammocora stellata* Verrill, 1864**

none	BPBM-SC 2897
none	BPBM-SC 2877
none	BPBM-SC 3301
1914	MacKaye, 1915 (as *Stephanaria brighami*)
1968	BPBM-SC 1403
1968	BPBM-SC 1400
1970	Young, 1971a (as *P. brighami*)
1970	Maragos, 1972 (as *P. brighami*)
1972	Lamberts, 1973 (as *Stephanaria brighami*)
1975	Henderson et al., 1976

1977 Lewis, 1980 (as *Stephanaria brighami*)
1979 AECOS, 1982 (as *Stephanaria brighami*)
1982 AECOS, 1982 (as *Stephanaria brighami*)
***Psammocora verrilli* Vaughan, 1907**
1968 Tomlinson, 1969
1970 Maragos, 1972
Order ZOANTHIDEA
Family ZOANTHIDAE
***Palythoa psammophilia* Walsh & Bowers, 1971**
1965 BPBM-D 437
1973 Environmental Consultants Inc., 1973
1982 AECOS, 1982
***Palythoa tuberculosa* (Esper, 1791)**
none BPBM-D 737
1964 Helfrich and Townsley, 1964-68
1965 BPBM-D 679
1966 BPBM-D 680
2000 Present study
Palythoa vestitus (Verrill, 1928)
none BPBM-D 733
1964 Helfrich and Townsley, 1964-68
1973 Cooke, 1976
1983 Hodgson, 1986
1983 Hodgson, 1985b
***Palythoa* sp.**
1965 BPBM-D 727
***Zoanthus pacificus* Walsh & Bowers, 1971**
1964 Helfrich and Townsley, 1964-68
1965 BPBM-D 444
1965 BPBM-D 779 (as *Zoanthus confertus*)
1965 BPBM-D 439
1967 Mariscal and Lenhoff, 1969 (as *Z. sandwichensis*)
1967 Reimer, 1971 (as *Z. sandwichensis*)
1973 Environmental Consultants Inc., 1973
1973 Cooke, 1976
1975 Environmental Consultants Inc., 1975
1977 Bowers, 1977 (as *Z. sandwichensis*)
1983 Hodgson, 1986
1983 Hodgson, 1985b
1984 Scelfo, 1985
1997 Muscatine et. al., 1998 (as *Z. sandwichensis*)
***Zoanthus* sp.**
none BPBM-D 724
1963 BPBM-D 350
1965 BPBM-D 743
Subclass CERIANTIPATHARIA
Order ANTIPATHARIA
Family ANTIPATHIDAE
***Antipathes grandis* Verrill, 1928**
1963 Grigg, 1964
Order CERIANTHARIA
Family ACONTIFERIDAE
***Isarachnanthus bandanensis* Carlgren, 1924**
1932 Edmondson, 1933a (as *Cerianthus* sp.)
Family CERIANTHIDAE
***Cerianthus* sp.**
1938 BPBM-D 228
1939 BPBM-D 238
Class SCYPHOZOA
Order STAUROMEDUSAE
Family ELEUTHEROCARPIDAE
***Kishinouyea hawaiiensis* Edmondson, 1930**
1929 Edmondson, 1930
Order SEMAEOSTOMAE

Family ULMARIDAE

***Aurelia* sp.** **Introduced**

1963 BPBM-D 352

Order RHIZOSTOMEAE

Family CASSIOPEIDAE

***Cassiopea andromeda* Light, 1914** **Introduced**

1964 BPBM-D 353 (as *Cassiopea mertensi*)
1965 Banner, 1968 (as *Cassiopea mertensi*)
1978 Uchida, 1979 (as *Cassiopea mertensi*)

Family MAGISTIIDAE

***Anomalorhiza shawi* Light, 1921** **Introduced**

1983 Cooke, 1984

***Mastigias papua* (Lesson, 1830)**

1963 BPBM-D 354
1965 Banner, 1968

***Phyllorhiza punctata* van Ledenfeld, 1884** **Introduced**

1960 Cuttress , in Doty, 1961
1961 Walsh, 1967 (as *Mastigias ocellata*)
1963 Piyakarnchana, 1965 (as *Rhizostoma ocellata*)
1976 Devaney and Eldredge, 1977

Phylum CTENOPHORA

Class TENTACULATA

Order PLATYCTENIDA

Family PLATYCTENIDAE

***Coeloplana duboscqui* Dawydoff, 1930**

1962 Matthews and Townsley, 1964

***Coeloplana echinicola* Tanaka**

1962 Matthews and Townsley, 1964

***Coeloplana willeyi* Abbott, 1902**

1962 Matthews and Townsley, 1964

***Vallicula multiformis* Rankin, 1955** **Introduced**

1994 Eldredge and Miller, 1995

Phylum PLATYHELMINTHES

Class TREMATODA

Order MONOPISTHOCOTYLEA

Family CAPSALIDAE

Benedenia hawaiiensis

1959 Martin, 1960

Order MONOGENEA

Family DACTYLOGYRIDAE

***Neobenedenia melleni* (MacCallum, 1927)**
Cryptogenic

1981 Keneko et al, 1968

Order TREMATODA

Family TREMATODA

Cercaria littorinalinae

1950 Chu, 1952

Coitcaecum banneri

1959 Martin, 1960

Coitcaecum norae

1959 Martin, 1960

***Haplorchis taichui* (Nishigori, 1924)**

1957 Martin, 1958

***Haplorchis yokoqawai* (Katsuta, 1932)**

1957 Martin, 1958

Opecoelus lanceolatus

1959 Martin, 1960

***Paracardicola hawaiensis* Martin, 1960**

1959 Martin, 1960

Podocotyloides stenometra

1996 Aeby, 1998

Pseudopecoelus tenuoides

1959 Martin, 1960

***Stellantchasmus falcatus* Onji and Nishio, 1924**

1957 Martin, 1958
Trigoncryptus conus **Martin, 1958**
1957 Martin, 1958
Class TURBELLARIA
Order POLYCLADIDA
Suborder ACOTYLEA
Family EUPLANIDAE
Taenioplana teredini **Hyman, 1944** **Introduced**
1986 Poulter, 1987
Family PROSTHIOSTOMIDAE
Prosthiostomum **(*Prosthiostomum*)** ***montiporae*** **Poulter, 1975**
1970 Jokiel and Townsley, 1974 (as *Prosthiostomum* sp.)
1971 Coles and Jokiel, 1978
Suborder COTYLEA
Family PSEUDOCEROTIDAE
Thysanozoon tentaculatum **Pease, 1860**
1960 BPBM-F 165
Phylum NEMATODA
Class SECERNENTEA
Order ASCARIDIDAE
Family ANISAKIDAE
Pulchrascaris chiloscyllii **(Johnston and Mawson, 1951)**
1986 Deardorff, 1987
Class SPIRURIDA
Family PHILOMETRIDAE
Philometra **sp.**
1982 Deardorff and Stanton, 1983
Phylum ENTOPROCTA
Class LOXOSOMATIDA
Family PEDICELLINIDAE
***Barentsia benedeni*?** **(Foettinger, 1887)**
1976 Grovhoug and Rastetter, 1980 (as *Barentsia gracilis*)
Phylum ANNELIDA
Class POLYCHAETA
Family APHRODITIDAE
Eunoe nodulosa **Day, 1967**
1975 Grovhoug, 1976
Lepidonatus purpureus
1976 Brock, 1976
Family POLYNOIDAE
Hololepidella nigropunctata **(Horst, 1915)**
1965 Devaney, 1967
Hololepidella **sp.**
1964 BPBM-R 284
1964 BPBM-R 283
1964 BPBM-R 282
Iphione muricata **(Savigny, 1818)**
1946 Hartman, 1966
2000 Present study
Paralepidonotus ampulliferus **(Grube, 1878)**
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973
1975 Henderson and Smith, 1978
1976 Brock, 1976
2000 Present study
Thormora atrata **(Treadwell, 1940)**
2000 Present study
unid. Polynoidae
2000 Present study
Family CHRYSOPETALIDAE
Paleanotus **sp.**
2000 Present study
Family SPINTHERIDAE
Spinther japonicus **Imajima and Hartman, 1964**

Cryptogenic
1976 Grovhoug and Rastetter, 1980
Family AMPHINOMIDAE
***Chloeia flava* (Pallas, 1766)**
1982 BPBM-R 1612
***Eurythoe complanata* (Pallas, 1766)**
none BPBM-R 913 (as *Eurythoe pacifica*)
1925 BPBM-R 250 (as *Eurythoe pacifica*)
1965 Banner, 1968 (as *Eurythoe pacifica*)
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973
1976 Brock, 1976
2000 Present study
***Pherecardia striata* (Kinberg, 1857)**
1946 BPBM-R 338
1946 Hartman, 1966
1946 BPBM-R 337
Pseudeurythoe occulifera
1976 Brock, 1976
Family PHYLLODOCIDAE
***Eulalia sanguinea* Oersted, 1843** **Introduced**
2000 Present study
***Phyllodoce* (*Anaitides*) *parva* (Hartmann-Schroder, 1965)**
1946 Hartman, 1966 (as *Anaitides parva*)
***Phyllodoce* sp.**
2000 Present study
***Prophyllodoce Hawai`ia* Hartman, 1966**
2000 Present study
unid. Phyllodocidae
2000 Present study
Family HESIONIDAE
***Hesione splendida* Savigny, 1818**
1946 Hartman, 1966 (as *H. pacifica*)
***Leocrates chinensis* Kinberg, 1866**
1971 BPBM-R 1420
Ophiodromus berrisfordi
1975 Henderson and Smith, 1978
***Podarke pugettensis* Johnson, 1901**
1975 Grovhoug, 1976 (as *Ophiodromus pugettensis*)
***Syllida armata* Quatrefages, 1865**
1975 Henderson and Smith, 1978
Family SYLLIDAE
***Branchiosyllis exilis* (Gravier, 1900)**
2000 Present study
***Branchiosyllis uncinigera* Hartmann-Schroder, 1960**
1946 Hartman, 1966
***Brania rhopalophora* (Ehlers, 1897)**
1977 White, 1980
***Exogone verugera* (Claparede, 1868)**
1977 White, 1980
2000 Present study
***Haplosyllis spongicola* (Grube, 1855)**
1946 Hartman, 1966
1976 Brock, 1976 (as *Syllis* (*H.*) *spongicola*)
2000 Present study
***Langerhansia cornuta* (Rathke, 1843)**
1946 Hartman, 1966
2000 Present study
***Myrianida crassicirrata* Hartmann-Schroder, 1965**
1946 Hartman, 1966
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980
2000 Present study
***Opisthosyllis brunnea* Langerhans, 1879**

1977 White, 1980

***Parasphaerosyllis indica* Monro, 1937**

1977 White, 1980

***Sphaerosyllis capensis serrata* Hartmann-Schroder, 1960**

1946 Hartman, 1966

***Sphaerosyllis sublaevis* Ehlers, 1913**

1977 White, 1980

***Trypanosyllis hawaiiensis* Hartmann-Schroder, 1978**

2000 Present study

***Trypanosyllis zebra* (Grube, 1860)**

1975 Henderson and Smith, 1978
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980
2000 Present study

***Typosyllis hyalina* (Grube, 1863)**

1946 Hartman, 1966
2000 Present study

Typosyllis intatta

1975 Henderson and Smith, 1978 (as *Syllis* (*Typosyllis*) *intatta*)

***Typosyllis microoculata* Hartmann-Schroder, 1965**

1946 Hartman, 1966

***Typosyllis prolifera* Krohn, 1852**

2000 Present study

***Typosyllis* sp.**

2000 Present study

***Typosyllis* sp.1**

2000 Present study

***Typosyllis variegata* (Grube, 1860)**

1975 Grovhoug, 1976 (as *Syllis* (*Typosyllis*) *variegata*)
1975 Henderson and Smith, 1978 (as *Syllis* (*Typosyllis*) *variegata*)
1976 Brock, 1976

Syllidae sp.15

2000 Present study

Syllidae sp.6

2000 Present study

Syllidae sp.16

2000 Present study

Syllidae sp.17

2000 Present study

unid. Syllidae

2000 Present study

Family NEREIDIDAE

***Ceratonereis tentaculata* Kinberg, 1866**

1934 Holly, 1935 (as *Ceratonereis mirabilis*)
1946 Hartman, 1966 (as *Ceratonereis mirabilis*)
1970 Henderson et al., 1976 (as *Ceratonereis mirabilis*)
1975 Henderson and Smith, 1978 (as *Ceratonereis mirabilis*)
1976 Brock, 1976 (as *Ceratonereis mirabilis*)
2000 Present study

***Neanthes arenaceodonta* Moore, 1903** **Introduced**

1946 Hartman, 1966 (as *N. caudata*)

Nereis acuminata

1975 Henderson and Smith, 1978

***Perinereis cultrifera* Iwajima, 1972**

1970 Henderson et al., 1976
1975 Henderson and Smith, 1978

***Perinereis helleri* Grube, 1878**

1946 Hartman, 1966
1946 BPBM-R 456

***Perinereis nigropunctata* (Horst, 1889)**

1975 Henderson and Smith, 1978 (as *P. nigropunctada*)
1976 Brock, 1976

***Platynereis abnormis* Horst, 1924**
Cryptogenic

1946 Hartman, 1966
***Platynereis dumerilii* (Audouin and Milne Edwards, 1833)**
1946 Hartman, 1966 (as *Platynereis massiliensis*)
1970 Henderson et al., 1976 (as *Platynereis massiliensis*)
1976 Brock, 1976
1980 Brostoff, 1985
***Platynereis pulchella* Gravier, 1901**
1934 Holly, 1935 (as *P. pestai*)
***Platynereis* sp.**
2000 Present study
Nereididae sp.3
2000 Present study
unid. Nereididae
2000 Present study
Family EUNICIDAE
***Eunice afra* Peters, 1854**
1946 BPBM-R 427
1946 BPBM-R 410
1975 Henderson and Smith, 1978 (as *E. afra punctada*)
1976 Brock, 1976
2000 Present study
***Eunice antennata* (Savigny, 1820)**
1946 BPBM-R 429
1975 Henderson and Smith, 1978
2000 Present study
***Eunice australis* Quatrefages, 1865**
2000 Present study
***Eunice cariboea* (Grube, 1856)**
2000 Present study
***Eunice filamentosa* Grube, 1856**
1976 Brock, 1976
2000 Present study
***Eunice vittata* (delle Chiaje, 1828)**
1975 Grovhoug, 1976
***Lysidice ninetta* Audouin and Milne Edwards, 1833**
1946 BPBM-R 392 (as *Lysidice collaris*)
1946 Hartman, 1966 (as *Lysidice collaris*)
1975 Henderson and Smith, 1978 (as *Lysidice collaris*)
1976 Brock, 1976 (as *Lysidice collaris*)
1977 Environmental Consultants Inc., 1977 (as *Lysidice collaris*)
2000 Present study
***Marphysa macintoshi* Crossland, 1903**
1938 BPBM-R 1365
***Marphysa sanguinea* Montagu, 1815**
1946 Hartman, 1966
***Nematonereis unicornis* Schmarda, 1861**
1946 Hartman, 1966
1973 Environmental Consultants Inc., 1973
1975 Grovhoug, 1976
1976 Brock, 1976
1977 White, 1980
2000 Present study
***Palola siciliensis* (Grube, 1840)**
1975 Henderson and Smith, 1978 (as *Eunice* (*Palola*) *siciliensis*)
1976 Brock, 1976 (as *Eunice* (*Palola*) *siciliensis*)
2000 Present study
Family ONUPHIDAE
***Diopatra leuckarti* Kinberg, 1865**
1976 Grovhoug, 1976
Family LUMBRINERIDAE
***Lumbrineris dentata* Hartmann-Schroder, 1965**
1965 Hartmann-Schroder, 1966
1976 Brock, 1976
***Lumbrineris* sp.**

        - 2000 Present study
    - ***Lumbrineris sphaerocephala*** **(Schmarda, 1861)**
    - **Cryptogenic**
        - 1976 Brock, 1976
        - 1986 Baily-Brock and Hartman, 1987
- Family ARABELLIDAE
    - ***Arabella iricolor*** **(Montagu, 1804)**
        - 1946 Hartman, 1966
        - 1977 White, 1980
- Family DORVILLEIDAE
    - ***Dorvillea moniloceras*** **(Moore, 1909)**
        - 1946 Hartman, 1966
        - 1946 BPBM-R 386
        - 1946 BPBM-R 388
    - ***Dorvillea*** **sp.**
        - 2000 Present study
- Family SPIONIDAE
    - ***Dispio uncinata*** **Hartman, 1951**
        - 1975 BPBM-R 808
    - ***Polydora Kane`ohe*** **Ward, 1981**
        - 1976 BPBM-R 643
        - 1976 BPBM-R 644
    - ***Polydora pilikia*** **Ward, 1981**
        - 1977 BPBM-R 646
        - 1977 BPBM-R 645
    - ***Polydora websteri*** **Hartman, 1943** **Introduced**
        - 1976 Brock, 1976
        - 1986 Ward, 1987
    - ***Pseudopolydora antennata*** **(Claparede, 1870)**
        - 1975 Henderson and Smith, 1978 (as *Polydora antennata*)
        - 1976 Brock, 1976 (as *Polydora antennata*)
    - ***Pseudopolydora pulchra*** **(Carazzi, 1895**
        - 1976 Grovhoug and Rastetter, 1980
    - ***Scolelepis squamata*** **(Muller, 1806)**
        - 1975 Henderson and Smith, 1978
    - ***Spiophanes bombyx*** **(Claparede, 1870)**
        - 1976 Brock, 1976
    - **unid. Spionidae**
        - 2000 Present study
- Family CIRRATULIDAE
    - ***Cirratulus*** **sp.**
        - 1938 BPBM-R 1422
    - ***Cirratulus zebuensis*** **McIntosh, 1885**
        - 1960 BPBM-R 262
    - ***Cirriformia capensis*** **(Schmarda, 1861)**
        - 1976 Brock, 1976
    - ***Cirriformia crassicollis*** **(Kinberg, 1866)**
        - 1976 Brock, 1976
    - ***Cirriformia hawaiensis*** **(Hartman, 1956)**
        - 1975 Henderson and Smith, 1978
    - ***Cirriformia punctata*** **(Grube, 1856)**
        - 1946 Hartman, 1966
        - 1975 Henderson and Smith, 1978
        - 1976 Brock, 1976
        - 2000 Present study
    - ***Cirriformia semicincta*** **(Ehlers, 1905)**
        - 1975 Henderson and Smith, 1978 (as *Cirratulus semicinctus*)
        - 1976 Brock, 1976 (as *Cirratulus semicinctus*)
    - ***Cirriformia*** **sp.**
        - 2000 Present study
    - ***Dodecaceria laddi*** **Hartman, 1954**
        - 1976 Brock, 1976
        - 1977 White, 1980
        - 1977 Environmental Consultants Inc., 1977

- Family CHAETOPTERIDAE
    - ***Chaetopterus* sp.**
    - **Cryptogenic**
        - 1958 Johnson, 1959 (as *Chaetopterus variopedatus*)
        - 1960 BPBM-R 260
        - 1970 Henderson et al., 1976 (as *Chaetopterus variopedatus*)
        - 1971 Hill, 1972 (as *Chaetopterus variopedatus*)
        - 1975 Grovhoug, 1976 (as *Chaetopterus variopedatus*)
        - 1976 Brock, 1976 (as *Chaetopterus variopedatus*)
        - 1976 Grovhoug and Rastetter, 1980 (as *Chaetopterus variopedatus*)
        - 2000 Present study
    - ***Mesochaetopterus minutus* Potts, 1914**
        - 1946 Hartman, 1966
    - ***Mesochaetopterus* sp.**
        - 1937 BPBM-R 1140
        - 1937 BPBM-R 1139
        - 1937 BPBM-R 1138
        - 1937 BPBM-R 1137
    - ***Phyllochaetopterus verrilli* Treadwell, 1943**
        - 1975 Grovhoug, 1976
        - 1976 Brock, 1976
    - ***Phyllochaetopterus* sp.**
        - 1937 BPBM-R 1421
- Family ORBINIIDAE
    - ***Naineris laevigata* (Grube, 1855)**
        - 1975 Henderson and Smith, 1978
- Family OPHELIIDAE
    - ***Armandia bioculata***
        - 1975 Henderson and Smith, 1978
    - ***Armandia intermedia* Fauvel, 1902**
    - **Cryptogenic**
        - 1975 Henderson and Smith, 1978
        - 1976 Brock, 1976
    - ***Polyophthalmus pictus* Dujardin, 1839**
        - 1982 BPBM-R 1609
- Family CAPITELLIDAE
    - ***Capitella* sp. (Fabricus, 1780)**
    - **Cryptogenic**
        - 1946 Baily-Brock and Hartman, 1987 (as *Capitella capitata*)
        - 1976 Brock, 1976 (as *Capitella capitata*)
        - 2000 Present study
    - ***Notomastus* (*Clistomastus*) *anoculatus* Hartmann-Schroder, 1965**
        - 1946 Hartman, 1966
- Family ARENICOLIDAE
    - ***Arenicola brasiliensis* (Nonato, 1958)**
        - none BPBM-R 315
        - 1946 Hartman, 1966
        - 1983 Bailey-Brock, 1984
- Family STERNASPIDAE
    - ***Sternaspis* sp.**
        - 2000 Present study
- Family TEREBELLIDAE
    - ***Loimia medusa* (Savigny, 1818)**
        - 2000 Present study
    - ***Nicolea gracilibranchis* (Grube, 1878)**
        - 1976 Brock, 1976
    - ***Nicolea* sp.**
        - 1946 BPBM-R 547
        - 1946 Hartman, 1966
    - ***Polycirrus* sp.**
        - 1963 Johnson, 1965
    - ***Thelepus setosus* (Quatrefages, 1865)**
        - 1975 Grovhoug, 1976
        - 1976 Grovhoug and Rastetter, 1980

1976 Brock, 1976

Family SABELLIDAE

***Branchiomma nigromaculata* (Baird, 1865)**

Cryptogenic

1970 Henderson et al., 1976 (as *Branchiomma cingulata*)
1971 Hill, 1972
1975 Grovhoug, 1976 (as *Branchiomma cingulata*)
1976 Grovhoug and Rastetter, 1980 (as *Branchiomma cingulata*)
1976 Brock, 1976
1976 Brock, 1976 (as *Branchiomma cingulata*)
2000 Present study

***Branchiomma* sp.**

1963 BPBM-R 2166

***Demonax leucaspis* Kinberg, 1867**

1976 Grovhoug and Rastetter, 1980

***Hypsicomus phaeotaenia* (Schmarda, 1861)**

1977 White, 1980

***Megalomma intermedium* (Beddard, 1888)**

1938 BPBM-R 651 (as *Megalomma* sp.)
2000 Present study

Potamilla torelli

1976 Brock, 1976

***Sabellastarte spectabilis* (Grube, 1878)** **Introduced**

1960 Bailey-Brock, 1976 (as *S. sanctijosephi*)
1976 Brock, 1976 (as *S. sanctijosephi*)
1976 Grovhoug and Rastetter, 1980 (as *S. sanctijosephi*)
2000 Present study

unid. Sabellidae

2000 Present study

Family SERPULIDAE

***Ficopomatus enigmaticus* (Fauvel, 1923)** **Introduced**

1976 Brock, 1976

***Hydroides brachyacantha* Rioja, 1941** **Introduced**

2000 Present study

***Hydroides crucigera* (Morch, 1863)** **Introduced**

1936 Straughan, 1969a
1970 Henderson et al., 1976
1975 Henderson and Smith, 1978
1976 Brock, 1976

***Hydroides dirampha* (Morch, 1863)** **Introduced**

none BPBM-R 1098 (as *Hydroides lunulifera*)
1935 Ingram, 1937 (as *Hydroides lunulifera*)
1935 Edmondson and Ingram, 1939 (as *H. lunulifera*)
1936 BPBM-R 1086 (as *Hydroides lunulifera*)
1936 BPBM-R 1232 (as *Hydroides lunulifera*)
1936 BPBM-R 1085 (as *Hydroides lunulifera*)
1936 BPBM-R 1084 (as *Hydroides lunulifera*)
1936 Straughan, 1969a (as *Hydroides lunulifera*)
1936 BPBM-R 1096 (as *Hydroides lunulifera*)
1937 BPBM-R 1087 (as *Hydroides lunulifera*)
1937 BPBM-R 1088 (as *Hydroides lunulifera*)
1937 BPBM-R 1091 (as *Hydroides lunulifera*)
1968 BPBM-R 922 (as *Hydroides lunulifera*)
1970 Henderson et al., 1976 (as *Hydroides lunulifera*)
1975 Henderson and Smith, 1978
1975 Grovhoug, 1976 (as *Hydroides lunulifera*)
1976 Grovhoug and Rastetter, 1980 (as *Hydroides lunulifera*)
1976 Brock, 1976 (as *Hydroides lunulifera*)

***Hydroides elegans* (Haswell, 1883)** **Introduced**

none BPBM-R 1119 (as *Hydroides norvegica*)
1935 Ingram, 1937 (as *Hydroides norvegica*)
1935 Edmondson and Ingram, 1939 (as *Hydroides norvegica*)
1936 BPBM-R 1104 (as *Hydroides norvegica*)
1936 BPBM-R 1106 (as *Hydroides norvegica*)

1936 BPBM-R 1102 (as *Hydroides norvegica*)
1936 BPBM-R 1229 (as *Hydroides norvegica*)
1936 BPBM-R 1103 (as *Hydroides norvegica*)
1936 BPBM-R 1105 (as *Hydroides norvegica*)
1937 BPBM-R 1107 (as *Hydroides norvegica*)
1938 BPBM-R 1112 (as *Hydroides norvegica*)
1964 Bowers, 1965 (as *Hydroides norvegica*)
1968 BPBM-R 924 (as *Hydroides norvegica*)
1968 BPBM-R 1230 (as *Hydroides norvegica*)
1968 Straughan, 1969a (as *Hydroides norvegica*)
1970 Henderson et al., 1976 (as *Hydroides norvegica*)
1975 Henderson and Smith, 1978
1975 Grovhoug, 1976 (as *Hydroides norvegica*)
1976 Grovhoug and Rastetter, 1980
1976 Brock, 1976 (as *Hydroides norvegica*)
2000 Present study

***Hydroides* sp.**
none BPBM-R 261
1936 BPBM-R 1233
1937 BPBM-R 1234
1937 BPBM-R 1236
1938 BPBM-R 1237

***Pomatoleios kraussii* Baird, 1865** **Introduced**
1960 Bailey-Brock, 1976
1967 Staughan, 1969b
1968 BPBM-R 1217
1968 BPBM-R 1192
1968 Staughan, 1969a
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980
2000 Present study

***Protula atypha* Bush, 1904**
1968 Straughan, 1969a
1976 Brock, 1976

***Pseudovermilia occidentalis* McIntosh, 1885**
1937 Straughan, 1969a (as *Vermiolopsis hawaiiensis*)
1976 Brock, 1976 (as *Vermiolopsis hawaiiensis*)
2000 Present study

***Salmacina dysteri* (Huxley, 1855)** **Introduced**
none BPBM-R 1226
none BPBM-R 1227
1935 Edmondson and Ingram, 1939
1936 BPBM-R 1219
1936 BPBM-R 1220
1937 BPBM-R 1221
1937 BPBM-R 1223
1937 Straughan, 1969a
1938 BPBM-R 1225
1946 Hartman, 1966
1975 Grovhoug, 1976 (as *Filograna implexa*)
1976 Brock, 1976 (as *Filograna implexa*)
1976 Grovhoug and Rastetter, 1980 (as *Filograna implexa*)
1986 Baily-Brock and Hartman, 1987 (as *Filograna implexa*)
2000 Present study

***Serpula* sp.**
Cryptogenic
1936 Straughan, 1969a (as *Serpula vermicularis*)
2000 Present study

***Spirobranchus giganteus corniculatus* (Grube, 1862)**
1946 BPBM-R 509 (as *Spirobranchus giganteus*)
1946 Hartman, 1966 (as *Spirobranchus giganteus*)
1968 BPBM-R 1244 (as *Spirobranchus giganteus*)

1968 Staughan, 1969a (as *Spirobranchus giganteus*)
2000 Present study
***Vermiliopsis* sp.1**
2000 Present study
***Vermiliopsis torquata* Treadwell, 1943**
1937 BPBM-R 1312
1937 Staughan, 1969a
2000 Present study
unid. Serpulidae
2000 Present study
Family SPIRORBIDAE
***Eulaeospira orientalis* (Pillai, 1960)**
Cryptogenic
1960 Bailey-Brock, 1976
***Janua foraminosa* (Moore and Bush, 1904)**
1971 BPBM-R 927
1976 Brock, 1976
***Janua pagenstecheri* Quatrefages, 1865** **Introduced**
1970 Vine et al., 1972
***Leodora knightjonesi* (de Silva, 1965)**
Cryptogenic
1970 Vine et al., 1972 (as *Janua knightjonesi*)
***Neodexiospira foraminosa* (Moore and Bush, 1904)**
Cryptogenic
1975 Grovhoug, 1976 (as *Janua stueri*)
1976 Grovhoug and Rastetter, 1980 (as *Janua stueri*)
***Neodexiospira pseudocorrugata* (Bush, 1904)**
Cryptogenic
1970 Vine et al., 1972 (as *Janua pseudocorrugata*)
1975 Grovhoug, 1976 (as *Janua pseudocorrugata*)
1976 Brock, 1976 (as *Janua pseudocorrugata*)
1976 Grovhoug and Rastetter, 1980 (as *Janua pseudocorrugata*)
***Pileolaria militaris* Claparede, 1868**
Introduced
1970 Vine et al., 1972
1976 Brock, 1976
***Pileolaria pseudoclavus* Vine, 1972**
Cryptogenic
1970 Vine, 1972 (as *Pileolaria semimilitaris*)
1975 Grovhoug, 1976 (as *Pileolaria semimilitaris*)
***Protolaeospira ambilateralis* (Pixell, 1912)**
1970 Vine et al., 1972
***Simplicaria pseudomilitaris* (Thiriot-Quievreux, 1965)**
Cryptogenic
1970 Vine et al., 1972 (as *Pileolaria pseudomilitaris*)
1975 Grovhoug, 1976 (as *Pileolaria pseudomilitaris*)
1976 Brock, 1976 (as *Pileolaria pseudomilitaris*)
1976 Grovhoug and Rastetter, 1980 (as *Pileolaria pseudomilitaris*)
***Vinearia koehleri* Caullery and Mesnil, 1897**
Cryptogenic
1975 Grovhoug, 1976 (as *Pileolaria koehleri*)
unid. Spirorbidae
2000 Present study
Class OLIGOCHAETA
Family TUBIFICIDAE
***Bathydrilus adriaticus* Hrabe, 1971**
Cryptogenic
1987 Erseus and Davis, 1989
***Limnodriloides rubicundus* Erseus, 1982**
Cryptogenic
1987 Erseus and Davis, 1989
Phylum SIPUNCULA
Class SIPUNCULIDEA
Order GOLFINGIIDAE

Family THEMISTIDAE
Themiste (_Langenopsis_) _langeniformis_ Baird, 1868
1973 Environmental Consultants Inc., 1973
1977 White, 1980

Phylum MOLLUSCA
Class GASTROPODA
Subclass PROSOBRANCHIA
Order ARCHAEOGASTROPODA
Family SCISSURELLIDAE
Sinezona insignis (Smith, 1910)
2000 Present study
Family HALIOTIDAE
Haliotis corrugata
1968 Anon., 1969
Haliotis crachrodii Leach
1959 Brock, 1960
1959 Eldredge, 1994
Haliotis ens
1968 Anon., 1969
Haliotis sp. **Introduced**
1927 Brock, 1952
1927 Edmondson and Wilson, 1940
Family FISSURELLIDAE (DIODORINAE)
Diodora granifera (Pease, 1861)
1957 Martin, 1958 (as *Tarebria granifera*)
1976 Brock, 1976
2000 Present study
Diodora octagona (Reeve, 1850)
1975 Henderson et al., 1976
2000 Present study
Diodora ruppelli (Sowerby, 1834) **Introduced**
2000 Present study
Diodora sp.
2000 Present study
Diodora cf. _quadriradiata_
2000 Present study
Family FISSURELLIDAE (EMARGINULINAE)
Emarginula hawaiiensis Dall, 1895
1975 Grovhoug, 1976
Family PATELLIDAE
Cellana exarata (Reeve, 1854)
1966 Rogers, 1967
Family PHASIANELLIDAE
Tricolia (_Hiloa_) _variabilis_ (Pease, 1861)
2000 Present study
Tricolia variabilis (Pease, 1861)
1975 Henderson and Smith, 1978
1975 Grovhoug, 1976
Family SKENEIDAE
Lophocochlias minutissimus (Pilsbry, 1921)
1970 Taylor, 1975 (as Haplocochlias minutissimus)
2000 Present study
Lophocochlias sp.
2000 Present study
Family STOMATELLIDAE
Synaptocochlea concinna (Gould, 1845)
1975 Grovhoug, 1976
2000 Present study
Family TROCHIDAE (ENCYCLINAE)
Euchelus gemmatus (Gould, 1845)
1975 Grovhoug, 1976
2000 Present study
Gibbula marmorea (Pease, 1861)
2000 Present study

    - Family TROCHIDAE (TROCHINAE)
      - ***Alcyna ocellata*** **Hickman & McLean, 1995**
        - 2000 Present study
      - ***Alcyna* sp.**
        - 2000 Present study
      - ***Thalotia ocellata*** **(A. Adams, 1861)**
        - 1975 Grovhoug, 1976 (as *Thalotia rubra*)
      - ***Trochus histrio*** **Reeve, 1848**
        - 1975 Henderson and Smith, 1978 (as *T. histrio intextus*)
        - 1975 Grovhoug, 1976
        - 1975 Henderson et al., 1976
      - ***Trochus intextus*** **Kiener, 1850**
        - 1966 Papagni, 1967 (as *T. sandwichensis*)
        - 2000 Present study
      - ***Trochus niloticus*** **Linnaeus, 1758** **Introduced**
        - 1952 Brock, 1952 (as *T. obelisus*)
        - 1968 Cross, 1968
        - 1978 Eldredge, 1994
      - ***Trochus* sp.**
        - 2000 Present study
    - Family TURBINIDAE (COLLONINAE)
      - ***Leptothyra candida*** **(Pease, 1861)**
        - 1975 Grovhoug, 1976
      - ***Leptothyra rubricincta*** **(Mighels, 1845)**
        - 1975 Grovhoug, 1976
        - 2000 Present study
      - ***Leptothyra verruca*** **(Gould, 1845)**
        - 1975 Grovhoug, 1976
        - 2000 Present study
    - Family TURBINIDAE (TURBININAE)
      - ***Turbo argyrostoma*** **Linnaeus**
        - 1975 Henderson et al., 1976
      - ***Turbo sandwicensis*** **Pease, 1861**
        - 1966 Papagni, 1967 (as *T. intercostalis*)
        - 2000 Present study
    - Family NERITIDAE (NERITINAE)
      - ***Nerita picea*** **(Recluz, 1841)**
        - 1968 Webber, 1970
        - 1968 Reese, 1969
        - 1970 Taylor, 1975
        - 1976 Brock, 1976
        - 2000 Present study
      - ***Theodoxus neglectus*** **(Pease, 1868)**
        - 1970 Taylor, 1975
        - 1975 Henderson and Smith, 1978
        - 1975 Henderson et al., 1976
      - ***Theodoxus vespertinus*** **(Sowerby, 1849)**
        - 1961 Walsh, 1967 (as *Neritina tahitiensis*)
    - Family NERITIDAE (SMARAGDIINAE)
      - ***Smaragdia bryanae*** **Pilsbry, 1917**
        - 1970 Taylor, 1975
        - 2000 Present study
    - Family PHENACOLEPADIDAE
      - ***Phenacolepas scobinata*** **(Gould, 1859)**
        - 1970 Taylor, 1975
        - 2000 Present study

- Order NEOTAENIOGLOSSA
  - Suborder DISCOPODA
    - Family CERITHIIDAE
      - ***Bittium impendens*** **(Hedley, 1899)**
        - 2000 Present study
      - ***Bittium parcum*** **(Gould, 1861)**
        - 1975 Grovhoug, 1976
        - 2000 Present study

- ***Bittium zebrum* (Kiener, 1841)**
  - 1970 Henderson et al., 1976
  - 1975 Grovhoug, 1976
- ***Cerithium atromarginatum* Dautzenberg and Bouge, 1933**
  - 1970 Taylor, 1975
- ***Cerithium bavayi* Vignal,1902**
  - 1970 Taylor, 1975
- ***Cerithium boeticum* Pease, 1860**
  - 2000 Present study
- ***Cerithium columna* Sowerby, 1834**
  - 1970 Taylor, 1975
  - 2000 Present study
- ***Cerithium egenum* Gould, 1849**
  - 2000 Present study
- ***Cerithium mutatum* Sowerby, 1834**
  - 1970 Taylor, 1975
- ***Cerithium nesioticum* Pilsbry and Vanatta, 1905**
  - 1975 Henderson et al., 1976
  - 2000 Present study
- ***Cerithium perparvulum* Watson 1886**
  - 1970 Taylor, 1975
- ***Cerithium rostratum* Sowerby, 1855**
  - 2000 Present study
- ***Cerithium zebrum***
  - 2000 Present study
- ***Cerithium* sp.**
  - 2000 Present study
- ***Litiopa melanostoma* Rang, 1828**
  - 1970 Taylor, 1975

Family DIALIDAE

- ***Cerithidium perparvulum* (Watson, 1886)**
  - 2000 Present study
- ***Diala semistriata* (Philippi, 1845)**
  - 2000 Present study

Family FOSSARIDAE

- ***Fossarus cumingii* (A. Adams, 1855)**
  - 1970 Taylor, 1975
- ***Fossarus garrettii* Pease, 1868**
  - 1970 Taylor, 1975
- ***Fossarus multicostatus* Pease, 1861**
  - 1970 Taylor, 1975

Family OBTORTIONIDAE

- ***Finella pupoides* A. Adams, 1860**
  - 2000 Present study
- ***Finella* sp.**
  - 2000 Present study

Family LITTORINIDAE (LITTORININAE)

- ***Littoraria pintado* (Wood, 1828)**
  - 1950 Chu, 1952 (as *Littorina pintado*)
  - 1965 Whipple, 1966 (as *Littorina pintado*)
  - 1970 Taylor, 1975 (as *Littorina pintado*)
  - 1976 Brock, 1976 (as *Littorina pintado*)
  - 2000 Present study
- ***Littoraria scabra* (Linnaeus, 1758)**
  - 1935 Ingram, 1937 (as *Littorina scabra*)
  - 1935 Edmondson and Ingram, 1939 (as *Littorina scabra*)
  - 1961 Walsh, 1967 (as *Littorina scabra*)
  - 1965 Whipple, 1966 (as *Littorina scabra*)
  - 1968 Webber, 1970 (as *Littorina scabra*)
  - 1976 Brock, 1976 (as *Littorina scabra*)
  - 2000 Present study
- ***Littoraria undulata* (Gray, 1839)**
  - 2000 Present study
- ***Nodilittorina picta***

1965 Whipple, 1966 (as *Littorina picta marmorata*)
1965 Whipple, 1966 (as *Littorina picta*)

***Peasiella tantilla* (Gould, 1849)**
2000 Present study

Family EATONIELLIDAE

***Eatoniella* (*Caveatoniella*) *janetaylorae* Kay, 1979**
2000 Present study

Family ASSIMENEIDAE

***Assiminea nitida* (Pease, 1865)**
2000 Present study

Family BARLEEIDAE

***Barleeia calcarea* Kay, 1979**
2000 Present study

Family CAECIDAE

***Caecum arcuatum* de Folin, 1867**
2000 Present study

***Caecum glabriformis* (A. Adams, 1868)**
2000 Present study

***Caecum sepimentum* de Folin, 1867**
2000 Present study

Family RISSOIDAE (RISSOINAE)

***Alvinia isolata* (Laseron, 1956)**
2000 Present study

***Parashiela beetsi* Ladd, 1966**
1970 Taylor, 1975

***Vitricithna marmorata* (Hedley, 1907)**
2000 Present study

***Isselia hiloense* (Pilsbry and Vanatta, 1908)**
2000 Present study

***Merelina granulosa* (Pease, 1862)**
1970 Taylor, 1975

***Merelina* sp.**
2000 Present study

***Rissoina ambigua* (Gould, 1849)**
1970 Taylor, 1975
2000 Present study

***Rissoina cerithiiformis* Tryon, 1887**
2000 Present study

***Rissoina costata* A. Adams, 1851**
2000 Present study

***Rissoina ephamilla* (Watson, 1886)**
1970 Taylor, 1975
1975 Henderson and Smith, 1978 (as *R. sphamilla*)
1975 Grovhoug, 1976

***Rissoina miltozona* Tomlin, 1915**
1970 Taylor, 1975
1975 Grovhoug, 1976

***Rissoina triticea* Pease, 1861**
1975 Henderson and Smith, 1978
1975 Grovhoug, 1976

***Rissoina turricula* Pease, 1861**
1970 Taylor, 1975
1975 Grovhoug, 1976
1975 Henderson and Smith, 1978

***Schwartziella ephamilla* Ponder, 1985**
2000 Present study

***Schwartziella gracilis* (Pease, 1861)**
1970 Taylor, 1975

***Schwartziella triticea* Pease, 1861**
1970 Taylor, 1975
2000 Present study

***Zebina semiplicata* (Pease, 1862)**
1975 Grovhoug, 1976

***Zebina* sp.**

- 2000 Present study
- **_Zebina tridentata_ (Michaud, 1830)**
  - 1970 Taylor, 1975
  - 2000 Present study
- Family STROMBIDAE
  - **_Strombus maculatus_ Sowerby, 1842**
    - 1970 Taylor, 1975
    - 1970 Berg, 1972
    - 1970 Berg, 1971
    - 1975 Henderson et al., 1976
  - **_Strombus ostergaardi_ Pilsbry**
    - 1927 Ostergaard, 1928
- Family HIPPONICIDAE
  - **_Hipponix_ (_Antisabia_) _foliaceus_ (Quoy and Gaimard, 1835)**
    - 1970 Taylor, 1975
    - 2000 Present study
  - **_Hipponix_ (_Cochlear_) _imbricatus_ Gould, 1846**
    - 1970 Taylor, 1975
  - **_Hipponix_ (_Pilosabia_) _pilosus_ (Deshayes, 1832)**
    - 1935 Ingram, 1937 (as *H. pilosus imbricatus*)
    - 1970 Taylor, 1975
    - 1970 Henderson et al., 1976
    - 1976 Brock, 1976
    - 2000 Present study
  - **_Hipponix australis_**
  - **Cryptogenic**
    - 2000 Present study
  - **_Hipponix barbatus_ Sowerby, 1835**
    - 1975 Grovhoug, 1976
  - **_Hipponix_ sp.**
    - 2000 Present study
  - **_Sabia conica_ (Schumacher, 1817)**
    - 1970 Taylor, 1975
- Family VANIKORIDAE
  - **_Vanikoro acuta_ (Recluz, 1844)**
    - 1970 Taylor, 1975
  - **_Vanikoro cancellata_ (Lamarck, 1822)**
    - 1970 Taylor, 1975
  - **_Vanikoro recluziana_ Adams and Angas 1863**
    - 1970 Taylor, 1975
- Family CALYPTRAEIDAE
  - **_Cheilea dillwyni_ Gray, 1825**
    - 1970 Taylor, 1975
    - 1976 Brock, 1976
  - **_Cheilea equestris_ (Linnaeus, 1758)**
    - 2000 Present study
  - **_Crepidula aculeata_ (Gmelin, 1791)** **Introduced**
    - 1935 Edmondson and Ingram, 1939
    - 1970 Taylor, 1975
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 1977 Lewis, 1980
    - 2000 Present study
  - **_Crepidula fornicata_ (Gmelin, 1791)**
    - 1977 White, 1980
  - **_Crepidula patula_ (Ranzani)**
    - 1935 Ingram, 1937
  - **_Crepidula spinosum_ (Sowerby, 1824)**
    - 1970 Taylor, 1975
  - **_Crepidula_ sp.**
    - 2000 Present study
  - **_Crucibulum spinosum_ (Sowerby, 1824)** **Introduced**
    - 1968 Ulbrick, 1969
    - 1968 Ulbrick, 1970

- 1970 Henderson et al., 1976
- 1970 Taylor, 1975
- 1973 Environmental Consultants Inc., 1973
- 1975 Henderson and Smith, 1978
- 1975 Grovhoug, 1976
- 1976 Brock, 1976
- 1976 Grovhoug and Rastetter, 1980
- 1977 Lewis, 1980
- 2000 Present study

Family VERMETIDAE

- ***Cephalaspidea* sp.**
  - 2000 Present study
- ***Dendropoma gregaria* Hadfield and Kay, 1972**
  - 1970 Taylor, 1975
- ***Dendropoma meroclista* Hadfield and Kay, 1972**
  - 1968 Hadfield et al., 1972
  - 1970 Taylor, 1975
  - 1977 White, 1980
- ***Dendropoma platypus* Mörch, 1861**
  - 1968 Hadfield et al., 1972
  - 1968 Kay, 1970
  - 1970 Taylor, 1975
  - 1975 Henderson et al., 1976
  - 2000 Present study
- ***Dendropoma psarocephala* Hadfield and Kay, 1972**
  - 1968 Hadfield et al., 1972
  - 1970 Taylor, 1975
  - 1977 White, 1980
  - 2000 Present study
- ***Dendropoma rhyssoconcha* Hadfield and Kay, 1972**
  - 1968 Hadfield et al., 1972
  - 1977 White, 1980
- ***Dendropoma* sp.**
  - 2000 Present study
- ***Eualetes tulipa* (Chenu, 1843)** **Introduced**
  - 1968 Hadfield et al., 1972 (as *Vermetus alii*)
  - 1970 Taylor, 1975 (as *Vermetus alii*)
  - 1975 Grovhoug, 1976 (as *Vermetus alii*)
  - 1976 Brock, 1976 (as *Vermetus alii*)
  - 1976 Grovhoug and Rastetter, 1980 (as *Vermetus alii*)
  - 1977 Lewis, 1980 (as *Vermetus alii*)
  - 1977 White, 1980 (as *Vermetus alii*)
  - 2000 Present study
- ***Petaloconchus keenae* Hadfield and Kay, 1972**
  - 1968 Hadfield et al., 1972
  - 1970 Taylor, 1975
  - 1975 Grovhoug, 1976
  - 1976 Grovhoug and Rastetter, 1980
  - 1977 Lewis, 1980
  - 2000 Present study
- ***Petaloconchus tokyoensis***
  - 1977 White, 1980
- ***Serpulorbis variabilis* Hadfield and Kay, 1972**
  - 1970 Taylor, 1975
  - 2000 Present study

Family CYPRAEIDAE

- ***Cypraea caputserpentis* Linnaeus, 1758**
  - 1946 Ingram, 1947
  - 1975 Henderson et al., 1976
  - 1976 Brock, 1976
- ***Cypraea chinensis* Gmelin, 1791**
  - 1970 Taylor, 1975
- ***Cypraea fimbriata* Gmelin, 1791**
  - 1970 Taylor, 1975

***Cypraea helvola* Linnaeus, 1758**
1970 Taylor, 1975
***Cypraea isabella* Linnaeus, 1758**
1946 Ingram, 1947
1970 Taylor, 1975
***Cypraea lynx* Linnaeus, 1758**
1946 Ingram, 1947
***Cypraea madagascariensis* Gmelin**
1938 Ingram, 1939
***Cypraea minoridens* Melvill, 1901**
2000 Present study
***Cypraea moneta* Linnaeus, 1758**
1946 Ingram, 1947
***Cypraea ostergaardi* Dall, 1921**
1938 Ingram, 1939
***Cypraea rashleighana* Melvill, 1888**
1970 Taylor, 1975
***Cypraea reticulata* Martyn**
1946 Ingram, 1947
***Cypraea sulcidentata* Gray, 1824**
1970 Taylor, 1975
***Cypraea talpa* Linnaeus, 1758**
1970 Taylor, 1975
***Cypraea teres* Gmelin, 1791**
1970 Taylor, 1975
***Cypraea tessellata* Swainson, 1822**
1938 Ingram, 1939

Family ERATOIDAE
***Erato sandwicensis* Pease, 1860**
1970 Taylor, 1975

Family TRIVIIDAE
***Trivia edgari* Shaw, 1909**
2000 Present study
***Trivia hordacea* Kiener, 1845**
1970 Taylor, 1975
2000 Present study
***Trivia pellucida* Reeve, 1846**
2000 Present study
***Trivia* sp.**
2000 Present study

Family NATICIDAE (NATICINAE)
***Natica gualteriana* Récluz, 1844**
1968 Miller, 1975
1970 Taylor, 1975
2000 Present study
***Natica sagittifera* Recluz, 1852**
1970 Taylor, 1975

Family NATICIDAE (POLINICINAE)
***Polinices mamilla* (Linn., 1758)**
1970 Taylor, 1975

Family BURSIDAE
***Bursa cruentata* Sowerby, 1841**
1970 Taylor, 1975
***Bursa granularis* (Röding, 1798)**
1968 Houbrick and Fretter, 1969
1970 Taylor, 1975
***Bursa rosa* (Perry, 1811)**
1970 Taylor, 1975

Family CASSIDAE (PHALINAE)
***Casmaria erinaceus kalosmodix* (Melvill, 1883)**
1970 Taylor, 1975 (as *Casmaria erinaceus*)

Family RANELLIDAE (CYMATIINAE)
***Charonia tritonis* (Linnaeus, 1767)**
1970 Taylor, 1975

Cymatium* (*Cymatium*) *nicobaricum **(Röding, 1798)**
1968 Houbrick and Fretter, 1969
1970 Taylor, 1975
Cymatium* (*Gutturnium*) *muricinum **(Röding, 1798)**
1970 Taylor, 1975
Cymatium* (*Septa*) *pileare **(Linnaeus, 1758)**
1968 Houbrick and Fretter, 1969
Family TONNIDAE
Tonna perdix **(Linnaeus, 1758)**
1968 Guinther, 1970
1970 Taylor, 1975
Suborder PTENOGLOSSA
Family CERITHIOPSIDAE
Cerithiopsis filofusca **Laseron, 1951**
1970 Taylor, 1975
Cerithiopsis leucocephalum **Watson, 1886**
1970 Taylor, 1975
Cerithiopsis tricarinata **(Pease, 1861)**
1970 Taylor, 1975
Cerithiopsis turrigera **Watson, 1886**
1970 Taylor, 1975
Clathropsis turreta **Laseron, 1955**
1970 Taylor, 1975
Joculator **sp.**
2000 Present study
Joculator uveanum **(Melvill and Standen, 1896)**
2000 Present study
Family TRIPHORIDAE (INIFORINAE)
Iniforis aemulans **(Hinds, 1843)**
2000 Present study
Family TRIPHORIDAE (MASTONIINAE)
Cautor intermissa **(Laseron, 1958)**
2000 Present study
Litharium oceanida **(Dall, 1924)**
2000 Present study
Mastonia cingulifera **(Pease, 1861)**
2000 Present study
Viriola fallax **Kay, 1979**
2000 Present study
Viriola fl**ammulata (Pease, 1871)**
2000 Present study
Family TRIPHORIDAE (METAXIINAE)
Metaxia albicephala **Kay, 1979**
2000 Present study
Family TRIPHORIDAE (TRIPHORINAE)
Triforis incisus **Pease**
1935 Edmondson and Ingram, 1939
Triforis niloticus
1968 Anon., 1969
Triphora cancellata **Hinds, 1843**
1970 Taylor, 1975
Triphora cingulifera
1970 Taylor, 1975
Triphora coralina **(Laseron, 1958)**
2000 Present study
Triphora flammulata **(Pease, 1861)**
1970 Taylor, 1975
Triphora incisa **(Pease, 1861)**
1970 Taylor, 1975
Triphora maculata **Pease, 1846**
1970 Taylor, 1975
Triphora pallida **(Pease, 1871)**
1970 Taylor, 1975
2000 Present study

***Triphora peasi* (Jousseaume, 1884)**
1970 Taylor, 1975
***Triphora perfecta* Pease, 1870**
1970 Taylor, 1975
***Triphora sulcosa* (Pease, 1870)**
1970 Taylor, 1975
***Triphora triticea* Pease, 1861**
1970 Taylor, 1975 (as *Schwartziella triticea*)
***Triphora tubularis* (Laseron, 1958)**
1970 Taylor, 1975
***Triphora* sp.**
2000 Present study

Family EPITONIIDAE
***Cycloscala hyalina* (Sowerby, 1844)**
2000 Present study
***Epitonium aculeatum* (Sowerby, 1844)**
1970 Taylor, 1975
***Epitonium alatum* (Sowerby, 1844)**
1970 Taylor, 1975
***Epitonium costalum* Sowerby**
1968 Guinther, 1970
***Epitonium fucatum* (Pease, 1861)**
1968 Guinther, 1970
1970 Taylor, 1975
2000 Present study
***Epitonium hyalina mokuoloense* Pilsbry, 1921**
1968 Guinther, 1970
***Epitonium kanemoe* Pilsbry, 1921**
1970 Taylor, 1975
***Epitonium millecostatum* (Pease, 1861)**
1935 Worcester, 1969
1970 Taylor, 1975
***Epitonium O`ahuense* (Pilsbry, 1921)**
1970 Taylor, 1975
***Epitonium paumotensis* (Pease, 1868)**
1970 Taylor, 1975
2000 Present study
***Epitonium perplexum* (Deshayes, 1863)**
1970 Taylor, 1975
***Epitonium ulu* Pilsbry, 1921**
1963 Bosch, 1965
1968 Guinther, 1970
1970 Taylor, 1975
***Epitonium umbilicatum* (Pease, 1869)**
1970 Taylor, 1975
***Epitonium* sp.**
2000 Present study
***Laeviscala* sp.**
2000 Present study

Family JANTHINIDAE
***Janthina globosa* Swainson, 1822**
1970 Taylor, 1975
***Janthina janthina* (Linnaeus, 1758)**
1970 Taylor, 1975

Family EULIMIDAE
***Balcis acanthyllis* (Watson, 1886)**
2000 Present study
***Balcis aciculata* (Pease, 1861)**
1935 Ingram, 1937 (as *Melanella aciculata*)
1935 Edmondson and Ingram, 1939 (as *Melanella aciculata*)
1975 Grovhoug, 1976
2000 Present study
***Balcis conoidalis* (Sowerby, 1865)**
2000 Present study

- ***Balcis inflexa* (Pease, 1868)**
  - 2000 Present study
- ***Balcis kanaka* (Pilsbry, 1917)**
  - 2000 Present study
- ***Balcis tha*anumi (Pilsbry, 1917)**
  - 2000 Present study
- ***Balcis* sp.**
  - 2000 Present study
- ***Eulima metcalfei* (A. Adams, 1853)**
  - 2000 Present study
- ***Melanella letsonae* Pilsbry, 1917**
  - 1916 Pilsbry, 1917
- ***Melanella l*unata Pilsbry, 1917**
  - 1916 Pilsbry, 1917
- ***Melania indefinita***
  - 1961 Walsh, 1967
- ***Mucronalia nitidula* Pease, 1861**
  - 1967 Hoskins, 1968
- ***Stenomelania newcombi* Lea**
  - 1957 Martin, 1958
- ***Stylifer linkiae* Sarasin**
  - 1966 Davis, 1967
  - 1967 Tullis, 1968
- ***Subularia delicata* Pilsbry, 1917**
  - 1916 Pilsbry, 1917

Family LITIOPIDAE

- ***Styliferina goniochila* (A. Adams, 1860)**
  - 1970 Taylor, 1975

Order NEOGASTROPODA

- Family BUCCINIDAE
  - ***Caducifer decapitata* (Reeve, 1844)**
    - 1970 Taylor, 1975 (as *Monostiolum decapitatus*)
    - 2000 Present study
  - ***Cantharus farinosus* (Gould, 1850)**
    - 1970 Taylor, 1975
  - ***Engina albocincta* Pease, 1860**
    - 1970 Taylor, 1975
    - 2000 Present study
  - ***Engina idiosa* (Duclos, 1845)**
    - 1970 Taylor, 1975
  - ***Prodotia ignea* (Gmelin, 1791)**
    - 1970 Taylor, 1975 (as *Pisiana ignea*)
    - 2000 Present study
- Family COLUMBELLIDAE
  - ***Anachis miser* (Sowerby, 1844)**
    - 2000 Present study
  - ***Columbella scabra* Linnaeus**
    - 1935 Ingram, 1937
  - ***Euplica turturina* (Lamarck, 1822)**
    - 1970 Taylor, 1975
  - ***Euplica varians* (Sowerby, 1832)**
    - 1970 Taylor, 1975
  - ***Mitrella bella* (Reeve, 1859)**
    - 1970 Taylor, 1975
  - ***Mitrella loyaltensis* (Hervier, 1900)**
    - 2000 Present study
  - ***Mitrella margarita* (Reeve, 1859)**
    - 1970 Taylor, 1975
    - 2000 Present study
  - ***Mitrella rorida* (Reeve, 1859)**
    - 1970 Taylor, 1975
    - 1975 Grovhoug, 1976
    - 2000 Present study
  - ***Mitrella* sp.**

2000 Present study

Mitrella zebra **(Gray, 1828)**

1970 Taylor, 1975

Pisiana gracilis **(Reeve, 1846)**

1970 Taylor, 1975

Pisiana tritonidea **(Reeve)**

1964 Barry, 1965

Seminella peasei **(von Martens & Langkaval 1871)**

2000 Present study

Seminella smithi **(Angas, 1877)**

1975 Grovhoug, 1976
2000 Present study

Seminella virginea **(Gould, 1860)**

1970 Taylor, 1975

Seminella **sp.**

2000 Present study

Family CORALLIOPHILIDAE

Coralliophila d'orbignyana **(Petit, 1851)**

1970 Taylor, 1975

Coralliophila erosa **(Röding, 1798)**

1970 Taylor, 1975

Coralliophila violacea **(Kiener, 1836)**

1970 Taylor, 1975

Quoyula madreporarum **(Sowerby, 1834)**

2000 Present study

Rhizochilus madreporarum **(Sowerby)**

1964 Barry, 1965

Family FASCIOLARIIDAE

Latirus nodatus **(Gmelin, 1791)**

1970 Taylor, 1975

Peristernia chlorostoma **(Sowerby, 1825)**

1935 Edmondson and Ingram, 1939
2000 Present study

Family MURICIDAE

Muricodrupa funiculus **(Wood, 1828)**

2000 Present study

Family NASSARIIDAE

Nassarius dermistina **(Gould, 1860)**

1970 Taylor, 1975

Nassarius ravidus **(A. Adams, 1851)**

1970 Taylor, 1975

Family THAIDIDAE

Drupa* (*Drupa*) *ricina **(Linnaeus, 1758)**

1970 Taylor, 1975
2000 Present study

Drupa* (*Ricinella*) *rubusidaeus **Röding, 1798**

1970 Taylor, 1975

Drupella cornus **(Roding, 1798)**

1970 Taylor, 1975

Drupella ochrostoma **(Blainville, 1832)**

1970 Taylor, 1975

Maculotriton bracteatus **(Hinds, 1844)**

1970 Taylor, 1975

Maculotriton **sp.**

2000 Present study

Morula dumosa **(Conrad, 1837)**

1970 Taylor, 1975
2000 Present study

Morula echinata **(Reeve, 1846)**

1970 Taylor, 1975

Morula foliacea **(Conrad, 1837)**

1970 Taylor, 1975
2000 Present study

Morula granulata **(Duclos, 1832)**

1970 Taylor, 1975
1976 Brock, 1976 (as *Drupa granulata*)

Morula parva **(Reeve, 1846)**
1970 Taylor, 1975

Morula uva **(Röding, 1798)**
1970 Taylor, 1975
2000 Present study

Pinaxia versicolor **(Gray, 1839)**
1970 Taylor, 1975

Vexilla fus**conigra Pease, 1860**
1970 Taylor, 1975

Vexilla vexillum **(Gmelin, 1791)**
1970 Taylor, 1975

Family COSTELLARIIDAE

Vexillum **(*Costellaria*)** ***bellum*** **(Pease, 1860)**
1970 Taylor, 1975

Vexillum **(*Costellaria*)** ***interruptum*** **(Anton, 1839)**
1970 Taylor, 1975

Vexillum **(*Costellaria*)** ***interstriatum*** **(Sowerby, 1870)**
1970 Taylor, 1975

Vexillum **(*Pusia*)** ***lautum*** **(Reeve, 1845)**
1970 Taylor, 1975
2000 Present study

Vexillum **(*Pusia*)** ***piceum*** **(Pease, 1860)**
1970 Taylor, 1975

Vexillum **(*Pusia*)** ***tusum*** **(Reeve, 1845)**
1970 Taylor, 1975
2000 Present study

Family MARGINELLIDAE

Cystiscus huna **Kay, 1979**
2000 Present study

Granula sandwicensis **(Pease, 1860)**
2000 Present study

Volvarina fu**siformis (Hinds, 1844)**
1975 Grovhoug, 1976
2000 Present study

Family MITRIDAE (IMBRICARIINAE)

Cancilla **(*Domiporta*)** ***granatina*** **(Lamarck, 1811)**
1970 Taylor, 1975

Imbricaria olivaeformis **(Swainson, 1821)**
1970 Taylor, 1975

Neocancilla waikikiensis **Pilsbry, 1921**
1970 Taylor, 1975

Scabricola **(*Swainsonia*)** ***newcombii*** **(Pease, 1869)**
1970 Taylor, 1975 (as *Stigatella newcombii*)

Subcancilla interlirata **Reeve, 1844**
1970 Taylor, 1975

Family MITRIDAE (MITRINAE)

Mitra **(*Mitra*)** ***mitra*** **(Linnaeus, 1758)**
1970 Taylor, 1975

Mitra **(*Nebularia*)** ***cucumerina*** **Lamarck, 1811**
2000 Present study

Mitra **(*Nebularia*)** ***luctuosa*** **A. Adams, 1853**
2000 Present study

Mitra **(*Nebularia*)** ***tricaonica*** **Reeve, 1844**
1976 Brock, 1976

Mitra **(*Strigatella*)** ***litterata*** **(Lamarck, 1811)**
1965 Banner, 1968
1970 Taylor, 1975
2000 Present study

Mitra **(*Strigatella*)** ***saltata*** **Pease, 1865**
2000 Present study

Mitra **(*Strigatella*)** ***typha*** **Reeve, 1845**
1970 Taylor, 1975 (as *Stigatella typha*)

***Mitra auiculoides* Reeve, 1845**
1970 Taylor, 1975
***Mitra tabunala* Lamarck, 1811**
1970 Taylor, 1975

Family CONIDAE

***Conus abbreviatus* Reeve, 1843**
1970 Taylor, 1975
***Conus leopardus* (Röding, 1798)**
1956 Kohn, 1961
***Conus pennaceus* Born, 1780**
1956 Kohn, 1961
1970 Taylor, 1975
***Conus perthusus* Hwass in Bruguière, 1792**
1970 Taylor, 1975
***Conus pulicarius* Hwass in Bruguière, 1792**
1970 Taylor, 1975
***Conus quercinus* Lightfoot, 1786**
1956 Kohn, 1961
1956 Kohn, 1959
1960 Doty, 1961
1973 Environmental Consultants Inc., 1973
***Conus rattus* Hwass in Bruguière, 1792**
1970 Taylor, 1975
2000 Present study
***Conus striatus* Linnaeus, 1758**
1970 Taylor, 1975
***Conus vexillum* Gmelin, 1791**
1970 Taylor, 1975
***Conus vitulinus* Hwass in Bruguière, 1792**
1970 Taylor, 1975
***Conus* sp.**
2000 Present study

Family TEREBRIDAE

***Hastula matheroniana* (Deshayes, 1859)**
1916 Pilsbry, 1917 (as *Terebra lauta*)
***Terebra affinis* Gray, 1834**
1970 Taylor, 1975
***Terebra areolata* (Link, 1807)**
1970 Taylor, 1975
***Terebra cerithina* Lamarck, 1822**
2000 Present study
***Terebra crenulata* (Linnaeus, 1758)**
1970 Taylor, 1975
***Terebra gouldi* Deshayes**
1968 Miller, 1970
1968 Miller and Croker, 1972
1968 Miller, 1975
***Terebra inconstans* (Hinds, 1844)**
1970 Taylor, 1975
***Terebra lanceata* (Linn., 1758)**
1970 Taylor, 1975
***Terebra maculata* (Linnaeus, 1758)**
1970 Taylor, 1975
***Terebra nodularis* Deshayes, 1859**
1916 Pilsbry, 1917
***Terebra penicillata* Hinds, 1844**
1970 Taylor, 1975
***Terebra plumbea* Quoy and Gaimard, 1832**
1970 Taylor, 1975
***Terebra strigulata* (Linn., 1758)**
1970 Taylor, 1975

Family TURRIDAE (CLAVININAE)

***Carinapex minutissima* (Garret, 1873)**
1970 Taylor, 1975

2000 Present study

Clavus (_Tylotiella_) sp.

2000 Present study

Clavus sp.

2000 Present study

Family TURRIDAE (DAPHNELLINAE)

Daphnella interrupta Pease, 1860

1970 Taylor, 1975

2000 Present study

Daphnella ornata (Hinds, 1844)

1970 Taylor, 1975

Daphnella sandwicensis Pease, 1860

1970 Taylor, 1975

Kermia apicalis (Montrozier, 1861)

1970 Taylor, 1975

Kermia bifasciata (Pease, 1860)

1970 Taylor, 1975

Kermia brunnea (Pease, 1860)

1970 Taylor, 1975

Kermia melanoxytum (Hervier, 1895)

1970 Taylor, 1975

Kermia pumilla (Mighels, 1845)

1970 Taylor, 1975

Tritonoturris elegans (Pease, 1860)

1970 Taylor, 1975

Veprecula brunonia (Dall, 1924)

1970 Taylor, 1975

Family TURRIDAE (MANGELIINAE)

Eucithara angiostoma (Pease, 1868)

1970 Taylor, 1975

Lienardia balteata (Pease, 1860)

1970 Taylor, 1975

1975 Grovhoug, 1976

Lienardia crassicostata (Pease, 1860)

1975 Grovhoug, 1976

Family TURRIDAE (MITROLUMININAE)

Mitrolumna metula (Hinds, 1843)

1975 Grovhoug, 1976 (as *Anarithna metula*)

2000 Present study

Family TURRIDAE (TURRINAE)

Gemmula monilifera (Pease, 1861)

1970 Taylor, 1975

Xenuroturris kingae Powell, 1964

1970 Taylor, 1975

Order HETEROSTROPHA

Family ORBITESTELLIDAE

Orbitestella regina Kay, 1979

2000 Present study

Orbitestella sp.

2000 Present study

Family ARCHITECTONICIDAE

Heliacus veriagatus Gmelin, 1791

1970 Taylor, 1975

Philippia oxytropis A. Adams, 1855

1970 Taylor, 1975

Family RISSOELLIDAE

Rissoella confusa confusa Ponder and Yoo, 1977

2000 Present study

Rissoella longispira Kay, 1979

2000 Present study

Family PYRAMIDELLIDAE

Herviera gliriella (Melvill and Standen, 1896)

2000 Present study

Herviera patricia Pilsbry, 1918

1975 Henderson and Smith, 1978 (as Odostomia patricia)

***Hinemoa indica* (Melvill, 1896)** **Introduced**

1978 Kay, 1979

2000 Present study

***Miralda paulbartschi* Pilsbry, 1921**

2000 Present study

***Odostomia indica* (Melvill)**

1970 Henderson et al., 1976

***Odostomia pupu* Pilsberg**

1970 Henderson et al., 1976

***Odostomia* sp. Pilsbry, 1917**

1916 Pilsbry, 1917

2000 Present study

***Odostomia stearnsiella* Pilsbry, 1918**

1975 Henderson and Smith, 1978

2000 Present study

***Pyramidella sulcata* A. Adams, 1854**

2000 Present study

***Pyrgulina oodes* (Watson, 1886)**

Cryptogenic

1978 Kay, 1979

2000 Present study

***Pyrgulina* sp.**

2000 Present study

***Turbonilla lirata* (A. Adams, 1855)**

1975 Henderson and Smith, 1978

2000 Present study

Subclass OPISTOBRANCHIA

Order CEPHALASPIDEA

Family BULLIDAE

***Bulla adamsi* (Menke, 1850)** **Introduced**

1970 Henderson et al., 1976

***Bulla vernicosa* Gould, 1859**

1954 Burgess, 1995

Family APLUSTRIDAE

***Hydatina amplustra* (Linnaeus, 1758)**

1965 Banner, 1968

Family HAMINEIDAE

***Atys debilis* Pease, 1860**

2000 Present study

***Atys kuhnsi* Pilsbry, 1917**

2000 Present study

***Atys semistriata* Pease, 1860**

1935 Ingram, 1937

1970 Henderson et al., 1976

1975 Grovhoug, 1976

2000 Present study

***Atys* sp.**

2000 Present study

***Haminoea crocata* Pease, 1860**

1975 Henderson and Smith, 1978

***Haminoea* sp.**

2000 Present study

Family AGLAJIDAE

***Chelidonura hirundina* (Quoy and Gaimard, 1833)**

1975 Henderson et al., 1976

***Philine* sp.**

2000 Present study

Family SCAPHANDRIDAE

***Acteocina hawaiensis* Pilsbry, 1921**

2000 Present study

***Cylichna pusilla* (Pease, 1860)**

2000 Present study

Order ANASPIDEA

- Family APLYSIIDAE (APLYSIINAE)
  - ***Aplysia juliana*** **Quoy and Gaimard, 1832**
    - 1970 Henderson et al., 1976
  - ***Aplysia parvula*** **Guilding in Mörch, 1863**
    - 1975 Henderson et al., 1976
  - ***Aplysia pulmonica*** **Gould, 1852**
    - 1968 Watson, 1969
  - ***Aplysia*** **sp.**
    - 2000 Present study
- Family APLYSIIDAE (DOLABELLINAE)
  - ***Dolabella auricularia*** **(Lightfoot, 1786)**
    - 1975 Henderson et al., 1976
- Family APLYSIIDAE (DOLABRIFERIINAE)
  - ***Dolabrifera dolabrifera*** **(Rang, 1828)**
    - 1970 Henderson et al., 1976
- Family APLYSIIDAE (NOTARCHIINAE)
  - ***Stylocheilus longicaudatus*** **(Quoy and Gaimard, 1824)**
    - 1970 Henderson et al., 1976
    - 2000 Present study

Order NOTASPIDEA

- Family PLEUROBRANCHIDAE
  - ***Pleurobranchus*** **sp.**
    - 1949 Ostergaard, 1950

Order SACOGLOSSA

- Family JULIIDAE
  - ***Julia exquisita*** **Gould, 1862**
    - 2000 Present study
- Family PLAKOBRANCHIDAE
  - ***Plakobranchus ocellatus*** **van Hasselt, 1824**
    - 1954 Ostergaard, 1955 (as *P. ianthobapus*)
    - 1968 Testerman, 1970
    - 1973 Environmental Consultants Inc., 1973
    - 1976 Brock, 1976 (as *Placobranchus ocellatus*)
    - 2000 Present study

Order NUDIBRANCHIA

- Family GONIODORIDIDAE
  - ***Okenia pellucida*** **Burn, 1967** **Introduced**
    - 1972 Gosliner, 1980
- Family HEXABRANCHIDAE
  - ***Hexabranchus*** **sp.**
    - 2000 Present study
- Family AEOLIDAE
  - ***Berghia major*** **(Elliot, 1903)**
    - 1981 Lawn and Ross, 1982
- Family CUTHONIDAE
  - ***Cuthona perca*** **(Marcus, 1958)** **Introduced**
    - 1972 Gosliner, 1980
  - ***Phestilla sibogae*** **Bergh, 1905**
    - 1970 Henderson et al., 1976
    - 1990 Haramaty, 1991
    - 1995 Gochfeld and Aeby, 1997
- Family FACELINIDAE
  - ***Caloria indica*** **(Berg, 1896)**
  - **Cryptogenic**
    - 1972 Gosliner, 1980

Subclass PULMONATA

Order BASOMMATOPHORA

- Family MELAMPIDAE
  - ***Melampus parvulus*** **Pfeiffer, 1846**
    - 1935 Edmondson and Ingram, 1939
- Family SIPHONARIIDAE
  - ***Siphonaria normalis*** **Gould, 1846**
    - 1968 Cook, 1969
    - 1976 Brock, 1976

2000 Present study

Williamia radiata **(Pease, 1861)**

2000 Present study

Class BIVALVIA

Family MYTILIDAE

Adipicola crypta **Dall, Bartsch and Rehder, 1938**

2000 Present study

Brachidontes crebristriatus **(Conrad, 1837)**

1916 Pilsbry, 1917 (as *Mytilus crebristriatus*)
1937 Dall, Bartsch & Rehder, 1938
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973 (as *Hormomya crebristriatus*)
1975 Henderson and Smith, 1978 (as *Brachiodontes crebristriatus*)
1976 Grovhoug and Rastetter, 1980
1976 Brock, 1976 (as *Mytilus* and *Hormomya cerebristriatus*)
2000 Present study

Crenella **sp.**

2000 Present study

Modiolaria **sp.**

1935 Ingram, 1937

Musculus aviarius **Dall, Bartsch, and Rehder, 1938**

2000 Present study

Musculus oahuensis **Dall, Bartsch & Rehder, 1938**

1932 Edmondson, 1933a
1935 Edmondson and Ingram, 1939

Septifer bryanae **(Pilsbry, 1921)**

2000 Present study

Family ARCIDAE (ARCINAE)

Arca parva **Sowerby**

1935 Ingram, 1937

Barbatia **(*Acar*)** ***divaricata*** **(Sowerby, 1833)**

2000 Present study

Barbatia **(*Arbabatia*)** ***O`ahua*** **Dall, Bartsch & Rehder, 1938**

1937 Dall, Bartsch & Rehder, 1938

Barbatia nuttingi **(Dall, Bartsch, and Rehder, 1938)**

2000 Present study

Barbatia **sp.**

2000 Present study

Family ISOGNOMONIDAE

Isognomon californicum **(Conrad, 1837)**

1976 Brock, 1976
2000 Present study

Isognomon costellatum **Conrad**

1937 Dall, Bartsch & Rehder, 1938

Isognomon incisum **(Conrad, 1837)**

2000 Present study

Isognomon legumen **(Gmelin, 1791)**

2000 Present study

Isognomon perna **(Linnaeus, 1767)**

1973 Environmental Consultants Inc., 1973
1976 Brock, 1976
2000 Present study

Isognomon **sp.**

2000 Present study

Isognomon torvum **Gould**

1937 Dall, Bartsch & Rehder, 1938

Family MALLEIDAE

Malleus regula **(Forskål, 1775)**

2000 Present study

Family PTERIIDAE

Pinctada margaritifera **(Linnaeus, 1758)**

1927 Galtsoff, 1933
1932 Edmondson, 1933a (as *P. galtsoffi*)

1937 Dall, Bartsch & Rehder, 1938 (as *P. galtsoffi*)
1970 Henderson et al., 1976 (as *P. margaratifera*)
1987 Rodgers et al. 2000
1993 Sims and Sarver, 1994
2000 Present study

***Pinctada radiata* (Leach, 1814)**
1935 Ingram, 1937 (as *Pteria nebulosa*)
1935 Edmondson and Ingram, 1939 (as *Pinctada nebulosa*)
1937 Dall, Bartsch & Rehder, 1938 (as *Pinctada nebulosa*)
1965 Banner, 1968 (as *Pinctada nebulosa*)
1975 Grovhoug, 1976 (as *Pinctada nebulosa*)
1975 Henderson and Smith, 1978 (as *Pinctada nebulosa*)
1976 Grovhoug and Rastetter, 1980

***Pinctada* sp.**
2000 Present study

Family PINNIDAE

***Pinna muricata* Linnaeus, 1758**
1965 Castro, 1966
1975 Henderson et al., 1976

Family LIMIDAE

***Lima keokea* Dall, Bartsch, and Rehder, 1938**
1937 Dall, Bartsch & Rehder, 1938

Family OSTREIDAE

***Crassostrea gigas* (Thunberg, 1793) Introduced**
1939 Brock, 1952
1939 Sparks, 1963
1939 Edmondson and Wilson, 1940 (as *Ostrea gigas*)
1939 Kay, 1979
1944 Edmondson, 1946 (as *Ostrea gigas*)
1965 Banner, 1968
1966 Corn, 1967
1969 Brick, 1970
1976 Brock, 1976
2000 Present study

***Crassostrea virginica* (Gmelin, 1971) Introduced**
1923 Sparks, 1963
1933 Edmondoson, 1933a
1944 Edmondson, 1946
1952 Matthews, 1953
1952 Brock, 1952
1966 Corn, 1967
1969 Brick, 1970
1983 Hunter et al., 1985
2000 Present study

***Dendostrea sandvicensis* (Sowerby, 1871)**
1965 Banner, 1968 (as *Ostrea sandvichensis*)
1966 Corn, 1967 (as *Ostrea sandvichensis*)
1970 Henderson et al., 1976 (as *Ostrea sanvicensis*)
1972 Chave, 1973 (as *Ostrea sanvichensis*)
1973 Environmental Consultants Inc., 1973 (as *Ostrea sanvichensis*)
1976 Brock, 1976 (as *Ostrea sandvichensis*)
1977 Lewis, 1980 (as *Ostrea sanvichensis*)
2000 Present study

***Ostrea hanleyana* Sowerby, 1871**
1916 Pilsbry, 1917
1970 Henderson et al., 1976
1976 Grovhoug and Rastetter, 1980

Ostrea mordax
1956 Sparks, 1963 (as *Crassostrea amasa*)

***Ostrea retusa* Sowerby, 1871**
1966 Corn, 1967

***Ostrea thaanumi* Dall, Bartsch & Rehder, 1940**
1935 Ingram, 1937
1935 Edmondson and Ingram, 1939

    - 1937 Dall, Bartsch & Rehder, 1938
    - 1966 Corn, 1967
  - ***Saccostrea cucullata*** **(Born, 1778)** **Introduced**
    - 1929 Sparks, 1963 (as *Crassostrea commercialis*)
    - 1939 Edmondson and Wilson, 1940 (as *Ostrea culculata*)
    - 1978 Kay, 1979 (as *Ostrea culculata*)
- Family PECTINIDAE
  - ***Chlamys coruscans h*****awaiensis Dall, Bartsch, and Rehder, 1938**
    - 2000 Present study
  - ***Chlamys irregularis*** **(Sowerby, 1842)**
    - 1937 Dall, Bartsch & Rehder, 1938 (as *Clamys cookei*)
    - 2000 Present study
- Family PROPEAMUSIIDAE
  - ***Chlamydella incubata*** **Hayami and Kase, 1993**
    - 2000 Present study
  - ***Chlamydella*** **sp.**
    - 2000 Present study
  - ***Chlamydella tenuissima*** **Hayami and Kase, 1993**
    - 2000 Present study
- Family SPONDYLIDAE
  - ***Spondylus violacescens***
    - 2000 Present study
- Family ANOMIIDAE
  - ***Anomia nobilis*** **Reeve, 1859** **Introduced**
    - 1970 Henderson et al., 1976
    - 1975 Henderson and Smith, 1978
    - 1976 Brock, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 1977 Lewis, 1980
    - 2000 Present study
- Family CHAMIDAE
  - ***Chama macerophylla*** **Introduced**
    - 2000 Present study
  - ***Chama fibula*** **Reeve, 1846**
  - **Cryptogenic**
    - 2000 Present study
  - ***Chama iostoma*** **Conrad, 1837**
    - 2000 Present study
- Family SPORTELLIDAE
  - ***Anisodonta lutea*** **Dall, Bartsch, and Rehder, 1938**
    - 1937 Dall, Bartsch & Rehder, 1938
- Family LUCINIDAE
  - ***Ctena bella*** **(Conrad, 1837)**
    - 1937 Dall, Bartsch & Rehder, 1938
    - 1973 Environmental Consultants Inc., 1973
    - 1975 Grovhoug, 1976
    - 1975 Henderson and Smith, 1978
    - 2000 Present study
  - ***Ctena transversa*** **Dall, Bartsch, and Rehder, 1938**
    - 2000 Present study
  - ***Epicodakia pygmaea*** **Hayami and Kase, 1993**
    - 2000 Present study
  - ***Epicodakia*** **sp.**
    - 2000 Present study
  - ***Pillucina spaldingi*** **(Pilsbry, 1921)**
    - 1937 Dall, Bartsch & Rehder, 1938
- Family GASTROCHAENIDAE
  - ***Rocellaria hawaiensis*** **Dall, Bartsch & Rehder, 1938**
    - 1937 Dall, Bartsch & Rehder, 1938
    - 1976 Brock, 1976
  - ***Rocellaria kanaka*** **Dall, Bartsch & Rehder, 1938**
    - 1937 Dall, Bartsch & Rehder, 1938
- Family HIATELLIDAE
  - ***Hiatella arctica*** **(Linnaeus, 1767)** **Introduced**

1976 Grovhoug and Rastetter, 1980
2000 Present study
Hiatella hawaiensis **(Dall, Bartsch & Rehder, 1938)**
1970 Henderson et al., 1976
Family TEREDINIDAE
Lyrodus affinis **(Deshayes, 1863)** **Introduced**
1943 Edmondson, 1944 (as *Teredo affinis, T. milleri*)
1976 Cooke et al., 1980 (as *Teredo affinis*)
Lyrodus medilobata **(Edmondson, 1942)**
1943 Edmondson, 1944
1976 Cooke et al., 1980
Lyrodus pedicellatus **(Quatrefages, 1849)** **Introduced**
1939 Edmondson, 1940 (as *Teredo diagensis*)
1943 Edmondson, 1944
1976 Cooke et al., 1980
Teredo bartschi **Clapp, 1923** **Introduced**
1939 Edmondson, 1940
1943 Edmondson, 1944
1976 Cooke et al., 1980
Teredo clappi **Bartsch, 1923** **Introduced**
1939 Edmondson, 1940
Teredo furcifera **von Martens, 1894** **Introduced**
1935 Edmondson and Ingram, 1939 (as *T. parksi*)
1935 Ingram, 1937 (as *T. parksi*)
1943 Edmondson, 1944 (as *T. parksi*)
1976 Cooke et al., 1980
Teredo gregoryi **Dall, Bartsch & Rehder, 1939**
Introduced
1939 Edmondson, 1940
1943 Edmondson, 1944
Teredo trulliformis **Miller 1970**
Introduced
1939 Edmondson, 1940
Teredo **sp.**
Introduced
2000 Present study
Family VENERIDAE
Irus **sp.**
2000 Present study
Lioconcha hieroglyphica **(Conrad, 1837)**
1937 Dall, Bartsch & Rehder, 1938
1965 Banner, 1968
1975 Henderson et al., 1976
2000 Present study
Mercenaria mercenaria **(Linn., 1758)**
1967 Anon., 1968
Meretrix meretrix **Linnaeus, 1758** **Introduced**
1926 Brock, 1952 (as *Cythera meretrix*)
1932 Edmondson, 1933a (as *Cythera meretrix*)
1939 Edmondson and Wilson, 1940 (as *Cythera meretrix*)
Periglypta reticulata **(Linnaeus, 1758)**
1970 Henderson et al., 1976
Venerupis philippinarum **Deshayes, 1853** **Introduced**
1920 Edmondson and Wilson, 1940 (as *Paphia philippinarum*)
1964 Anon., 1966 (as *Tapes philippinarum*)
1965 Banner, 1968 (as *Ruditapes phippinarum*)
1967 Worcester, 1969 (as *Tapes philippinarum*)
1967 Anon., 1968 (as *Tapes philippinarum*)
1967 Higgins, 1969 (as *Tapes philippinarum*)
1970 Henderson et al., 1976
1972 Yap, 1977 (as *Tapes philippinarum*)
1972 Yap, 1974 (as *Tapes philippinarum*)
1973 Yap, 1974 (as *Tapes philippinarum*)
1973 Yap, 1977 (as *Tapes philippinarum*)

1978 Kay, 1979 (as *Tapes philippinarum*)
2000 Present study

Family GALEOMMATIDAE

***Scintilla hiloa* Dall, Bartsch, and Rehder, 1938**

2000 Present study

***Scintillona stigmatica* (Pilsbry, 1921)**

2000 Present study

Family LASAEIDAE

***Kellia hawaiensis* Dall, Bartsch, and Rehder, 1938**

1937 Dall, Bartsch & Rehder, 1938 (as *Lesaea hawaiensis*)
2000 Present study

***Kellia rosea* (Dall, Bartsch, and Rehder, 1938)**

1937 Dall, Bartsch & Rehder, 1938 (as *Kaneoha rosea*)

***Kellia* sp.**

2000 Present study

***Lasaea hawaiensis* Dall, Bartsch, & Rehder, 1938**

2000 Present study

***Nesobornia bartschi* Chavan, 1969**

1937 Dall, Bartsch & Rehder, 1938 (as *Nesobornia hawaiensis*)
1975 Grovhoug, 1976 (as *N. ovata, N. hawaiiensis*)

***Radobornia bryani* (Pilsbry, 1921)**

2000 Present study

Family CARDIIDAE

***Fragum* (*Fragum*) *mundum* (Reeve, 1845)**

2000 Present study

***Trachycardium hawaiensis* Dall, Bartsch & Rehder, 1938**

1937 Dall, Bartsch & Rehder, 1938

Family CARDITIDAE

***Cardita aviculina* Lamarck, 1819**

2000 Present study

Family TELLINIDAE

***Macoma* (*Scissulina*) *dispar* (Conrad, 1837)**

1937 Dall, Bartsch & Rehder, 1938 (as *Scissulina dispar*)
1961 Walsh, 1967 (as *Scissulina dispar*)
2000 Present study

***Macoma* (*Scissulina*) *obliquilineata* (Gould, 1837)**

1937 Dall, Bartsch & Rehder, 1938 (as *Jactellina (Loxoglypta) obliquilineata*)
1973 Environmental Consultants Inc., 1973 (as *Jactellina (Loxoglypta) obliquilineata*)

***Quadrans palatum* (Iredale)**

1937 Dall, Bartsch & Rehder, 1938 (as *Quidnipagus palatum*)
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973

***Tellina* (*Angulus*) *hawaiensis* Dall, Bartsch, and Rehder, 1938**

1970 Henderson et al., 1976

***Tellina* (*Angulus*) *nucella* (Dall, Bartsch & Rehder, 1938)**

1973 Environmental Consultants Inc., 1973 (as *Pinquitellina nucella*)

***Tellina* (*Arcopagia*) *robusta* (Hanley, 1844)**

2000 Present study

***Tellina* (*Quidnipagus*) *palatam* Iredale, 1929**

2000 Present study

Family MACTRIDAE

***Mactra thaanumi* Dall, Bartsch, and Rehder, 1938**

1937 Dall, Bartsch & Rehder, 1938

Family MESODESMATIDAE

***Ervilia bisculpta* Gould, 1861**

2000 Present study

***Ervilia sandwichensis* (Smith, 1885)**

1975 Henderson and Smith, 1978
2000 Present study

Family NUCULIDAE

***Nucula hawaiensis* Pilsbry, 1921**

2000 Present study

- Class CEPHALOPODA
  - Order OCTOPODA
    - Family OCTOPODIDAE
      - ***Octopus cyanea*** **Gray, 1849**
        - 1965 Van Heukelem, 1966
        - 1965 Banner, 1968
        - 1968 Maginniss and Wells, 1969
        - 1968 Yarnall, 1970
        - 1968 Yarnall, 1969
        - 1969 Van Heukelem, 1973
        - 1995 Mather et al., 1997
  - Order SEPIOIDEA
    - Family SEPIOLIDAE
      - ***Euprymna morsei***
        - 1960 Jander, Duamer & Waterman, 1963
      - ***Euprymna scolopes*** **Berry, 1913**
        - 1981 Moynihan, 1983
        - 1984 Wei and Young, 1989
        - 1992 Lee and Ruby, 1994
  - Order TEUTHOIDEA
    - Family LOLIGINIDAE
      - ***Sepioteuthis lessoniana*** **Lesson, 1830**
        - 1960 Jander, Duamer & Waterman, 1963
- Class POLYPLACOPHORA
  - Order CHITONID
    - Family ACANTHOCHITONIDAE
      - ***Acanthochiton*** **sp.**
        - 2000 Present study
      - ***Acanthochiton viridis*** **(Pease, 1872)**
        - 1975 Henderson et al., 1976
    - Family ISCHNOCHITONIDAE
      - ***Ischnochiton*** **sp.**
        - 2000 Present study

Phylum ARTHROPODA

- Class PYCNOGONIDA
  - Order PANTOPODA
    - Family AMMOTHEIDAE
      - ***Ammothella pacifica*** **Hilton, 1942**
        - 2000 Present study
      - ***Tanystylum rehderi*** **Child**
      - **Cryptogenic**
        - 2000 Present study
    - Family CALLIPALLENIDAE
      - ***Callipallene*** **sp.**
      - **Cryptogenic**
        - 2000 Present study
      - ***Pigrogromitus timsanus*** **Calman** **Introduced**
        - 2000 Present study
    - Family ENDEIDAE
      - ***Endeis biseriata*** **Stock, 1968**
        - 1960 BPBM-S 7240
      - ***Endeis nodosa*** **Hilton, 1942**
        - 1924 BPBM-S 7207
        - 1927 BPBM-S 7220
        - 1932 Edmondson, 1933a
        - 1941 Hilton, 1942
        - 1944 Edmondson, 1946
        - 1960 BPBM-S 7015
    - Family PHOXICHILIDIIDAE
      - ***Anoplodactylus arescus*** **Marcus** **Introduced**
        - 2000 Present study
      - ***Anoplodactylus californicus*** **Hall**
      - **Cryptogenic**
        - 2000 Present study

Anoplodactylus digitatus **(Bohm)**
Cryptogenic
2000 Present study
Anoplodactylus marshallensis **Child**
Cryptogenic
2000 Present study
Anoplodactylus portus **Calman, 1927**
Cryptogenic
1976 Grovhoug and Rastetter, 1980
Anoplodactylus pycnosoma **(Helfer)**
2000 Present study
Anoplodactylus **sp.**
2000 Present study
Class COLLEMBOLA
Family COLLEMBOLA
Lipura maritima
1976 Brock, 1976
Class BRANCHIOPODA
Subclass SARSOSTRACA
Order ANOSTRACA
Family BRANCHINECTIDAE
Evadne **sp.**
1963 Piyakarnchana, 1965
Class MAXILLOPODA
Subclass CIRRIPEDIA
Order THORACICA
Family BALANIDAE
Balanus amphitrite **(Darwin)** **Introduced**
none BPBM-B 574
1928 Pilsbry, 1927
1935 Ingram, 1937
1935 Edmondson and Ingram, 1939
1959 Utinomi, 1960 (as *B. ampitrite hawaiiensis*)
1970 Henderson et al., 1976
1972 Matsuda, 1973 (as *B. ampitrite ampitrite*)
1975 BPBM-B 617
1975 BPBM-B 583
1975 BPBM-B 582
1975 Grovhoug, 1976 (as *B. ampitrite hawaiiensis*)
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980 (as *B. ampitrite ampitrite*)
1977 BPBM-B 548
1977 Lewis, 1980
2000 Present study
Balanus eburneus **Gould** **Introduced**
none BPBM-B 607
none BPBM-B 605
none BPBM-B 603
none BPBM-B 601
none BPBM-B 575
1970 Henderson et al., 1976
1972 Matsuda, 1973
1975 BPBM-B 560
1975 BPBM-B 558
1975 Grovhoug, 1976
1975 Henderson and Smith, 1978
1976 BPBM-B 591
1976 BPBM-B 614
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980
1977 Lewis, 1980
2000 Present study
Balanus reticulatus **Utinomi** **Introduced**
none BPBM-B 600

none BPBM-B 576
none BPBM-B 608
none BPBM-B 592
none BPBM-B 593
1972 Matsuda, 1973
1975 BPBM-B 619
1975 BPBM-B 594
1975 BPBM-B 556
1975 Grovhoug, 1976
1976 BPBM-B 612
1976 Grovhoug and Rastetter, 1980
1977 Lewis, 1980

Balanus trigonus **Darwin**

none BPBM-B 577
none BPBM-B 599
none BPBM-B 598
none BPBM-B 609
none BPBM-B 596
none BPBM-B 604
1964 BPBM-B 456
1964 Bowers, 1965
1970 Henderson et al., 1976
1972 Matsuda, 1973
1975 BPBM-B 557
1975 BPBM-B 571
1975 BPBM-B 578
1975 BPBM-B 559
1975 BPBM-B 627
1975 Henderson and Smith, 1978
1976 BPBM-B 613
1976 Brock, 1976
1976 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
2000 Present study

Balanus **sp.**

none BPBM-B 606
1963 BPBM-B 416
1975 BPBM-B 570
1976 BPBM-B 626
1977 BPBM-B 536
1983 BPBM-B 547

Chelonibia patula **(Ranzani)**

1928 Pilsbry, 1927
1935 Ingram, 1937
1964 BPBM-B 455
1964 Bowers, 1965
1972 Matsuda, 1973

Chelonibia testudinaria **(Linnaeus, 1758)**

1935 Edmondson and Ingram, 1939

Megabalanus **sp.**

1975 BPBM-B 550
1976 BPBM-B 569
1978 BPBM-B 552
1978 BPBM-B 551

Megabalanus tanagrae **(Pilsbry, 1928)**

1983 BPBM-B 546 (as *Balanus tintinnabulum tanagrae*)
1983 BPBM-B 566 (as *Megabalanus tintinnabulum tanagrae*)

Stephanolepas muricata

1977 BPBM-B 555

Family CHTHAMALIDAE

Chthamalus proteus **Dando & Southward, 1980** **Introduced**

1994 Southward et al., 1998
2000 Present study

Euraphia hembeli **(Conrad)**

1972 Matsuda, 1973 (as *Chthamalus hembeli*)
***Nesochthamalus intertextus* (Darwin)**
1975 BPBM-B 618
2000 Present study
Family LEPADIDAE
Lepas anatifera
1976 BPBM-B 549
***Lepas anserifera* Linnaeus, 1758**
none BPBM-B 257
1915 BPBM-B 230
1972 Matsuda, 1973
***Lepas* sp.**
1979 BPBM-B 543
1980 BPBM-B 590
***Trilasmis fissum hawaiense* Pilsbry, 1928**
1964 Bowers, 1965
Family POECILASMATIDAE
***Octolasmis* (*Octolasmis*) *indubia* Newman**
1960 Newman, 1961
***Octolasmis* (*Octolasmis*) *lavei* (Darwin)**
1964 Bowers, 1965
Order ACROTHORACIA
Family LITHOGLYPTIDAE
***Weltneria hirsuta* Tomlinson, 1963**
1962 Tomlinson, 1963 (as *Lithoglyptes hirsutus*)
1964 BPBM-B 423
1964 BPBM-B 429
1968 Tomlinson, 1969
Subclass COPEPODA
Order CALANOIDA
Family CALANOIDA
Acrocalanus inermis
1976 Kimmerer, 1983
1977 Kimmerer, 1984
1985 Kitalong, 1986b
1985 Kitalong, 1986a
***Arcartia* sp.**
1963 Piyakarnchana, 1965
***Labidocera madurae* Scott**
1963 Piyakarnchana, 1965
***Paracalanus parvus* Claus**
1963 Piyakarnchana, 1965
***Pseudocalanus* sp.**
1963 Piyakarnchana, 1965
***Undinula vulgaris* Dana**
1963 Piyakarnchana, 1965
1991 Park and Landry, 1993
1997 Lenz and Hartline, 1999
Order CYCLOPOIDA
Family CYCLOPOIDA
Oithona nana
1985 Kitalong, 1986b
Oithona simplex
1985 Kitalong, 1986b
***Oncaea* sp.**
1963 Piyakarnchana, 1965
Order CALIGOIDA
Family CALIGOIDA
***Lepeophtheirus dissimulatus* Wilson**
1961 Ball, 1963
Class MALACOSTRACA
Subclass HOPLOCARIDA
Order STOMATOPODA
Family GONODACTYLIDAE

***Gonodactylaceus falcatus* (Forskal, 1775)** **Introduced**
- 1963 BPBM-S 10017 (as *Gonodactylus aloha*)
- 1964 BPBM-S 10015 (as *Gonodactylus aloha*)
- 1964 BPBM-S 10018 (as *Gonodactylus aloha*)
- 1966 BPBM-S 10014 (as *Gonodactylus aloha*)
- 1967 BPBM-S 10016 (as *Gonodactylus aloha*)
- 2000 Present study

***Gonodactylellus hendersoni* (Manning, 1967)**
- 2000 Present study

***Gonodactylus glabrous* Brooks**
- 1959 Eley, 1960

Family PSEUDOSQUILLIDAE

***Pseudosquilla ciliata* (Fabricuis, 1787)**
- 1925 BPBM-S 2458
- 1927 BPBM-S 2814
- 1929 BPBM-S 3729
- 1934 BPBM-S 3894
- 1938 BPBM-S 4413
- 1952 Kinzie, 1968
- 1952 Townsley, 1953
- 1961 Ball, 1963
- 1965 Banner, 1968
- 2000 Present study

***Pseudosquillisma oculata* (Brulle, 1837)**
- none BPBM-S 6332 (as *Pseudosquilla oculata*)
- 1920 Edmondson, 1921 (as *Pseudosquilla oculata*)
- 1925 BPBM-S 2457 (as *Pseudosquilla oculata*)
- 1938 BPBM-S 4414 (as *Pseudosquilla oculata*)

Family SQUILLIDAE

***Busquilla quadraticauda* (Fukuda, 1911)**
- 1949 Townsley, 1950 (as *Squilla boops*)

***Oratosquilla calumnia* (Townsley, 1953)**
- 1949 BPBM-S 10881 (as *Squilla oratoria*)
- 1961 Ball, 1963 (as *Squilla oratoria*)

Subclass EUMALACOSTRACA

Superorder PERACARIDA

Order MYSIDACEA

Suborder MYSIDA

Family MYSIDAE

Anisomysis incisa
- 1970 Henderson et al., 1976

Order AMPHIPODA

Suborder GAMMARIDEA

Family AMPHILOCHIDAE

***Amphilochus menehune* Barnard, 1970**
- 2000 Present study

***Amphilochus* sp.**
- 2000 Present study

***Gitana liliuokalaniae* Barnard, 1970**
- 1967 BPBM-S 7247

***Gitanopsis pele* Barnard, 1970**
- 1967 BPBM-S 7251

Family AMPITHOIDAE

***Ampithoe* spp.**
- 2000 Present study

***Ampithoe waialua* Barnard, 1970**
- 2000 Present study

Family ANAMIXIDAE

***Anamixis moana* Thomas, 1997**
- 1967 Thomas, 1997 (as *Anamixis stebbingi*)
- 2000 Present study

Family AORIDAE

***Aloiloi nenue* Barnard, 1970**
- 1967 BPBM-S 7257

- ***Bemlos concavus* (Stout, 1913)**
  Cryptogenic
    - 1935 Edmondson and Ingram, 1939 (as *Lembos concavus*)
    - 1944 Edmondson, 1946 (as *Lembos concavus*)
- ***Bemlos intermedius* Schellenberg, 1938**
    - 1954 Barnard, 1955 (as *Lembos (Bemlos) intermedius*)
    - 1962 Johannes, 1964a (as *Lembos (Bemlos) intermedius*)
    - 1962 Johannes, 1964b (as *Lembos (Bemlos) intermedius*)
- ***Bemlos macromanus* Shoemaker, 1925**
    - 1975 BPBM-S 11216 (as *Lembos macromanus*)
- ***Bemlos waipio* Barnard, 1970**
    - 2000 Present study
- ***Bemlos* spp.**
    - 2000 Present study

Family COLOMASTIGIDAE

- ***Colomastix kapiolani* Barnard, 1970**
    - 2000 Present study
- ***Colomastix lunalilo* Barnard, 1970**
    - 1967 BPBM-S 7266
    - 2000 Present study
- ***Colomastix pusilla* Grube, 1864**
    - 1954 Barnard, 1955
    - 2000 Present study

Family COROPHIIDAE

- ***Corophium baconi* Shoemaker, 1934** **Introduced**
    - 1969 Barnard, 1970
    - 1970 Barnard, 1971
    - 1976 Grovhoug and Rastetter, 1980
- ***Corophium* spp.** **Introduced**
    - 2000 Present study
- ***Ericthonius brasiliensis* (Dana, 1853)** **Introduced**
    - 1935 Edmondson and Ingram, 1939 (as *Ericthonius disjunctus*)
    - 1976 Grovhoug and Rastetter, 1980
    - 1976 Brock, 1976
    - 2000 Present study

Family EUSIRIDAE

- ***Eursiroides diplonyx* Walker, 1904**
    - 2000 Present study

Family GAMMARIDAE

- ***Eriopisa hamakua* Barnard, 1970**
    - 2000 Present study
- ***Eriopisella schellensis* upolu Barnard, 1970**
    - 1967 BPBM-S 7275

Family ISAEIDAE

- ***Gammaropsis alamoana* Barnard, 1970**
    - 1967 BPBM-S 7279
    - 1976 Brock, 1976
- ***Gammaropsis haleiwa* Barnard, 1970**
    - 1967 BPBM-S 7280
- ***Gammaropsis pali* Barnard, 1970**
    - 1967 BPBM-S 7282
- ***Photis hawaiensis* Barnard, 1955**
  Cryptogenic
    - 1937 BPBM-S 6012
    - 1937 BPBM-S 6011
    - 1954 Barnard, 1955
    - 2000 Present study

Family ISCHYROCERIDAE

- ***Ischyrocerus kapu* Barnard, 1970**
    - 1967 BPBM-S 7286
- ***Ischyrocerus O`ahu* Barnard, 1970**
    - 1967 BPBM-S 7287
- ***Leucothoe hyhelia* Barnard, 1965**
    - 1975 Grovhoug, 1976

2000 Present study

Leucothoe micronesiae **Barnard, 1965** **Introduced**

2000 Present study

***Leucothoe* sp.**

2000 Present study

Leucothoe tridens **Stebbing, 1888**

2000 Present study

Family LEUCOTHOIDAE

Paraleucothoe flindersi **Stebbing** **Introduced**

2000 Present study

Family LILJEBORGIIDAE

Liljeborgia heeia **Barnard, 1970**

2000 Present study

Family LYSIANASSIDAE

Lysianassa ewa **Barnard, 1970**

1967 BPBM-S 7292
2000 Present study

Family MELITIDAE

Elasmopus hawaiiensis **Schellenberg, 1938**

1976 Grovhoug and Rastetter, 1980

Elasmopus piikoi **Barnard, 1970**

1967 BPBM-S 7272

Elasmopus rapax **Costa, 1853** **Introduced**

1936 BPBM-S 5987
1937 BPBM-S 5988
1954 Barnard, 1955
2000 Present study

***Elasmopus* spp.**

2000 Present study

Maera insignis **(Chevreux, 1901)**

2000 Present study

Maera pacifica **Schellenberg, 1938**

2000 Present study

Maera quadrimana **(Dana, 1853)**

2000 Present study

Maera serrata **Schellenberg, 1938**

2000 Present study

Melita appendiculata **(Say, 1818)**

1954 Barnard, 1955 (as *Melita fresneli*)

Melita fresnelli

1936 BPBM-S 5928
1936 BPBM-S 5929

Family OCHELESIDAE

Ochlesis alii **Barnard, 1970**

2000 Present study

Family PLEUSTIDAE

Parapleustes derzhavini **(Gurjanova, 1938)** **Introduced**

1967 BPBM-S 7297 (as *Parapleustes derzhavini makiki*)

Family PODOCERIDAE

Podocerus brasiliensis **Dana, 1853** **Introduced**

none BPBM-S 5930
1935 BPBM-S 5955
1935 BPBM-S 5954
1935 BPBM-S 5956
1937 BPBM-S 5950
1937 BPBM-S 5953
1937 BPBM-S 5951
1937 BPBM-S 5952
1937 BPBM-S 5949
1954 Barnard, 1955
1975 Grovhoug, 1976

Family STENOTHOIDAE

Stenothoe gallensis **Walker, 1904** **Introduced**

none BPBM-S 5974

- 1935 BPBM-S 5968
- 1936 BPBM-S 5969
- 1937 BPBM-S 5971
- 1937 BPBM-S 5970
- 1954 Barnard, 1955
- 2000 Present study

- ***Stenothoe valida* Dana, 1853**
  - **Cryptogenic**
  - 2000 Present study
- ***Stenothoe* sp.**
  - 2000 Present study

- Family TALITROIDAE
  - ***Orchestia platensis* Kroyer, 1845** **Introduced**
    - 1966 Fee, 1967
  - ***Parhyale hawaiensis* Dana, 1853**
    - none BPBM-S 5973
    - 1935 BPBM-S 5967
    - 1954 Barnard, 1955 (as *Parhyale inyacka*)
- Suborder CAPRELLIDEA
  - Family CAPRELLIDAE
    - ***Caprella penantis* Leach, 1814** **Introduced**
      - none BPBM-S 5223 (as *Caprella acutifrons*)
      - none BPBM-S 8125
      - none BPBM-S 5231 (as *Caprella acutifrons*)
      - 1927 BPBM-S 5217 (as *Caprella acutifrons*)
      - 1927 BPBM-S 5218 (as *Caprella acutifrons*)
      - 1932 BPBM-S 5219 (as *Caprella acutifrons*)
      - 1935 BPBM-S 5220 (as *Caprella acutifrons*)
      - 1935 BPBM-S 5221 (as *Caprella acutifrons*)
      - 1936 BPBM-S 5222 (as *Caprella acutifrons*)
      - 1936 BPBM-S 5224 (as *Caprella acutifrons*)
      - 1936 BPBM-S 5225 (as *Caprella acutifrons*)
      - 1936 BPBM-S 5226 (as *Caprella acutifrons*)
      - 1937 BPBM-S 5227 (as *Caprella acutifrons*)
      - 1937 BPBM-S 5228 (as *Caprella acutifrons*)
      - 1937 BPBM-S 5229 (as *Caprella acutifrons*)
      - 1939 BPBM-S 5230 (as *Caprella acutifrons*)
      - 1935 BPBM-S 7309 (as *Caprella acutifrons*)
      - 1935 BPBM-S 7311 (as *Caprella acutifrons*)
      - 1936 BPBM-S 7313 (as *Caprella acutifrons*)
      - 1947 Edmondson and Mansfield, 1948 (as *C. acutifrons*)
    - ***Paracaprella pusilla* Mayer, 1890** **Introduced**
      - 1976 Grovhoug and Rastetter, 1980

- Order ISOPODA
  - Suborder ANTHURIDEA
    - Family ANTHURIDAE
      - ***Apanthura inornata* Miller and Menzies, 1952**
        - 1975 Grovhoug, 1976
      - ***Apanthura* sp.**
        - 2000 Present study
      - ***Mesanthura hieroglyphica* Miller and Menzies, 1952**
        - 1976 Grovhoug and Rastetter, 1980
      - ***Mesanthura* n.sp.** **Introduced**
        - 2000 Present study
      - ***Pendanthura* sp.**
        - 2000 Present study
    - Family PARANTHURIDAE
      - ***Paranthura* sp.**
        - 2000 Present study
  - Suborder FLABELLIFERA
    - Family CIROLANIDAE
      - ***Cirolana parva* Hansen,**
        - 1975 Grovhoug, 1976
      - ***Cirolana* sp. Edmondson, 1946**

- 2000 Present study
- ***Metacirolana sphaeromiformia***
  - 2000 Present study
- Family LIMNORIIDAE
  - ***Limnoria* sp.**
    - 1935 Edmondson and Ingram, 1939
    - 2000 Present study
  - ***Limnoria tripunctata* Menzies, 1951** **Introduced**
    - 1935 Ingram, 1937 (as L. lignorum)
    - 1961 Walsh, 1967 (as L. lignorum)
- Family SPHAEROMATIDAE
  - ***Neonaesa rugosa* Harrison and Holdich, 1982**
    - 2000 Present study
  - ***Paracerceis sculpta* Holmes, 1904** **Introduced**
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 1976 Grovhoug and Rastetter, 1980
    - 1976 Brock, 1976
    - 2000 Present study
  - ***Paradella dianae***
    - 2000 Present study
  - ***Sphaeroma walkeri* Stebbing, 1905** **Introduced**
    - 1976 Grovhoug and Rastetter, 1980
  - **unid. Sphaeromatidae**
    - 2000 Present study
- Suborder ASELLOTA
  - Family JANIRIDAE
    - ***Bagatus algicola* Miller, 1941**
      - 1941 Miller, 1941 (as *Janira algicola*)
    - ***Carpias algicola***
      - 2000 Present study
    - ***Carpias* sp.**
      - 2000 Present study
  - Family JOEROPSIDAE
    - ***Joeropsis* sp.**
      - 2000 Present study
  - Family MUNNIDAE
    - ***Munna acarina* Miller, 1941**
      - 1941 Miller, 1941
      - 1976 Grovhoug and Rastetter, 1980
    - ***Munna* n.sp.**
      - 2000 Present study
  - Family PARAMUNNIDAE
    - ***Paramunna* sp.**
      - 2000 Present study
  - Family STENETRIIDAE
    - ***Stenetrium* sp.**
      - 2000 Present study
- Suborder EPICARIDEA
  - Family BOPYRIDAE
    - ***Ionella murchisoni* Danforth, 1970**
      - 1965 Danforth, 1970
- Suborder ONISCIDEA
  - Family PHILOSCIIDAE
    - ***Littorophiloscia bifasciata***
      - 1985 BPBM-S 11219
- Order TANAIDACEA
  - Suborder TANAIDOMORPHA
    - Family TANAIDAE
      - ***Anatanais insularis***
        - 2000 Present study
      - ***Apseudes* sp.**
        - 1996 BPBM-S 11300
        - 1996 BPBM-S 11302

1996 BPBM-S 11301

***Apseudes tropicalis* Miller, 1940**

1996 BPBM-S 11306
2000 Present study

***Parapseudes neglectus* Miller, 1940**

2000 Present study

Family PSEUDOZUXIDAE

***Leptochelia dubia* Kroyer,**
Cryptogenic

1975 Grovhoug, 1976
1976 Brock, 1976
1985 Kitalong, 1986a
1985 Kitalong, 1986b
2000 Present study

Order CUMACEA

Family NANNASTACIDAE

***Nannastacus* sp.** **Introduced**

1996 Muir, 1997

Superorder EUCARIDA

Order DECAPODA

Suborder DENDROBRANCHIATA

Family BENTHESICYMIDAE

***Benthesicymus investigatoris* Alcock and Anderson, 1899**

1905 Rathbun, 1906

Family PENAEIDAE

***Haliporus equalis* Bate**

1905 Rathbun, 1906

***Melicertus marginatus* (Randall, 1840)**

1920 BPBM-S 2667 (as *Penaeus marginatus*)
1924 BPBM-S 1609 (as *Penaeus marginatus*)

Family SERGESTIDAE

***Lucifer chacei* Bowman, 1967**

1966 Burdick, 1969
1967 Peterson, 1969
1968 Zimmerman, 1969

***Lucifer faxoni* Borradaile, 1915**

1963 Piyakarnchana, 1965

Suborder PLEOCYEMATA

Infraorder STENOPODIDEA

Family STENOPODIDAE

***Stenopus hispidus* (Olivier, 1811)**

1934 BPBM-S 3774
1951 Wiersma and Ripley, 1952
1966 Johnson, 1967
1966 Johnson, 1971
1967 Higa, 1967
1975 Johnson, 1977
1985 Jonasson, 1986
2000 Present study

Infraorder CARIDEA

Family PASIPHAEIDAE

***Psathyrocaris hawaiiensis* Rathbun, 1906**

1905 Rathbun, 1906

Family NEMATOCARCINIDAE

***Nematocarcinus ensiferus* (Smith,)**

1905 Rathbun, 1906

***Nematocarcinus tenuirostris* Bate, 1888**

1905 Rathbun, 1906

Family GNATHOPHYLLIDAE

***Gnathophyllum americanum* Guerin-Meneville, 1856**

1970 Henderson et al., 1976 (as *Gnathophyllum fasciolatum*)

Family HYMENOCERIDAE

***Hymenocera picta* Dana, 1852**

1934 BPBM-S 3895 (as *Hymenocera elegans*)

- 1934 Edmondson, 1935 (as *Hymenocera elegans*)
- 1934 Titgen, 1989
- 1944 Hiatt, 1948
- 1964 BPBM-S 7046
- 1964 Barry, 1965

Family PALAEMONIDAE (PALAEMONINAE)

- ***Palaemon debilis* (Dana, 1852)**
  - 1927 BPBM-S 2813
  - 1930 BPBM-S 3518
  - 1970 Henderson et al., 1976
  - 1976 Brock, 1976
- ***Paleamonetes* sp.**
  - 1961 Walsh, 1967

Family PALAEMONIDAE (PONTONIINAE)

- ***Harpiliopsis beaupresi* (Audouin, 1826)**
  - 1937 BPBM-S 4389
- ***Harpiliopsis depressa* (Stimpson, 1860)**
  - 1964 Barry, 1965
  - 1976 Brock, 1976
- ***Palaemonella tenuipes* Dana, 1852**
  - 1970 Henderson et al., 1976
  - 1976 Brock, 1976
- ***Periclimenaeus tridentatus* (Miers, 1884)**
  - 1934 BPBM-S 3750
- ***Periclimenes grandis* (Stimpson)**
  - 1976 Brock, 1976
- ***Periclimenes soror* Nobili, 1904**
  - 1934 Edmondson, 1935 (as *Periclimenes bicolor*)
- ***Vir orientalis* (Dana, 1852)**
  - 1976 Brock, 1976 (as *Palaemon orientalis*)

Family ALPHEIDAE

- ***Alpheus brevipes* Stimpson, 1860**
  - 1964 BPBM-S 9343
  - 1964 BPBM-S 9342
  - 1964 BPBM-S 9344
  - 1964 Barry, 1965
  - 1965 BPBM-S 9345
  - 2000 Present study
- ***Alpheus clypeatus* Coutiere, 1905**
  - 1935 BPBM-S 4451
  - 1964 Barry, 1965
  - 1968 Bowers, 1970
  - 2000 Present study
- ***Alpheus collumianus* Stimpson, 1860**
  - 1935 BPBM-S 4453
  - 1964 Barry, 1965
  - 2000 Present study
- ***Alpheus deuteropus* Hilgendorf, 1878**
  - 1934 BPBM-S 3778
  - 1939 Banner, 1940 (as *Crangon deuteropus*)
  - 1952 Banner, 1953 (as *Crangon deuteropus*)
- ***Alpheus diadema* Dana, 1852**
  - none BPBM-S 6414 (as *Alpheus insignis*)
  - 1934 BPBM-S 8897
  - 1938 BPBM-S 6413 (as *Alpheus insignis*)
  - 1938 BPBM-S 6412 (as *Alpheus insignis*)
  - 1939 Banner, 1940 (as *Alpheus insignis*)
  - 1952 Banner, 1953 (as *Crangon diadema*)
  - 1964 Barry, 1965
  - 2000 Present study
- ***Alpheus gracilipes* Stimpson, 1860**
  - 1925 BPBM-S 2459
  - 1934 BPBM-S 8918
  - 1934 BPBM-S 8919

- 2000 Present study

***Alpheus gracilis* Heller, 1861**

- 1938 BPBM-S 6419 (as *Alpheus gracilis* var. *monacantha*)
- 1964 Barry, 1965

***Alpheus heeia* Banner & Banner, 1975**

- 1964 Banner and Banner, 1974
- 1973 BPBM-S 8547
- 1973 BPBM-S 8548
- 1973 BPBM-S 8549

***Alpheus lanceloti* Coutiere, 1905**

- 1958 Banner, 1959
- 1964 Banner and Banner, 1974

***Alpheus leptochirus* Coutiere, 1905**

- 1973 Environmental Consultants Inc., 1973

***Alpheus lobidens* de Haan, 1849**

- none BPBM-S 6443 (as *Alpheus crassimanus*)
- 1939 Banner, 1940 (as *Crangon crassimanus*)
- 1964 Banner and Banner, 1974
- 1970 Henderson et al., 1976 (as *Alpheus lobidens polynesica*)
- 1973 BPBM-S 8544 (as *Alpheus lobidens polynesica*)
- 1973 BPBM-S 8545 (as *Alpheus lobidens polynesica*)
- 1973 BPBM-S 8546 (as *Alpheus lobidens polynesica*)
- 1973 Environmental Consultants Inc., 1973 (as *Alpheus crassimanus*)
- 1975 Grovhoug, 1976 (as *Alpheus lobidens polynesica*)
- 1976 Brock, 1976 (as *Alpheus lobidens polynesica*)
- 2000 Present study

***Alpheus lottini* Guerin, 1829**

- 1964 BPBM-S 9133
- 1964 BPBM-S 9136
- 1964 BPBM-S 9137
- 1964 BPBM-S 9138
- 1964 BPBM-S 9139
- 1964 BPBM-S 9140
- 1964 BPBM-S 9141
- 1964 BPBM-S 9142
- 1964 BPBM-S 9143
- 1964 BPBM-S 9144
- 1964 BPBM-S 9145
- 1964 BPBM-S 9146
- 1964 BPBM-S 9147
- 1964 BPBM-S 9148
- 1964 BPBM-S 9149
- 1964 BPBM-S 9150
- 1964 BPBM-S 9151
- 1964 BPBM-S 9152
- 1964 BPBM-S 9153
- 1964 BPBM-S 9154
- 1964 BPBM-S 9155
- 1964 BPBM-S 9156
- 1964 BPBM-S 9157
- 1964 BPBM-S 9158
- 1964 BPBM-S 9159
- 1964 BPBM-S 9160
- 1964 BPBM-S 9161
- 1964 BPBM-S 9162
- 1964 BPBM-S 9163
- 1964 BPBM-S 9164
- 1964 BPBM-S 9165
- 1964 BPBM-S 9166
- 1964 BPBM-S 9167
- 1964 BPBM-S 9168
- 1964 BPBM-S 9169
- 1964 BPBM-S 9170
- 1964 BPBM-S 9171

1964	BPBM-S 9172
1964	BPBM-S 9174
1964	BPBM-S 9175
1964	BPBM-S 9176
1964	BPBM-S 9177
1964	BPBM-S 9178
1964	BPBM-S 9183
1964	BPBM-S 9185
1964	BPBM-S 9187
1964	BPBM-S 9188
1964	BPBM-S 9189
1964	BPBM-S 9190
1964	BPBM-S 9191
1964	BPBM-S 9192
1964	BPBM-S 9193
1964	BPBM-S 9194
1964	BPBM-S 9195
1964	BPBM-S 9196
1964	BPBM-S 9197
1964	BPBM-S 9198
1964	BPBM-S 9199
1964	BPBM-S 9200
1964	BPBM-S 9201
1964	BPBM-S 9202
1964	BPBM-S 9203
1964	BPBM-S 9204
1964	BPBM-S 9205
1964	BPBM-S 9206
1964	BPBM-S 9207
1964	Barry, 1965
1965	BPBM-S 9131
1965	BPBM-S 9132
1965	BPBM-S 9134
1965	BPBM-S 9135
1965	BPBM-S 9173
1965	BPBM-S 9179
1965	BPBM-S 9180
1965	BPBM-S 9181
1965	BPBM-S 9182
1965	BPBM-S 9184
1965	BPBM-S 9186
1965	BPBM-S 9208
1965	BPBM-S 9209
1965	BPBM-S 9210
1965	BPBM-S 9211
1965	BPBM-S 9212
1965	BPBM-S 9213
1965	BPBM-S 9214
1965	BPBM-S 9215
1965	BPBM-S 9216
1965	BPBM-S 9217
1965	Castro, 1966
1982	BPBM-S 10862
1982	BPBM-S 10863
1982	BPBM-S 10864
1982	BPBM-S 10865
1982	BPBM-S 10866
1982	BPBM-S 10868

Alpheus mackayi **(Banner, 1959)**

1961	Walsh, 1967 (as *A. fabricus mackayi*)
1962	BPBM-S 7121 (as *Alpheus malabaricus mackayi*)
1962	BPBM-S 7140 (as *Alpheus malabaricus mackayi*)
1977	Gust and Harrison, 1981
1980	Harrison, 1981

- 2000 Present study

***Alpheus pacificus* Dana, 1852**
- 1937 BPBM-S 6455
- 1975 Henderson et al., 1976

***Alpheus paracrinatus* Miers, 1881**
- 1922 BPBM-S 6472 (as *Alpheus paracrinitus* var. *bengalensis*)
- 1952 Banner, 1953 (as *Crangon paracrinata*)
- 2000 Present study

***Alpheus paralcyone* Coutiere, 1905**
- 1934 BPBM-S 6476
- 1939 BPBM-S 9107
- 1948 BPBM-S 9106
- 1952 Banner, 1953 (as *Crangon paralcyone*)
- 1964 BPBM-S 9670
- 1964 BPBM-S 9669
- 1975 Grovhoug, 1976
- 2000 Present study

***Alpheus platyunguiculatus* (Banner, 1953)**
- 1952 Banner, 1953 (as *Crangon platyunguiculata*)
- 1958 Banner, 1959
- 1975 Grovhoug, 1976

***Alpheus pugnax* Dana, 1852**
- 2000 Present study

***Alpheus rapacida* de Man, 1909**
- 1970 BPBM-S 9979

***Alpheus rapax* Fabricius, 1789**
- 1952 Banner, 1953 (as *Crangon rapax*)
- 1958 Banner, 1959
- 1965 Banner, 1968
- 1970 Preston, 1972
- 1970 Henderson et al., 1976
- 1970 Preston, 1978
- 1973 Environmental Consultants Inc., 1973
- 2000 Present study

***Alpheus rapicida* De Man, 1908**
- 1964 Banner and Banner, 1974
- 1970 Preston, 1972
- 1970 Preston, 1978
- 1975 Grovhoug, 1976
- 2000 Present study

***Leptalpheus pacificus* Banner & Banner, 1974**
- 1939 Banner, 1940 (as *Crangon pacifica*)
- 1952 Banner, 1953 (as *Crangon pacifica*)
- 1964 Banner and Banner, 1974

***Metalpheus paragracilis* Coutiere, 1897**
- 1952 Banner, 1953 (as *Cragon paragracila*)
- 1952 Banner, 1953 (as *Crangon paragracila*)
- 1964 Barry, 1965 (as *Alpheus paragracilis*)
- 2000 Present study

***Neoalpheopsis euryone* (de Man, 1910)**
- none BPBM-S 10600

***Synalpheus bituberculatus* de Man, 1910**
- 2000 Present study

***Synalpheus charon* (Heller, 1861)**
- none BPBM-S 10849
- none BPBM-S 10848
- 1938 BPBM-S 6485
- 1938 BPBM-S 6486
- 1964 BPBM-S 9960
- 1964 BPBM-S 9961
- 1964 BPBM-S 9962
- 1964 BPBM-S 9963
- 1964 BPBM-S 9964
- 1964 BPBM-S 9965

      - 1964 BPBM-S 9966
      - 1964 BPBM-S 9967
      - 1964 BPBM-S 9968
      - 1964 BPBM-S 9969
      - 1964 BPBM-S 9970
      - 1964 BPBM-S 9971
      - 1964 BPBM-S 9972
      - 1964 Barry, 1965
      - 1982 BPBM-S 10850
      - 1982 BPBM-S 10851
    - ***Synalpheus pachymeris*** **Coutiere, 1905**
      - 1970 Henderson et al., 1976
    - ***Synalpheus paraneomeris*** **Coutiere, 1905**
      - 1965 Castro, 1966
      - 1970 Henderson et al., 1976
      - 1975 Grovhoug, 1976
      - 1997 Au and Banks, 1998
      - 2000 Present study
    - ***Synalpheus streptodactylus*** **Coutiere, 1905**
      - none BPBM-S 7203 (as *Synalpheus streptodactylus streptodactylus*)
      - 1964 Barry, 1965
      - 1976 Brock, 1976
      - 2000 Present study
  - Family HIPPOLYTIDAE
    - ***Lebbeus profundus*** **(Rathbun, 1906)**
      - 1905 Rathbun, 1906 (as *Spirontocaris profundus*)
    - ***Lysmata grabhami*** **(Gordon, 1935)**
      - 1967 Higa, 1967
      - 1985 Jonasson, 1986
    - ***Lysmata kukenthali*** **(de Man,)**
      - 1975 Henderson et al., 1976
    - ***Saron marmoratus*** **(Olivier, 1811)**
      - none BPBM-S 6324
      - 1964 Barry, 1965
      - 1966 Kruschwitz, 1967
    - ***Saron neglectus*** **de Man, 1902**
      - 1964 BPBM-S 7048
      - 1964 Barry, 1965
    - ***Thor amboinensis*** **(de Man, 1888)**
      - 1973 BPBM-S 8482
      - 1973 Titgen, 1987
    - ***Thorina maldivensis*** **(Borradaile, 1915)**
      - 1964 BPBM-S 10842 (as *Thor maldivensis*)
      - 1964 BPBM-S 10841 (as *Thor maldivensis*)
  - Family PROCESSIDAE
    - ***Nikoides danae*** **Paulson, 1875**
      - 1975 Henderson and Smith, 1978
    - ***Processa hawaiensis*** **(Dana,)**
      - 1929 Edmondson, 1930 (as *Processa paucirostris*)
      - 1931 BPBM-S 3540
    - ***Processa processa*** **(Bate, 1888)**
      - 1970 Henderson et al., 1976
      - 1973 Environmental Consultants Inc., 1973
      - 1975 Grovhoug, 1976
      - 1975 Henderson and Smith, 1978
  - Family CRANGONIDAE
    - ***Pontophilus gracilis*** **Smith, 1884**
      - 1905 Rathbun, 1906
- Suborder REPTANTIA
  - Infraorder BRACHYURA
    - Family RANINIDAE
      - ***Ranina ranina*** **(Linnaeus, 1758)**
        - none BPBM-S 4910 (as *Ranina serrata*)
        - none BPBM-S 6306

Family CRYPTOCHIRIDAE
- ***Hapalocarcinus marsupialis* Stimpson, 1859**
  - 1937 BPBM-S 4388
  - 1960 MacNamee, 1961
  - 1964 Barry, 1965
  - 1965 Castro, 1966
  - 1967 Reed, 1971
  - 2000 Present study
- ***Pseudocryptochirus kahe***
  - 1976 BPBM-S 8520
- ***Troglocarcinus* (*Favicola*) *minutus* (Edmondson, 1933)**
  - 1932 Edmondson, 1933c (as *Cryptochirus minutus*)

Family GRAPSIDAE
- ***Grapsus grapsus***
  - 2000 Present study
- ***Grapsus tenuicrustatus* (Herbst, 1783)**
  - none BPBM-S 6313 (as *Grapsus grapsus tenuicrustatus*)
  - 1935 Ingram, 1937 (as *G. grapsus tenicrustatus*)
  - 1965 Johnson, 1965 (as *Grapsus grapsus*)
- ***Metopograpsus messor* (Forskal, 1775)**
  - 1935 BPBM-S 4100
  - 1961 Walsh, 1967 (as *Metagrapsus messor*)
  - 1961 Ball, 1963 (as *Metagrapsus messor*)
  - 1964 Brownscombe, 1965 (as *Metagrapsus messor*)
- ***Pachygrapsus plicatus* (A.Milne Edwards, 1873)**
  - 1924 BPBM-S 1600
- ***Percnon abbreviatum* (Dana, 1851)**
  - 2000 Present study
- ***Percnon planissimum* (Herbst, 1904)**
  - 1975 Henderson et al., 1976
  - 2000 Present study
- ***Plagusia tuberculata* (Lamarck, 1818)**
  - 2000 Present study

Family OCYPODIDAE
- ***Macrophthalmus telescopicus* (Owen, 1839)**
  - 1939 BPBM-S 4429
  - 1961 Edmondson, 1962
  - 1965 Banner, 1968
- ***Ocypode ceratophthalmus* (Pallas, 1772)**
  - 1925 BPBM-S 2463
  - 1965 Fellows, 1966
- ***Ocypode pallidula* Jacquinot,**
  - 1965 Fellows, 1966 (as *Ocypode laevis*)

Family PALICIDAE
- ***Crossotonotus spinipes* (de Man, 1888)**
  - 1925 BPBM-S 2448 (as *Manella spinipes*)
  - 1961 Edmondson, 1962 (as *Manella spinipes*)

Family PORTUNIDAE
- ***Callinectes sapidus* (Forskal, 1775)** **Introduced**
  - 1985 Eldredge, 1995
- ***Callinectes* sp.**
  - 1992 BPBM-S 11231
- ***Carupa tenuipes* Dana, 1851**
  - 1923 BPBM-S 1824 (as *Carupa laeviuscula*)
  - 1925 BPBM-S 2451 (as *Carupa laeviuscula*)
  - 1934 BPBM-S 3775 (as *Carupa laeviuscula*)
- ***Catoptrus nitidus* A. Milne Edwards, 1870**
  - none BPBM-S 10503
  - 1934 BPBM-S 3891
  - 1953 Edmondson, 1954
- ***Charybdis* (*Charybdis*) *hawaiensis* (Dana, 1851)**
  - none BPBM-S 6304
  - 1961 Walsh, 1967 (as *Charybdis orientalis*)
- ***Goniosupradens erythrodactyla* (Lamarck, 1818)**

1964 Barry, 1965 (as *Charybdis erythrodactyla*)
***Libystes edwardsi* Alcock, 1900**
1976 Brock, 1976 (as *Thalamita edwardsi*)
Libystes nitidus
1975 Grovhoug, 1976
Libystes villosus
1959 BPBM-S 6748
***Lissocarcinus laevis* Miers, 1886**
1959 BPBM-S 6753
***Lissocarcinus orbicularis* Dana, 1852**
none BPBM-S 10720
1958 Nishioka, 1959
***Lupocyclus quinquedentatus* Rathbun, 1906**
1905 Rathbun, 1906
***Podophthalmus vigil* (Fabricus, 1798)**
none BPBM-S 6321
1958 Nishioka, 1959
1960 Sather, 1966
1960 Sather, 1965
1961 Sather, 1967
1961 Walsh, 1967
1969 Hazlett, 1971
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973
***Portunus granulatus* (H. Milne Edwards, 1834)**
none BPBM-S 10709
1935 BPBM-S 4097
1959 BPBM-S 6703
***Portunus longispinosus* (Dana, 1852)**
1921 BPBM-S 750
1923 BPBM-S 1821
1961 Ball, 1963
1964 BPBM-S 10067
1975 Grovhoug, 1976
***Portunus orbicularis* (Richers, 1880)**
1923 BPBM-S 1822
1924 BPBM-S 1604
***Portunus sanguinolentus hawaiiensis* (Herbst, 1783)**
none BPBM-S 6308 (as *Portunus sanguinolentus*)
none BPBM-S 4911 (as *Portunus sanguinolentus*)
1924 BPBM-S 1603 (as *Portunus sanguinolentus*)
1958 Nishioka, 1959 (as *Portunus sanguinolentus*)
1961 Walsh, 1967 (as *Portunus sanguinolentus*)
1961 Walsh, 1967 (as *Portunus sanguinolentus*)
1962 Ryan, 1966c (as *Portunus sanguinolentus*)
1962 Ryan, 1966d (as *Portunus sanguinolentus*)
1964 Skolnik, 1965 (as *Portunus sanguinolentus*)
1964 Ryan, 1965 (as *Portunus sanguinolentus*)
1965 Ryan, 1966a (as *Portunus sanguinolentus*)
1965 Ryan, 1966b (as *Portunus sanguinolentus*)
***Scylla serrata* (Forskal, 1775)** **Introduced**
none BPBM-S 6311
1926 BPBM-S 2623
1926 Brock, 1952
1926 Brock, 1960
1940 Edmondson and Wilson, 1940
1969 Hazlett, 1971
1972 Brick, 1974
1976 Brock, 1976
1977 Environmental Consultants Inc., 1977
***Thalamita admete* (Herbst, 1803)**
1970 Henderson et al., 1976
1973 Environmental Consultants Inc., 1973
1975 Henderson and Smith, 1978

- ***Thalamita alcocki*** **de Mann**
    - 1905 Rathbun, 1906
- ***Thalamita auauensis*** **(Rathbun, 1906)**
    - 1905 Rathbun, 1906
- ***Thalamita crenata*** **(Latreille, 1829)**
    - none BPBM-S 6323
    - 1969 Hazlett, 1971
    - 1970 Henderson et al., 1976
    - 1977 Environmental Consultants Inc., 1977
- ***Thalamita edwardsi***
    - 1925 BPBM-S 2450
    - 1927 BPBM-S 2812
    - 1932 BPBM-S 3632
    - 1934 BPBM-S 3747
    - 2000 Present study
- ***Thalamita integra*** **Dana, 1852**
    - 1921 BPBM-S 749
    - 1927 BPBM-S 2806
    - 1932 BPBM-S 3631
    - 1935 BPBM-S 4099
    - 1935 Ingram, 1937
    - 1936 BPBM-S 4471
    - 1970 Henderson et al., 1976
    - 1973 Environmental Consultants Inc., 1973
    - 1975 Grovhoug, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 1979 AECOS, 1982
    - 2000 Present study
- ***Thalamita picta*** **Stimpson, 1858**
    - none BPBM-S 6322
- ***Thalamita spiceri*** **Edmondson, 1954**
    - 1964 Barry, 1965
- ***Thalamita*** **sp.**
    - 2000 Present study
- ***Thalamitoides quadridens*** **A. Milne Edwards, 1869**
    - none BPBM-S 6315
    - 1925 BPBM-S 4894

Family CARPILIIDAE

- ***Carpilius convexus*** **(Forskal, 1775)**
    - none BPBM-S 6302
    - 1923 BPBM-S 1825
- ***Carpilius maculatus*** **(Linnaeus, 1758)**
    - none BPBM-S 6301
    - none BPBM-S 4909
    - none BPBM-S 6326
    - 1961 Ball, 1963
    - 1976 Brock, 1976

Family EUMEDONIDAE

- ***Echinoecus pentagonus*** **(A. Milne Edwards, 1879)**
    - 1905 Rathbun, 1906
    - 1968 Castro, 1969
    - 1977 Castro, 1978

Family PILUMNIDAE

- ***Pilumnus longicornis*** **Hilgendorf, 1878**
    - 2000 Present study
- ***Pilumnus oahuensis*** **Edmondson, 1931** **Introduced**
    - 1935 BPBM-S 4279
    - 1935 Ingram, 1937
    - 1935 Edmondson and Ingram, 1939
    - 1936 BPBM-S 4275
    - 1975 Grovhoug, 1976
    - 1975 Henderson et al., 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 2000 Present study

- ***Pilumnus planes*? Edmondson, 1931**
  - 1975 Grovhoug, 1976
- Family TRAPEZIIDAE
  - ***Domecia hispida* Eydoux and Souleyet, 1842**
    - 1964 Barry, 1965
    - 1970 BPBM-S 10655
    - 2000 Present study
  - ***Jonesius triunguiculatus* (Borradaile, 1902)**
    - 2000 Present study
  - ***Trapezia cymodoce* (Herbst, 1799)**
    - 1964 Barry, 1965
    - 1970 Preston, 1973
    - 1970 Preston, 1971
  - ***Trapezia digitalis* Latreille, 1825**
    - 1964 Barry, 1965
    - 1965 Castro, 1966
    - 1970 Preston, 1971
    - 1970 Preston, 1973
    - 1984 Huber and Coles, 1986
  - ***Trapezia flavopunctata* Eydoux and Souleyet, 1842**
    - 1964 Barry, 1965
    - 1970 Preston, 1971
    - 1970 Preston, 1973
  - ***Trapezia intermedia* Miers, 1886**
    - none BPBM-S 10686 (as *Trapezia cymodoce intermedia*)
    - 1964 BPBM-S 10385
    - 1964 Barry, 1965
    - 1965 Castro, 1966
    - 1970 Preston, 1971
    - 1970 Preston, 1973
    - 1984 Huber and Coles, 1986
    - 2000 Present study
  - ***Trapezia rufopunctata* (Herbst, 1799)**
    - none BPBM-S 10675
    - none BPBM-S 6329
  - ***Trapezia tigrina* Eydoux and Souleyet, 1842**
    - 1964 Barry, 1965 (as *T. maculata*)
    - 1965 BPBM-S 10469 (as *Trapezia maculata*)
    - 1970 Preston, 1973 (as *T. maculata*)
    - 1970 Preston, 1971 (as *T. maculata*)
- Family ATELECYCLIDAE
  - ***Kraussia rugulosa* (Krauss, 1843)**
    - 1924 BPBM-S 1606
- Family PANOPEIDAE
  - ***Panopeus pacificus* Edmondson, 1931** **Introduced**
    - 1935 BPBM-S 4101
    - 1973 Environmental Consultants Inc., 1973
    - 1975 Henderson et al., 1976
    - 2000 Present study
- Family XANTHIDAE
  - ***Atergatis* sp.**
    - 1934 BPBM-S 3773
  - ***Chlorodiella cytherea* Dana, 1852**
    - 1925 BPBM-S 2452 (as *Chlorodiella niger*)
    - 1927 BPBM-S 2809 (as *Chlorodiella niger*)
    - 1932 BPBM-S 3634 (as *Chlorodiella niger*)
    - 1934 BPBM-S 3745 (as *Chlorodiella niger*)
    - 1938 BPBM-S 4410 (as *Chlorodiella niger*)
    - 2000 Present study
  - ***Chlorodiella laevissima* (Dana, 1852)**
    - none BPBM-S 6327
    - 1973 Environmental Consultants Inc., 1973
    - 2000 Present study
  - ***Etisus electra* (Herbst, 1801)**

1934 BPBM-S 3896
1973 Environmental Consultants Inc., 1973
1975 Henderson et al., 1976
2000 Present study
***Etisus laevimanus* Randall, 1839**
none BPBM-S 6330
1925 BPBM-S 2447
1934 BPBM-S 3744
1964 Barry, 1965
1970 BPBM-S 10510
1973 Environmental Consultants Inc., 1973
1975 Grovhoug, 1976
1975 Henderson et al., 1976
1976 BPBM-S 8528
2000 Present study
***Etisus* sp.**
2000 Present study
***Leptodius sanguineus* (H. Milne Edwards, 1834)**
none BPBM-S 6334
1935 BPBM-S 4098
1962 Lewis, 1963
***Liocarpilodes biunguis* (Rathbun, 1906)**
2000 Present study
***Liocarpilodes integerrimus* Dana, 1852**
2000 Present study
***Liomera bella* (Dana, 1852)**
none BPBM-S 10405 (as *Carpilodes bellus*)
none BPBM-S 6333 (as *Carpilodes bellus*)
1925 BPBM-S 2445 (as *Carpilodes vaillantianus*)
1927 BPBM-S 2811 (as *Carpilodes vaillantianus*)
1932 BPBM-S 3630 (as *Carpilodes vaillantianus*)
1934 BPBM-S 3743 (as *Carpilodes vaillantianus*)
1934 BPBM-S 3776 (as *Carpilodes vaillantianus*)
1938 BPBM-S 4411 (as *Carpilodes vaillantianus*)
1975 Henderson et al., 1976 (as *Carpilodes bellus*)
2000 Present study
***Liomera rubra* (A. Milne Edwards, 1865)**
1925 BPBM-S 2444 (as *Carpilodes ruber*)
***Liomera rugata* (H. Milne Edwards, 1834)**
1961 Ball, 1963 (as *Carpilodes rugatus*)
1964 Barry, 1965 (as *Carpilodes rugatus*)
***Liomera supernodosa* Rathbun, 1906**
none BPBM-S 6328 (as *Carpilodes supernodosus*)
1925 BPBM-S 2446 (as *Carpilodes supernodosus*)
1961 Ball, 1963 (as *Carpilodes supernodosus*)
***Lophozozymus dodone* (Herbst, 1801)**
1925 BPBM-S 2454
1934 BPBM-S 3893
1938 BPBM-S 4409
1961 Ball, 1963
Lophozozymus intonsus
none BPBM-S 6314
***Lophozozymus pulchellus* A. Milne Edwards, 1867**
2000 Present study
***Lybia edmondsoni* Takeda and Miyake, 1970**
2000 Present study
***Medaeus* sp.**
1938 BPBM-S 4412
***Neoliomera pubescens* (H. Milne Edwards, 1834)**
none BPBM-S 6316
1925 BPBM-S 2449
***Paramedaeus simplex* (A. Milne Edwards, 1873)**
1925 BPBM-S 2453 (as *Medaeus simplex*)
1932 BPBM-S 3635 (as *Medaeus simplex*)

- 1934 BPBM-S 3748 (as *Medaeus simplex*)
- 1934 BPBM-S 3749 (as *Medaeus simplex*)
- 1934 BPBM-S 3892 (as *Medaeus simplex*)
- 1964 Barry, 1965 (as *Medaeus simplex*)
- 1970 Henderson et al., 1976 (as *Medaeus simplex*)
- 2000 Present study

***Paraxanthias notatus* (Dana, 1852)**

- 2000 Present study

***Phymodius monticulosus* (Dana, 1852)**

- 1927 BPBM-S 2807 (as *Phymodius obscurus*)
- 2000 Present study

***Phymodius nitidus* (Dana, 1852)**

- 1927 BPBM-S 2808
- 1961 Ball, 1963
- 2000 Present study

***Phymodius* sp.**

- 2000 Present study

***Phymodius ungulatus* (H. Milne Edwards, 1834)**

- none BPBM-S 6317
- none BPBM-S 10670
- 1925 BPBM-S 2455
- 1932 BPBM-S 3633
- 1934 BPBM-S 3742
- 1938 BPBM-S 4407
- 1975 Henderson et al., 1976
- 2000 Present study

***Pilodius areolatus* (H. Milne Edwards, 1834)**

- none BPBM-S 6325 (as *Chlorodopsis areolata*)
- 1961 Ball, 1963 (as *Chlorodopsis areolata*)
- 2000 Present study

***Pilodius flavus* Rathbun, 1893**

- 2000 Present study

***Platypodia actaeoides* (A. Milne Edwards, 1867)**

- none BPBM-S 6320

***Platypodia eydouxii* (A. Milne Edwards, 1865)**

- none BPBM-S 6318
- 1925 BPBM-S 2456
- 1927 BPBM-S 2810
- 1932 BPBM-S 3629
- 1934 BPBM-S 3746
- 1938 BPBM-S 4408
- 1976 Brock, 1976
- 2000 Present study

***Platypodia granulosa* (Ruppell, 1830)**

- none BPBM-S 6319

***Platypodia semigranosa* (Heller, 1861)**

- 2000 Present study

***Platypodia* sp.**

- 2000 Present study

***Polydectus cupulifer* Latreille, 1825**

- 1924 BPBM-S 1605

***Pseudoliomera speciosa* (Dana, 1852)**

- none BPBM-S 10743 (as *Actaea speciosa*)
- none BPBM-S 10735 (as *Actaea speciosa*)
- 1964 Barry, 1965
- 1976 Brock, 1976

***Pseudoliomera variolosa* (Borradaile, 1902)**

- 1964 Barry, 1965
- 2000 Present study

***Tweedieia laysani* (Rathbun, 1906)**

- 2000 Present study

unid. Xanthidae

- 2000 Present study

***Xanthias canaliculatus* Rathbun, 1906**

1964 Barry, 1965
2000 Present study
Xanthias latifrons **(de Man, 1888)**
2000 Present study
Family DROMIIDAE
Cryptodromiopsis tridens **(Lewinsohn, 1984)**
1964 BPBM-S 7085
2000 Present study
Dromia dormia **(Linnaeus, 1763)**
none BPBM-S 6305 (as *Dromidiopsis dormia*)
1951 Wiersma and Ripley, 1952
Dromidia unidentata hawaiiensis **Edmondson, 1922**
1924 BPBM-S 1607 (as *Dromidia unidentata*)
Family DYNOMENIIDAE
Dynomene hispida **Guerin-Meneville, 1832**
2000 Present study
Family MAJIDAE
Huenia proteus **De Haan, 1839**
1905 Rathbun, 1906
Hyastenus tenuicornis **(Pocock , 1895)**
2000 Present study
Menaethius monoceros **(Latreille, 1825)**
1905 Rathbun, 1906
Micippa parca **Alcock, 1895**
1905 Rathbun, 1906
Perinea tumida **Dana, 1852**
1964 Barry, 1965
2000 Present study
Schizophorida hilensis **Rathbun, 1906**
2000 Present study
Simocarcinus simplex **(Dana, 1852)**
1923 BPBM-S 1831
1976 Brock, 1976
2000 Present study
Trigonothir **sp.**
2000 Present study
Family PARTHENOPIDAE
Parthenope **(*Aulacolambrus*)** ***hoplonotus*** **(Adams and White,**
1938 BPBM-S 10498
Parthenope **(*Platylambrus*)** ***nummifera*** **Rathbun, 1906**
1905 Rathbun, 1906
Family CALAPPIDAE
Calappa calappa **(Linnaeus, 1758)**
none BPBM-S 6303
Calappa hepatica **(Linnaeus, 1758)**
1951 Wiersma and Ripley, 1952
1961 Ball, 1963
1962 Wiersma and Bush, 1963
1965 Banner, 1968
1968 Miller, 1970
1968 Miller, 1975
Calappa **sp.**
1968 BPBM-S 10438
Family LEUCOSIIDAE
Nucia **sp.**
2000 Present study
Infraorder ASTACIDEA
Family ASTACIDAE
Procambrus clarkii **(Girard, 1852)**
Introduced
1961 Walsh, 1967
Infraorder THALASSINIDEA
Family AXIIDAE
Axius **(*Paraxius*)** ***tridens***

      - 1905 Rathbun, 1906 (as *Peraxius tridens*)
  - Family CALLIANASSIDAE
    - ***Callianassa articularta* Rathbun 1906**
      - 1905 Rathbun, 1906
    - ***Callianassa* sp.**
      - 2000 Present study
- Infraorder PALINURIDEA
  - Family ERYONIDAE
    - ***Polycheles snyderi* Rathbun, 1906**
      - 1905 Rathbun, 1906
  - Family PALINURIDAE
    - ***Panulirus marginatus* (Quoy & Gaimard, 1825)**
      - 1951 Wiersma and Ripley, 1952 (as *Panulirus japonicus*)
      - 1964 Bowers, 1965 (as *Panulirus japonicus*)
    - ***Panulirus penicillatus* (Oliver, 1791)**
      - 1947 Matthews, 1951
      - 1951 Wiersma and Ripley, 1952
      - 1964 Bowers, 1965
  - Family SCYLLARIDAE
    - ***Paribacus antarcticus* (Lund, 1793)**
      - none BPBM-S 6307
      - 1986 Lau, 1987
    - ***Paribacus hispidus* (Olivier)**
      - 1951 Wiersma and Ripley, 1952
    - ***Scyllarides squammosus* (Milne Edwards)**
      - none BPBM-S 6312
      - 1951 Wiersma and Ripley, 1952
      - 1986 Lau, 1987
- Infraorder ANOMURA
  - Family DIOGENIDAE
    - ***Aniculus strigatus***
      - 1924 BPBM-S 1601
    - ***Calcinus elegans* Milne Edwards, 1836**
      - 1968 Reese, 1969
    - ***Calcinus gaimardii* Milne Edwards, 1848**
      - 1925 BPBM-S 4723 (as *Calcinus terrae-reginae*)
    - ***Calcinus laevimanus* (Randall, 1839)**
      - 1960 Reese, 1968
      - 1961 Reese, 1962a
      - 1961 Reese, 1962b
      - 1961 Reese, 1962c
      - 1961 Ball, 1963 (as *Calcinus herbstii*)
      - 1966 Papagni, 1967
      - 1968 Reese, 1969
      - 1969 Reese, 1970
      - 1972 Dunham, 1981
      - 1972 Dunham, 1978b
      - 1972 Dunham, 1978a
      - 1988 Hazlett, 1990
    - ***Calcinus latens* (Randall, 1839)**
      - none BPBM-S 10729
      - 1960 Reese, 1968
      - 1964 Barry, 1965
      - 1966 Papagni, 1967
      - 1968 Reese, 1969
      - 1969 Reese, 1970
      - 1970 Henderson et al., 1976
      - 1995 Mather et, 1997
    - ***Calcinus seurati* Forest, 1951**
      - 1968 Reese, 1969
      - 1972 Dunham, 1981
      - 1972 Dunham, 1978b
    - ***Calcinus* sp.**
      - 1969 Hazlett, 1972

Clibanarius zebra
1923 BPBM-S 1096
1960 Reese, 1968
1966 Papagni, 1967
1968 Reese, 1969
1969 Reese, 1970
1972 Dunham, 1978b
1972 Dunham, 1981
1988 Hazlett, 1989
Dardanus pedunculatus
1951 Wiersma and Ripley, 1952 (as *Dardanus asper*)
***Paguristes* sp.**
1969 Hazlett, 1972
Family PAGURIDAE
Pagurixus festinus
1964 BPBM-S 10336
Pagurus magistos
none BPBM-S 4969
Pagurus sameulis
1961 Reese, 1962c
***Pagurus* sp.**
1969 Hazlett, 1972
Family GALATHEIDAE
***Galathea spinosorostris* Dana, 1852**
2000 Present study
Family PORCELLANIDAE
***Pachycheles pisoides* (Heller, 1865)**
1964 Barry, 1965
***Petrolisthes coccineus* (Owen, 1839)**
1932 BPBM-S 3484
***Petrolisthes* sp.**
2000 Present study
Family ALBUNEIDAE
***Albunea danai* Boyko, 1999**
1924 BPBM-S 7806
***Albunea speciosa* Dana, 1852**
1923 BPBM-S 1823
1924 BPBM-S 1602
Family HIPPIDAE
***Hippa pacifica* (Dana, 1852)**
1923 BPBM-S 1832
1981 Haley, 1982

Phylum PHORONIDA
Family PHORONIDAE
***Phoronis hippocrepia* Wright, 1856**
1976 BPBM-L 2
1976 Brock, 1976
1998 Bailey-Brock and Emig 2000
***Phoronis ovalis* Wright, 1856**
1976 BPBM-L 3
1977 White, 1980
1998 Bailey-Brock and Emig 2000
***Phoronis psammophila* Cori, 1889**
1975 BPBM-L 4
1998 Bailey-Brock and Emig 2000

Phylum ECTOPROCTA
Class GYMNOLAEMATA
Order CHEILOSTOMATA
Suborder ANASCA
Family BEANIIDAE
***Beania discodermiae* (Ortmann, 1890)**
2000 Present study
Family BUGULIDAE
***Bugula neritina* (Linnaeus, 1758)** **Introduced**

none	BPBM-K 349	
none	BPBM-K 402	
1935	BPBM-K 272	
1935	BPBM-K 275	
1935	BPBM-K 278	
1935	BPBM-K 291	
1935	BPBM-K 292	
1935	BPBM-K 294	
1935	BPBM-K 295	
1935	BPBM-K 296	
1935	BPBM-K 297	
1935	BPBM-K 298	
1935	BPBM-K 301	
1935	BPBM-K 302	
1935	BPBM-K 305	
1935	BPBM-K 306	
1935	BPBM-K 348	
1935	BPBM-K 421	
1935	Ingram, 1937	
1935	Edmondson and Ingram, 1939	
1963	BPBM-K 396	
1963	BPBM-K 398	
1966	Soule and Soule, 1968	
1975	BPBM-K 566	
1975	BPBM-K 700	
1975	Grovhoug, 1976	
1976	Brock, 1976	
1976	Grovhoug and Rastetter, 1980	
1977	Rastetter and Cooke, 1979	
1983	Dade and Honkalehto, 1986	
2000	Present study	
***Bugula robusta* MacGilivray, 1869**		**Introduced**
2000	Present study	
***Bugula* sp.**		
1935	BPBM-K 299	
1935	BPBM-K 300	
2000	Present study	
***Bugula stolonifera* Ryland, 1960**		**Introduced**
none	BPBM-K 276	
1935	BPBM-K 304	
1963	BPBM-K 395	
1966	Soule and Soule, 1968 (as *B. california*)	
1975	Grovhoug, 1976 (as *B. california*)	
1983	Dade and Honkalehto, 1986 (as *B. california*)	
***Bugula vectifera* Harmer, 1926**		
2000	Present study	
***Caulibugula dendrograpta* (Waters, 1913)**		**Introduced**
2000	Present study	
***Celleporaria aperta* (Hincks, 1882)**		
2000	Present study	
***Celleporaria fusca* (Busk, 1854)**		
2000	Present study	
***Celleporaria pilaefera* (Canu and Bassler, 1929)**		
2000	Present study	
***Celleporaria* sp.**		
1975	BPBM-K 645	
2000	Present study	
***Celleporaria vagans* (Busk, 1881)**		
1975	BPBM-K 633	
1975	BPBM-K 634	
1975	BPBM-K 635	
1975	BPBM-K 636	
1975	BPBM-K 637	
1975	BPBM-K 638	

1975 BPBM-K 639
1975 BPBM-K 640
1975 BPBM-K 641
1975 BPBM-K 642
1975 BPBM-K 643
1975 BPBM-K 644
2000 Present study
Holoporella aperta **(Hincks, 1882)**
1975 BPBM-K 668
1975 BPBM-K 669
1975 BPBM-K 670
1975 BPBM-K 671
1975 BPBM-K 672
1975 BPBM-K 673
1975 BPBM-K 674
1975 BPBM-K 675
1976 Grovhoug and Rastetter, 1980
1977 White, 1980
Holoporella brunnea **(Hincks, 1884)**
1976 Grovhoug and Rastetter, 1980
Holoporella pilaefera **Canu and Bassler, 1929**
1975 BPBM-K 676
1975 BPBM-K 677
1975 BPBM-K 678
1975 BPBM-K 679
1975 BPBM-K 680
1975 BPBM-K 681
1975 BPBM-K 682
1975 BPBM-K 683
1975 Grovhoug, 1976
1977 White, 1980
Schismopora **sp.**
1975 BPBM-K 603 (as *Costazia* sp.)
1975 BPBM-K 604 (as *Costazia* sp.)
Family CRIBRILINIDAE
Cribrilaria radiata **Moll, 1803**
1975 BPBM-K 717 (as *Colletosia radiata*)
Family CHORIZOPORIDAE
Rhamphostomella argentea **(Hincks, 1881)**
2000 Present study
Family SCRUPOCELLARIIDAE
Caberia boryi **(Audouin, 1826)**
Cryptogenic
1966 Soule and Soule, 1987
2000 Present study
Cleidochasma laterale
2000 Present study
Cleidochasma porcellanum **(Busk, 1860)**
1975 BPBM-K 620 (as *Hippoporina porcellana*)
1975 BPBM-K 619 (as *Hippoporina porcellana*)
1975 BPBM-K 618 (as *Hippoporina porcellana*)
Diaperoforma **sp.**
2000 Present study
Hippoporella calyciformis **(Phillips, 1899)**
2000 Present study
Scrupocellaria maderensis **Busk, 1860**
2000 Present study
Scrupocellaria scruposa
1975 BPBM-K 723
1975 BPBM-K 722
Scrupocellaria sinuosa **Canu and Bassler, 1927**
1966 Soule and Soule, 1968
1975 BPBM-K 736
1975 BPBM-K 737

***Scrupocellaria* sp.**

1975 BPBM-K 721

Family EXECHONELLIDAE

***Exechonella tuberculata* (MacGillivray, 1883)**

1975 BPBM-K 605

Family HIPPOPODINIDAE

***Cosciniopsis fusca* Canu and Bassler, 1927**

2000 Present study

Cosciniopsis lonchaea

1975 BPBM-K 632
1975 BPBM-K 631
1975 BPBM-K 630

***Hippopodina feegeensis* (Busk, 1884)**

1966 Soule and Soule, 1968
1975 BPBM-K 667
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980

Family HIPPOTHOIDAE

***Trypostega venusta* (Norman, 1864)**

Cryptogenic

1966 Soule and Soule, 1987

Family MARGARETTIDAE

***Margaretta gracilior* Ortmann, 1892**

2000 Present study

***Margaretta tenuis* (Harmer, 1957)**

1975 BPBM-K 568
1975 BPBM-K 585
1975 BPBM-K 587
1975 BPBM-K 594
1975 BPBM-K 599
1975 BPBM-K 606
1975 BPBM-K 607
1975 BPBM-K 608
1975 BPBM-K 609
1975 BPBM-K 610
1975 BPBM-K 611
1975 BPBM-K 612
1975 BPBM-K 613
1975 BPBM-K 614
1975 BPBM-K 615
1975 BPBM-K 616
1975 BPBM-K 617
1975 BPBM-K 694
1975 BPBM-K 695
1975 BPBM-K 714
2000 Present study

***Margaretta watersi* Canu and Bassler, 1930**

2000 Present study

Family MICROPORELLIDAE

Fenestrulina malusii

1975 BPBM-K 691

***Microporella ciliata* (Pallas, 1776)**

1976 Grovhoug and Rastetter, 1980

***Microporella* sp.**

1975 BPBM-K 706
1975 BPBM-K 707
1975 BPBM-K 708

Family SAVIGNYELLIDAE

***Savignyella lafontii* (Audouin, 1826)** **Introduced**

1935 Edmondson and Ingram, 1939 (as *Catenaria lafonti*)
1935 Ingram, 1937 (as *Catenaria lafonti*)
1966 Soule and Soule, 1968
1975 Grovhoug, 1976 (as *Catenaria lafonti*)
1976 Grovhoug and Rastetter, 1980 (as *Catenaria lafonti*)

- 1977 Lewis, 1980 (as *Catenaria lafonti*)
- 2000 Present study

- Family SCHIZOPORELLIDAE
  - ***Arthropoma circinatum***
    - 1975 BPBM-K 666
  - ***Schizomavella* sp.**
    - 2000 Present study
  - ***Schizoporella crassomurialis* Canu and Bassler, 1927**
    - 1966 Soule and Soule, 1968
  - ***Schizoporella decorata* Canu and Bassler, 1927**
    - 2000 Present study
  - ***Schizoporella* cf. *errata* (Waters, 1878)** **Introduced**
    - none BPBM-K 251
    - 1935 BPBM-K 241
    - 1935 BPBM-K 242
    - 1935 BPBM-K 246
    - 1936 BPBM-K 254
    - 1936 BPBM-K 255
    - 1936 BPBM-K 256
    - 1935 BPBM-K 268
    - 1975 BPBM-K 595
    - 1975 BPBM-K 687
    - 1976 BPBM-K 716
    - 1977 White, 1980
    - 2000 Present study
  - ***Schizoporella serialis* (Heller, 1867)**
    - 1976 Grovhoug and Rastetter, 1980
  - ***Schizoporella unicornis* Johnston, 1847** **Introduced**
    - 1926 Canu and Bassler, 1927
    - 1935 Ingram, 1937
    - 1935 Edmondson and Ingram, 1939
    - 1966 Soule and Soule, 1968
    - 1975 BPBM-K 596
    - 1975 Grovhoug, 1976
    - 1976 Brock, 1976
    - 1979 Jokiel, 1980
    - 1983 Dade and Honkelehto, 1986
  - ***Schizoporella* sp.**
    - 2000 Present study
- Family SERTELLIDAE
  - ***Reteporellina denticulata* (Busk, 1884)**
    - 2000 Present study
  - ***Reteporellina fimbriata* (Canu and Bassler, 1927)**
    - 1975 BPBM-K 692
    - 1975 BPBM-K 693
    - 1975 BPBM-K 628
  - ***Rhynchozoon nudum* (Canu and Bassler, 1927)**
    - 1926 Canu and Bassler, 1927
    - 1966 Soule and Soule, 1968
  - ***Rhynchozoon tuberosum* (Canu and Bassler, 1927)**
    - 1975 BPBM-K 712
    - 1975 BPBM-K 710
    - 1975 BPBM-K 709
    - 1975 BPBM-K 713
    - 1975 BPBM-K 711
  - ***Rhynchozoon* sp.**
    - 2000 Present study
- Family SMITTINIDAE
  - ***Parasmittina alanbanneri* Soule and Soule, 1973**
    - 1975 BPBM-K 701
  - ***Parasmittina crosslandi***
    - 1975 BPBM-K 702
    - 1975 BPBM-K 703
    - 1975 BPBM-K 704

- ***Parasmittina marsupialis* (Busk, 1884)**
  - 1975 BPBM-K 705
- ***Parasmittina* sp.**
  - 2000 Present study
- Family TETRAPLARIIDAE
  - ***Pollaploecium brevis* Canu and Bassler, 1927**
    - 1975 BPBM-K 564
    - 1975 BPBM-K 565
    - 1975 BPBM-K 571
    - 1975 BPBM-K 576
    - 1975 BPBM-K 578
    - 1975 BPBM-K 582
    - 1975 BPBM-K 583
    - 1975 BPBM-K 622
    - 1975 BPBM-K 623
    - 1975 BPBM-K 624
    - 1975 BPBM-K 625
    - 1975 BPBM-K 626
    - 1976 BPBM-K 627
    - 1975 BPBM-K 697
    - 1975 BPBM-K 698
    - 1975 BPBM-K 699
  - ***Tetraplaria ventricosa* (Haswell, 1880)**
    - 2000 Present study
- Family WATERSIPORIDAE
  - ***Watersipora calcullata***
    - 1958 BPBM-K 464
  - ***Watersipora edmondsoni* Soule and Soule, 1968** **Introduced**
    - 1975 BPBM-K 563
    - 1975 BPBM-K 569
    - 1975 BPBM-K 573
    - 1975 BPBM-K 577
    - 1975 BPBM-K 579
    - 1975 BPBM-K 580
    - 1975 BPBM-K 590
    - 1975 BPBM-K 591
    - 1975 BPBM-K 597
    - 1975 BPBM-K 598
    - 1975 BPBM-K 696
    - 1975 Grovhoug, 1976
    - 1976 BPBM-K 665
    - 1976 Brock, 1976
    - 1976 Grovhoug and Rastetter, 1980
    - 1983 Dade and Honkelehto, 1986
    - 2000 Present study
- Family VESICULARIIDAE
  - ***Amathia distans* Busk, 1886** **Introduced**
    - 1935 BPBM-K 274 (as *Amathia* sp.)
    - 1935 BPBM-K 279
    - 1935 BPBM-K 281 (as *Amathia* sp.)
    - 1935 BPBM-K 282 (as *Amathia* sp.)
    - 1935 BPBM-K 285 (as *Amathia* sp.)
    - 1935 BPBM-K 287 (as *Amathia* sp.)
    - 1935 Edmondson and Ingram, 1939 (as *Amathia* sp.)
    - 1966 Soule and Soule, 1968
    - 1975 BPBM-K 629
    - 1975 Grovhoug, 1976
    - 1976 BPBM-K 602
    - 1976 Grovhoug and Rastetter, 1980
    - 1983 Dade and Honkelehto, 1986
    - 2000 Present study
  - ***Amathia vidovici*? (Heller, 1867)**
    - 1976 Grovhoug and Rastetter, 1980
  - ***Bowerbankia* cf. *gracilis* Leidy, 1855** **Introduced**

1966 Soule and Soule, 1968
1976 Grovhoug and Rastetter, 1980
***Bowerbankia* cf. *imbricata* (Adams, 1800)** **Introduced**
1966 Soule and Soule, 1968
***Steginoporella lateralis* MacGillivray, 1895**
1975 BPBM-K 718
***Steginoporella magnilabris* (Busk, 1854)**
1975 BPBM-K 726
1975 BPBM-K 727
***Zoobotryon verticillatum* (delle Chiaje, 1828)** **Introduced**
none BPBM-K 465
1935 BPBM-K 280
1935 BPBM-K 290
1935 Soule and Soule, 1968
1935 Edmondson and Ingram, 1939
1961 BPBM-K 432
1963 BPBM-K 397
1966 Soule and Soule, 1968 (as *Barentsia gracilis*)
Family THALAMOPORELLIDAE
***Thalamoporella* sp.**
1975 BPBM-K 725
1975 BPBM-K 724
2000 Present study
Family AETEIDAE
***Aetea* sp.**
2000 Present study
***Aetea truncata* (Landsborough, 1852)** **Introduced**
1935 BPBM-K 284
1935 BPBM-K 286
1935 Edmondson and Ingram, 1939
1935 Ingram, 1937
1966 Soule and Soule, 1968
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
1977 Rastetter and Cooke, 1979
1977 Lewis, 1980
1983 Dade and Honkalehto, 1986
Family CALLOPORIDAE
***Parellisina curvirostris* (Hincks, 1862)**
1975 BPBM-K 719
Family HINCKSINIDAE
Antropora levigata
1975 BPBM-K 733
1975 BPBM-K 734
1975 BPBM-K 735
Family SCRUPARIIDAE
***Scruparia* sp.**
2000 Present study
Class STENOLAEMATA
Order CYCLOSTOMATA
Suborder ARTICULATA
Family CRISIIDAE
***Crisia circinata* Waters, 1914**
2000 Present study
***Crisina radians* (Lamarck, 1816)**
1928 BPBM-K 454
2000 Present study
***Crisia* sp.**
2000 Present study
***Diaperoecia californica* (d'Orbigny, 1852)**
1975 BPBM-K 562
1975 BPBM-K 567
1975 BPBM-K 570
1975 BPBM-K 572

1975 BPBM-K 575
1975 BPBM-K 581
1975 BPBM-K 584
1975 BPBM-K 588
1975 BPBM-K 589
1975 BPBM-K 592
1975 BPBM-K 593
1975 BPBM-K 690
1975 BPBM-K 715
1975 BPBM-K 741
1975 BPBM-K 742
1975 BPBM-K 743
1975 BPBM-K 744
1975 BPBM-K 745
1975 BPBM-K 755
1975 BPBM-K 756
1975 BPBM-K 757
Diaperoecia floridana
1975 BPBM-K 574
***Diaperoecia* sp.**
1975 BPBM-K 688
1975 BPBM-K 689
Family LICHENOPORIDAE
Lichenopora buski
1975 BPBM-K 729
1975 BPBM-K 728
1975 BPBM-K 730
1975 BPBM-K 731
1975 BPBM-K 732
***Lichenopora* sp.**
2000 Present study
Lichenopora violacea
1975 BPBM-K 763
1975 BPBM-K 764
1975 BPBM-K 765
Family TUBULIPORIDAE
***Idmodronea flexuosa* Pourtales, 1867**
1975 BPBM-K 758 (as *Tubulipora flexuosa*)
1975 BPBM-K 759 (as *Tubulipora flexuosa*)
1975 BPBM-K 760 (as *Tubulipora flexuosa*)
1975 BPBM-K 761 (as *Tubulipora flexuosa*)
Tubulipora pacifica
1975 BPBM-K 749
1975 BPBM-K 750
Tubulipora pulchea
1975 BPBM-K 752
1975 BPBM-K 753
1975 BPBM-K 754
***Tubulipora* sp.**
1975 BPBM-K 746
1975 BPBM-K 747
1975 BPBM-K 748
Phylum BRACHIOPODA
Class INARTICULATA
Order LINGULIDA
Family LINGULIDAE
***Lingula reevii* Davidson, 1880**
none BPBM-M 104
none BPBM-M 120
1918 BPBM-M 102
1938 BPBM-M 103
1963 Oyama, 1964
1965 Banner, 1968
1967 Higgins, 1969

1980 Emig, 1981
Class ARTICULATA
Order RHYNCHONELLIDA
Family LAQUEIDAE
Frenulina sanguinolenta **Gmelin, 1817**
none BPBM-M 121
2000 Present study

Phylum ECHINODERMATA
Class ASTEROIDEA
Order PAXILLOSIDA
Family ASTROPECTINIDAE
Astropecten polyacanthus **Muller and Troschel, 1842**
1907 Clark, 1908
Family LUIDIIDAE
Luidia hystrix **Fisher, 1906**
1905 Fisher, 1906
Order VALVATIDA
Family ACANTHASTERIDAE
Acanthaster planci **Linnaeus, 1758**
none BPBM-W 1251
Family ASTERINIDAE
Asterina anomala **Clark, 1921**
2000 Present study
Family GONIASTERIDAE
Peltaster micropeltus **(Fisher, 1906)**
1905 Fisher, 1906 (as *Tosia micropelta*)
Family MITHRODIIDAE
Mithrodia fisheri **Holly, 1932**
1905 Fisher, 1906 (as *Mithrodia bradleyi*)
Family OREASTERIDAE
Culcita novaeguineae **Muller and Troschel, 1842**
1983 Glynn and Krupp, 1986
Family OPHIDIASTERIDAE
Leiaster callipeplus **Fisher, 1906**
1905 Fisher, 1906
Linckia guildingi **Gray, 1840**
1905 Fisher, 1906
1932 Edmondson, 1933a
1934 Edmondson, 1935-36 (as *Linckia diplax*)
Linckia multifora **(Lamarck, 1816)**
none BPBM-W 836
1932 Edmondson, 1933a
1934 BPBM-W 865
1934 BPBM-W 861
1934 Edmondson, 1935
1934 Edmondson, 1935-36
1938 BPBM-W 963
1941 Ely, 1942
1941 Ely, 1942
1966 Davis, 1967
1967 Tullis, 1968
Order VELATIDA
Family MYXASTERIDAE
Asthenactis papyraceus **Fisher, 1906**
1905 Fisher, 1906
Order SPINULOSIDA
Family ECHINASTERIDAE
Henricia pauperrima **Fisher, 1906**
1966 Davis, 1967
Order FORCIPULATIDA
Family ASTERIIDAE
Coscinasterias acutispina **(Stimpson, 1862)**
1932 Edmondson, 1933a

1934 Edmondson, 1935-36
1938 BPBM-W 964
Order BRISINGIDA
Family HYMENODISCIDAE
Hymenodiscus fragilis **(Fisher, 1906)**
1905 Fisher, 1906 (as *Brisinga fragilis*)

Class OPHIUROIDEA
Order OPHIURIDA
Family OPHIOCOMIDAE
Ophiocoma dentata **Muller and Troschel, 1842**
1923 BPBM-W 327
Ophiocoma erinaceus **Muller and Troschel, 1842**
1923 BPBM-W 487
2000 Present study
Ophiocoma pica **Muller and Troschel, 1842**
1967 Devaney, 1968
Ophiocomella sexradia **(Duncan, 1887)**
2000 Present study
Family OPHIODERMATIDAE
Distichophis clarkii
2000 Present study
Family OPHIOTRICHIDAE
Ophiothrix fragilis
1976 Brock, 1976
Family AMPHIURIDAE
Amphiodia **sp.1**
2000 Present study
Amphipholis squamata **(Delle Chiaje, 1828)**
1935 BPBM-W 894
1973 Environmental Consultants Inc., 1973
2000 Present study
Amphiura immira **Ely, 1942**
2000 Present study
Amphiura **sp.2**
2000 Present study
Amphiura **sp.4**
2000 Present study
Amphiura **sp.5**
2000 Present study
Family OPHIACTIDAE
Ophiactis modesta **Brock, 1888**
1941 Ely, 1942
1948 Clark, 1949
1963 BPBM-W 1383
1966 Soule and Soule, 1968
2000 Present study
Ophiactis savignyi **(Muller and Troschel, 1842)**
none BPBM-W 2353
1924 BPBM-W 525
1925 BPBM-W 737
1932 Edmondson, 1933a
1939 BPBM-W 972
1941 Ely, 1942
1944 MacKaye, 1945
1948 Clark, 1949
1970 Henderson et al., 1976
1976 Brock, 1976
1983 Caspers, 1985
2000 Present study
Ophiactis **sp. (red-spotted)**
2000 Present study
Class ECHINOIDEA

Order CIDAROIDA
Family CIDARIDAE
***Eucidaris metularia* Lamarck, 1816**
2000 Present study
Order DIADEMATOIDA
Family DIADEMATIDAE
***Diadema paucispinum* Agassiz, 1863**
1960 Hinegardner, 1961
2000 Present study
***Echinothrix calamaris* (Pallas, 1774)**
1960 Hinegardner, 1961
1968 Castro, 1969
1977 Castro, 1978
***Echinothrix diadema* (Linnaeus, 1758)**
1960 Hinegardner, 1961
1962 Matthews and Townsley, 1964
1965 Castro, 1966
1966 Gupta, 1967
1972 Chave, 1973
1979 AECOS, 1982
Order TEMNOPLEUROIDA
Family TOXOPNEUSTIDAE
***Cyrtechinus verruculatus* (Lutken, 1864)**
1932 Edmondson, 1933a (as *Lytechinus verruculatus*)
***Pseudoboletia indiana* (Michelin, 1862)**
1925 BPBM-W 557
1932 Edmondson, 1933a
1960 Hinegardner, 1961
***Tripneustes gratilla* (Linnaeus, 1758)**
1932 Edmondson, 1933a
1960 Hinegardner, 1961
1962 Alender, 1963
1977 Environmental Consultants Inc., 1977
2000 Present study
***Tripneustes pileolus* (Linnaeus, 1758)**
1963 Alender et al., 1964
1963 Hsiao, 1965
1977 Lewis, 1980
Order ECHINOIDA
Family ECHINOMETRIDAE
***Colobocentrotus atratus* (Linnaeus, 1758)**
1960 Hinegardner, 1961
***Echinometra mathaei* (Blainville, 1825)**
1960 Hinegardner, 1961
1969 Kelso, 1970
1973 Environmental Consultants Inc., 1973
1979 AECOS, 1982
2000 Present study
***Echinometra oblonga* (Blainville, 1825)**
1960 Hinegardner, 1961 (as *E. mathaei oblonga*)
1969 Kelso, 1970
1973 Environmental Consultants Inc., 1973 (as *E. mathaei oblonga*)
***Heterocentrotus mammillatus* (Linnaeus, 1758)**
1932 Edmondson, 1933a
1960 Hinegardner, 1961
1962 Matthews and Townsley, 1964
2000 Present study
Family ECHINONEIDAE
***Echinoneus cyclostomus* Leske, 1778**
1924 BPBM-W 377
1960 Hinegardner, 1961
Order CLYPEASTEROIDA
Family CLYPEASTERIDAE
***Clypeaster* (*Rhaphidoclypus*) *reticulatus* (Linnaeus, 1758)**

- 1924 BPBM-W 376
- Family FIBULARIIDAE
  - **_Mortonia australis_ (Desmoulins, 1837)**
    - none BPBM-W 1250
- Order SPATANGOIDA
  - Family BRISSIDAE
    - **_Brissus latecarinatus_ (Leske, 1778)**
      - 1924 BPBM-W 382
- Class HOLOTHUROIDEA
  - Order ASPIDOCHIROTIDA
    - Family HOLOTHURIIDAE
      - **_Actinopyga mauritiana_ (Quoy and Gaimard, 1833)**
        - 1953 Van Weel, 1955
        - 2000 Present study
      - **_Actinopyga obesa_ (Selenka, 1867)**
        - 2000 Present study
      - **_Holothuria_ (_Halodeima_) _atra_ Jaeger, 1833**
        - 1924 Clark, 1925
        - 1953 Van Weel, 1955
        - 1967 Hoskins, 1968
        - 1972 Chave, 1973
        - 1973 Environmental Consultants Inc., 1973
        - 1975 Henderson et al., 1976
        - 1977 Lewis, 1980
        - 1979 AECOS, 1982
        - 2000 Present study
      - **_Holothuria_ (_Halodeima_) _edulis_ Lesson, 1830**
        - 1924 Clark, 1925
        - 1932 BPBM-W 835
        - 1953 Van Weel, 1955
        - 2000 Present study
      - **_Holothuria_ (_Mertensiothuria_) _fuscorubra_ Theel, 1886**
        - 1932 Edmondson, 1933a
      - **_Holothuria_ (_Platyperona_) _difficilis_ Semper, 1868**
        - 1932 Edmondson, 1933a
        - 2000 Present study
      - **_Holothuria_ (_Semperothuria_) _cinerascens_ (Brandt, 1835)**
        - 1965 Banner, 1968
        - 1973 Environmental Consultants Inc., 1973
        - 1979 AECOS, 1982
        - 1982 AECOS, 1982
      - **_Holothuria_ (_Thymiosycia_) _arenicola_ Semper, 1868**
        - 1924 Clark, 1925
      - **_Holothuria_ (_Thymiosycia_) _hilla_ Lesson, 1830**
        - 1953 Van Weel, 1955 (as *Holothuria monocaria*)
        - 1970 Henderson et al., 1976 (as *Holothuria monocaria*)
        - 1972 BPBM-W 2102
        - 1973 Environmental Consultants Inc., 1973 (as *Holothuria monocaria*)
        - 2000 Present study
      - **_Holothuria_ (_Thymiosycia_) _impatiens_ (Forskal, 1775)**
        - 2000 Present study
      - **_Holothuria_ sp.**
        - 1960 BPBM-W 1730
    - Family STICHOPODIDAE
      - **_Stichopus horrens_ Selenka, 1867**
        - 1970 Henderson et al., 1976
        - 1979 AECOS, 1982
  - Order ELASIPODIDA
    - Family ELPIDIIDAE
      - **_Scotodeima vitreum_ Fisher, 1907**
        - 1906 Fisher, 1907
        - 1924 Clark, 1925
  - Order APODIDA
    - Family SYNAPTIDAE

Chiridota hawaiiensis **Fisher, 1907**
1970 Henderson et al., 1976
Opheodesoma grisea **Semper, 1868**
1972 BPBM-W 2101
Opheodesoma spectabilis **Fisher, 1907**
1906 Fisher, 1907
1914 Bryan, 1915
1917 MacCaughey, 1918
1929 BPBM-W 860
1941 BPBM-W 975
1945 BPBM-W 1041
1953 Van Weel, 1955
1964 Berrill, 1965
1964 Berrill, 1966
1965 Freeman, 1966
1970 Henderson et al., 1976
1972 Banner, 1974
1972 Chave, 1973
1973 Environmental Consultants Inc., 1973
1977 Lewis, 1980
1977 Yamamoto and Yoshida, 1978
2000 Present study

Phylum CHAETOGNATHA
Class SAGITTOIDEA
Order APHRAGMOPHORA
Family SAGITTIDAE
Sagitta enflata **Grassi, 1881**
1963 Piyakarnchana, 1965
1967 Peterson, 1969
1974 Szyper, 1976
1977 Szyper, 1978
1977 Kimmerer, 1984
1980 Szyper, 1981
1985 Kitalong, 1986b
1985 Kitalong, 1986a
Sagitta serratodentata **Krohn, 1853**
1963 Piyakarnchana, 1965

Phylum HEMICHORDATA
Class ENTEROPNEUSTA
Family PTYCHODERIDAE
Ptychodera flava laysanica **Spengel**
1965 Banner, 1968 (as Ptychodera flava)
1968 Miller, 1970 (as *Ptychodera flava*)
1968 Miller, 1975 (as *Ptychodera flava*)
1968 Miller and Croker, 1972 (as *Ptychodera flava*)

Phylum CHORDATA
Class ASCIDIACEA
Order ENTEROGONA
Suborder APLOUSOBRANCHIA
Family DIDEMNIDAE
Didemnum candidum **Savigny, 1816** **Introduced**
1961 Eldredge, 1965
1961 Eldredge, 1966
1967 Straughan, 1969
1975 Grovhoug, 1976
1976 BPBM-Y 262
1976 Brock, 1976
1976 Grovhoug and Rastetter, 1980
1979 Jokiel, 1980
Didemnum chilense
none BPBM-Y 219
Didemnum edmondsoni **Eldredge, 1967**
1961 Eldredge, 1966
1961 Eldredge, 1965

1963 BPBM-Y 197
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
Didemnum elikapekae Eldredge, 1967
1962 BPBM-Y 198
1962 Eldredge, 1965
1962 Eldredge, 1966
1975 Grovhoug, 1976
Didemnum moseleyi (Herdman, 1886)
1961 Eldredge, 1965
1961 Eldredge, 1965
1975 Grovhoug, 1976
1980 BPBM-Y 259
Didemnum perlucidum Monniot, 1983 **Introduced**
2000 Present study
Didemnum vanderhorsti
none BPBM-Y 220
Diplosoma listerianum (Milne Edwards, 1841) **Introduced**
1961 Eldredge, 1966 (as *D. macdonaldi*)
1961 Eldredge, 1965 (as *D. macdonaldi*)
1962 BPBM-Y 193 (as *Diplosoma macdonaldi*)
1975 Grovhoug, 1976 (as *D. macdonaldi*)
1976 Grovhoug and Rastetter, 1980 (as *D. macdonaldi*)
1977 Rastetter and Cooke, 1979 (as *D. macdonaldi*)
2000 Present study
Diplosoma similis (Sluiter, 1909)
1961 Eldredge, 1965 (as *Diplosoma virens*)
1961 Eldredge, 1966 (as *Diplosoma virens*)
1961 Stoner, 1994
1975 Grovhoug, 1976 (as *Diplosoma virens*)
1976 Brock, 1976
1985 Stoner, 1989
1985 Stoner, 1986
1990 Stoner, 1992
Diplosoma sp.
none BPBM-Y 222
Leptoclinides madara Tokioka, 1953
1962 Eldredge, 1966 (as *Leptoclinides rufus*)
Lissoclinum fragile (Van Name, 1902)
1962 Eldredge, 1966
1962 Eldredge, 1965
1975 Grovhoug, 1976
Trididemnum profundum (Sluiter, 1909)
1963 Eldredge, 1966
1963 Eldredge, 1965
Trididemnum savignii (Herdman, 1886)
1963 Eldredge, 1965
1963 Eldredge, 1966
1975 Grovhoug, 1976
1976 Grovhoug and Rastetter, 1980
Family POLYCLINIDAE
Aplidium sp.
2000 Present study
Polyclinum constellatum Savigny, 1816 **Introduced**
none BPBM-Y 226
1960 BPBM-Y 191
1963 BPBM-Y 181
1970 Henderson et al., 1976
1975 Henderson and Smith, 1978
1977 Lewis, 1980
2000 Present study
Polyclinum sp.
1938 BPBM-Y 137
1960 BPBM-Y 190

1963 BPBM-Y 234
Suborder PHLEBOBRANCHIA
Family ASCIDIIDAE
***Ascidia archaia* Sluiter, 1890**
2000 Present study
***Ascidia corelloides* Abbott, 1941**
1975 Henderson et al., 1976
***Ascidia interrupta* Heller, 1878**
1970 Henderson et al., 1976
1975 Grovhoug, 1976
1975 Grovhoug, 1976
1976 BPBM-Y 255
1976 Grovhoug and Rastetter, 1980
1976 Brock, 1976
1977 Lewis, 1980
1979 Jokiel, 1980
1980 BPBM-Y 240
***Ascidia melanostoma* Sluiter, 1885**
2000 Present study
***Ascidia* sp.A** **Introduced**
2000 Present study
***Ascidia* sp.B** **Introduced**
2000 Present study
***Ascidia sydneiensis* Stimpson, 1855** **Introduced**
1970 Henderson et al., 1976
1976 Grovhoug and Rastetter, 1980
1979 Jokiel, 1980
1980 BPBM-Y 246
2000 Present study
***Ascidia* sp.**
1963 BPBM-Y 185
1963 BPBM-Y 183
1980 BPBM-Y 242
***Phallusia nigra* Savigny, 1816** **Introduced**
1975 BPBM-Y 241 (as *Ascidia nigra*)
2000 Present study
Family CIONIDAE
***Ciona intestinalis* (Linnaeus, 1767)** **Introduced**
1976 Grovhoug and Rastetter, 1980
1979 Jokiel, 1980
Family CORELLIDAE
***Corella minuta* Traustedt, 1882** **Introduced**
2000 Present study
Family PEROPHORIDAE
***Ecteinascidia imperfecta* Tokioka, 1950**
1979 BPBM-Y 235
Order PLEUROGONA
Suborder STOLIDOBRANCHIA
Family STYELIDAE
***Botrylloides simodensis* Saito & Watanabe, 1981**
Introduced
1967 Straughan, 1969
***Botrylloides* sp.**
1963 BPBM-Y 184
***Botryllus* sp.**
2000 Present study
***Cnemidocarpa areolata* (Heller, 1878)**
2000 Present study
***Eusynstyela hartmeyeri* Monniot (= *E. aliena*)** **Introduced**
2000 Present study
***Polyandrocarpa sagamiensis* Tokioka, 1953** **Introduced**
2000 Present study
***Polyandrocarpa zooritensis* Van Name, 1931** **Introduced**
2000 Present study

Polycarpa aurita **(Sluiter, 1890)**
2000 Present study
Polycarpa **sp.**
2000 Present study
Styela canopus **Savigny, 1816** **Introduced**
1963 BPBM-Y 187 (as *Styela partita*)
1975 Grovhoug, 1976 (as *S. partita*)
1976 Grovhoug and Rastetter, 1980 (as *S. partita*)
2000 Present study
Symplegma brakenhielmi **(Michaelsen, 1904)** **Introduced**
1975 Grovhoug, 1976 (as *S. connectans*)
1975 Straughan, 1969 (as *Symplegma oceania*)
Symplegma connectans **Yokioka, 1949**
1976 Grovhoug and Rastetter, 1980
Family PYURIDAE
Herdmania pallida **(Savigny, 1816)** **Introduced**
1963 BPBM-Y 186 (as *Herdmania momus*)
1963 BPBM-Y 182 (as *Herdmania momus*)
1975 BPBM-Y 243 (as *Herdmania momus*)
2000 Present study
Herdmania **sp.** **Introduced**
2000 Present study
Microcosmus exasperatus **Heller, 1878** **Introduced**
1976 Grovhoug and Rastetter, 1980
2000 Present study
Microcosmus **sp.**
1962 BPBM-Y 192
Class APPENDICULARIA
Order LARVACEA
Suborder COPELATA
Family OIKOPLEURIDAE
Oikopleura diocia **Fol, 1872**
1985 Kitalong, 1986a
1985 Kitalong, 1986b
Oikopleura longicauda **(Vogt, 1854)**
1967 Peterson, 1969
1970 Rowe, 1971
1977 Taguchi, 1982
Class CHONDRICHTHYES
Subclass ELASMOBRANCHII
Order CARCHARHINIFORMES
Family CARCHARHINIDAE
Carcharhinus amblyrhynchos **(Bleeker, 1856)**
1962 Hobson, 1963 (as *C. menisorrah*)
Galeocerdo cuvier **(Peron and Lesueur, 1822)**
1962 Tester, 1963
Family SPHYRNIDAE
Sphyrna lewini **(Griffith and Smith, 1834)**
1959 Gosline and Brock, 1960
1961 Olla, 1962
1962 Tester and Hobson, 1963
1962 Tester, 1963
1965 Tester and Nelson, 1967
1967 BPBM-I 15439
1968 Clarke, 1971
1970 Clarke, 1971
1991 Holland et al., 1993
Order SQUALIFORMES
Family DALATIIDAE
Centroscyllium nigrum **Garman, 1899**
1970 BPBM-I 20779
Order RAJIFORMES
Family DASYATIDAE
Dasyatis latus **(Garman, 1880)**

2000 Present study
Class OSTEICHTHYES
Subclass ACTINOPTERYGII
Order ELOPIFORMES
Family ELOPIDAE
***Elops hawaiensis* Regan, 1909**
1966 BPBM-I 5574
Order ANGUILLIFORMES
Family OPHICHTHIDAE
***Callechelys lutea* Snyder, 1904**
1948 BPBM-I 12381
1948 BPBM-I 12491
***Leiuranus semicinctus* (Lay and Bennett, 1839)**
1969 BPBM-I 7916
***Ophichthus erabo* (Jordan and Snyder, 1901)**
1985 BPBM-I 33450
Ophichthidae sp.
1996 BPBM-I 37866
Family MURAENIDAE
***Anarchias cantonensis* (Schultz, 1943)**
1966 Wass, 1967
***Anarchias leucurus* (Snyder, 1904)**
1970 Clarke
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979
***Echidna nebulosa* (Ahl, 1789)**
1937 Mainland, 1939 (as *Amejurus nebulosus*)
***Echidna polyzona* (Richardson, 1844)**
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
***Enchelycore pardalis* (Temminck and Schlegel, 1846)**
1970 BPBM-I 9797
***Gymnomuraena zebra* (Shaw, 1797)**
1966 Wass, 1967 (as *Echidna zebra*)
1968 BPBM-I 7358
1977 Lewis, 1980 (as *Echidna zebra*)
1977 Brock, 1982 (as *Echidna zebra*)
2000 Present study
***Gymnothorax buroensis* (Bleeker, 1857)**
1977 Brock, 1982
1977 Brock et al., 1979
***Gymnothorax chilospilus* Bleeker, 1865**
1975 BPBM-I 19660
***Gymnothorax eurostus* (Abbott, 1860)**
1922 Fowler, 1928 (as *Gymnothorax laysanus*)
1966 Wass, 1967
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979
***Gymnothorax flavimarginatus* (Rüppell, 1830)**
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Brock, 1982
2000 Present study
***Gymnothorax gracilicauda* Jenkins, 1903**
1977 Lewis, 1980
1977 Brock, 1982
1977 Brock et al., 1979
***Gymnothorax hilonis* Jordan and Evermann, 1903**
1959 Gosline and Brock, 1960
1966 Wass, 1967
***Gymnothorax javanicus* (Bleeker, 1859)**

      - 1959 Gosline and Brock, 1960
      - 1977 Brock, 1982
      - 1977 Brock et al., 1979
    - ***Gymnothorax kidako***
      - 1969 BPBM-I 8511
      - 1970 BPBM-I 10179
      - 1971 BPBM-I 12729
    - ***Gymnothorax meleagris* (Shaw and Nodder, 1795)**
      - 1977 Lewis, 1980
      - 1977 Brock, 1982
      - 1977 Brock et al., 1979
      - 2000 Present study
    - ***Gymnothorax rueppelliae* (McClelland, 1845)**
      - 1975 Henderson et al., 1976 (as *Gymnothorax petelli*)
    - ***Gymnothorax steindachneri* Jordan and Evermann, 1903**
      - 1966 Wass, 1967
      - 1977 Brock et al., 1979
      - 1977 Brock, 1982
      - 1977 Lewis, 1980
    - ***Gymnothorax undulatus* (Lacepède, 1803)**
      - 1966 Wass, 1967
      - 1966 BPBM-I 5576
      - 1973 Environmental Consultants Inc., 1973
      - 1977 Brock et al., 1979
      - 1977 Brock, 1982
    - ***Uropterygius fuscoguttatus* Schultz, 1953**
      - 1966 Wass, 1967
      - 1977 Lewis, 1980
      - 1977 Brock, 1982
      - 1977 Brock et al., 1979
    - ***Uropterygius inornatus* Gosline, 1958**
      - 1966 Wass, 1967
    - ***Uropterygius supraforatus* (Regan, 1909)**
      - 1966 Wass, 1967
    - ***Uropterygius tigrinus* (Lesson,)**
      - 1966 Wass, 1967
      - 1977 Brock, 1982
      - 1977 Lewis, 1980
      - 1977 Brock et al., 1979
  - Family CONGRIDAE
    - ***Conger cinereus* Rüppell, 1830**
      - 1961 Walsh, 1967 (as *C. cinereus marginatus*)
      - 1966 Wass, 1967 (as *C. cinereus marginatus*)
      - 1977 Lewis, 1980
      - 1977 Brock et al., 1979
      - 1977 Brock, 1982
    - ***Conger oligoporus* Kanazawa, 1958**
      - 1966 Wass, 1967 (as C. wilsoni)
      - 1966 Brock et al., 1979
- Order CLUPEIFORMES
  - Family CLUPEIDAE
    - ***Etrumeus teres* (De Kay, 1842)**
      - 1972 Cooney, 1973 (as *Etrumeus micropus*)
      - 1977 Brock et al., 1979 (as *Etrumeus micropa*)
      - 1977 Brock, 1982 (as *Etrumeus micropa*)
    - ***Herklotsichthys quadrimaculatus* (Rüppell, 1837)** **Introduced**
      - 1975 Williams and Clarke, 1982
      - 1975 Baldwin, 1984
    - ***Sardinella marquesensis* Berry and Whitehead, 1968**
      - 1959 Murphy, 1960 (as *Harengula vittata*)
      - 1977 Lewis, 1980
  - Family ENGRAULIDAE
    - ***Encrasicholina purpurea* (Fowler, 1900)**
      - 1944 Tester and Hiatt, 1952 (as *Stolephorus purpureus*)

1948 Bachman, 1963 (as *Stolephorus purpureus*)
1949 Tester, 1951 (as *Stolephorus purpureus*)
1950 Tester, 1955 (as *Stolephorus purpureus*)
1950 Hiatt, 1951 (as *Stolephorus purpureus*)
1950 Yamasita, 1951 (as *Stolephorus purpureus*)
1950 Morgan, 1951 (as *Stolephorus purpureus*)
1954 Pritchard, 1955 (as *Stolephorus purpureus*)
1959 Gosline and Brock, 1960 (as *Stolephorus purpureus*)
1959 Murphy, 1960 (as *Stolephorus purpureus*)
1963 Piyakarnchana, 1965 (as *Stolephorus purpureus*)
1966 Burdick, 1969 (as *Stolephorus purpureus*)
1967 Leary et al., 1975 (as *Stolephorus purpureus*)
1969 Maginniss, 1970 (as *Stolephorus purpureus*)
1969 Nakamura, 1970 (as *Stolephorus purpureus*)
1969 BPBM-I 31321
1971 Murphy and Clutter, 1972 (as *Stolephorus purpureus*)
1971 BPBM-I 22684
1973 Leary and Murphy, 1975 (as *Stolephorus purpureus*)
1976 Brock, 1976 (as *Stolephorus pur*pureus)
1977 Wetheral, 1977 (as *Stolephorus purpureus*)
1980 Johnson, 1982 (as *Stolephorus purpureus*)
1984 Clarke, 1992
1985 Clarke, 1987
1987 Kobayashi, 1987 (as *Stolephorus purpureus*)
1987 Kobayashi, 1989 (as *Stolephorus purpureus*)
1988 Clarke, 1989 (as *Stolephorus purpureus*)
1995 Chiappa et al., 1996
1995 BPBM-I 36797
2000 Present study

Order CYPRINIFORMES
Family CYPRINIDAE
***Carassius auratus* (Linnaeus, 1758)**
1937 Mainland, 1939
Family COBITIDIDAE
***Misgurnus anguillicaudatus* (Cantor, 1842)**
1937 Mainland, 1939

Order SILURIFORMES
Family CLARIIDAE
***Clarias fuscus* (Lacepède, 1803)**
1937 Mainland, 1939

Order AULOPIFORMES
Family SYNODONTIDAE
***Saurida gracilis* (Quoy and Gaimard, 1824)**
1968 BPBM-I 6358
1969 BPBM-I 31316
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982
***Saurida* sp.**
2000 Present study
***Synodus dermatogenys* Fowler, 1912**
1966 Wass, 1967
***Synodus falcatus* Waples and Randall, 1988**
1997 BPBM-I 37857
***Synodus ulae* Schultz, 1953**
1957 BPBM-I 15429
***Synodus variegatus* (Lacepède, 1803)**
1973 Environmental Consultants Inc., 1973
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980

Order OPHIDIIFORMES
Family OPHIDIIDAE
***Brotula multibarbata* Temminck and Schlegel, 1846**

1966 Wass, 1967
1966 Lewis, 1980
1966 Brock, 1982
1977 Brock et al., 1979
1991 BPBM-I 35429
1991 BPBM-I 37259

Family BYTHITIDAE

Microbrotula rubra **Gosline, 1953**

1948 BPBM-I 13760
1948 BPBM-I 13759
1952 Gosline, 1953
1959 Gosline and Brock, 1960
1966 Wass, 1967

Order LOPHIIFORMES

Family ANTENNARIIDAE

Antennarius drombus **Jordan and Evermann, 1903**

1969 BPBM-I 7927
1969 BPBM-I 7381
1975 BPBM-I 19655
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980

Antennarius moluccensis **Bleeker, 1855**

1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982

Antennarius nummifer **(Cuvier, 1817)**

1928 BPBM-I 5143

Antennarius pictus **(Shaw and Nodder, 1794)**

none BPBM-I 22602

Antennarius **sp.**

1969 BPBM-I 7914

Histrio histrio **(Linneaus, 1758)**

1991 BPBM-I 37269

Order ATHERINIFORMES

Family ATHERINIDAE

Atherinomorus insularum **(Jordan and Evermann, 1903)**

1922 Fowler, 1928 (as *Hepsetia insularum*)
1950 Yamasita, 1951 (as *Pranesus insularum*)
1954 Pritchard, 1955 (as *Pranesus insularum*)
1965 Banner, 1968 (as *Pranesus insularum*)
1968 Chase, 1969 (as *Pranesus insularum*)
1968 BPBM-I 22650
1970 Miller, 1972 (as *Pranesus insularum*)
1972 Major, 1977 (as *Pranesus insularum*)
1972 Key, 1973 (as *Pranesus insularum*)
1973 McMahon, 1975 (as *Pranesus insularum*)
2000 Present study

Order CYPRINODONTIFORMES

Family POECILIIDAE

Poecilia latipinna **(Lesueur, 1821)** **Introduced**

1937 Mainland, 1939 (as *Mollienesia latipinna*)

Poecilia mexicana **Steindachner, 1863** **Introduced**

1979 Akiyama, 1982

Poecilia reticulata **Peters, 1860**

1937 Mainland, 1939 (as *Lebistes reticulatus*)
1961 Walsh, 1967 (as *Lebistes reticulatus*)

Poecilia vittata **Guichenot, 1853** **Introduced**

1970 Baldwin, 1978

Xiphophorus maculatus **(Günther, 1866)**

1937 Mainland, 1939 (as *Platypoecilius maculatus*)

Order BELONIFORMES

Family BELONIDAE

Strongylura gigantea

        - 1966 Wass, 1967
- Order BERYCIFORMES
    - Family HOLOCENTRIDAE
        - ***Myripristis amaena*** **(Castelnau, 1873)**
            - 1966 Brock et al., 1979 (as *Myripristis amaenus amaenus*)
            - 1966 Wass, 1967 (as *Myripristis argyromus*)
            - 1967 BPBM-I 5582
            - 1971 Popper et al.1973 (as *Myripristis argyromus*)
        - ***Myripristis berndti*** **Jordan and Evermann, 1903**
            - 1971 Popper et al.1973
        - ***Myripristis*** **sp.**
            - 2000 Present study
        - ***Neoniphon sammara*** **(Forsskål, 1775)**
            - 1966 Wass, 1967 (as *Holocentrus sammara*)
            - 2000 Present study
        - ***Plectrypops lima*** **(Valenciennes, 1831)**
            - 1966 Wass, 1967 (as *Holotrachus lima*)
        - ***Sargocentron diadema*** **(Lacepède, 1802)**
            - 1966 Wass, 1967 (as *Holocentrus diadema*)
            - 1967 BPBM-I 5804
            - 1977 Brock, 1982 (as *Adioryx diadema*)
            - 1977 Brock et al., 1979 (as *Adioryx diadema*)
            - 1977 Lewis, 1980 (as *Adioryx diadema*)
        - ***Sargocentron punctatissimum*** **(Cuvier, 1829)**
            - 1966 Wass, 1967 (as *Holocentrus lacteoguttatus*)
            - 1977 Brock et al., 1979 (as *Adioryx lacteoguttatus*)
            - 1977 Lewis, 1980 (as *Adioryx lacteoguttatus*)
            - 1977 Brock, 1982 (as *Adioryx lacteoguttatus*)
- Order SYNGNATHIFORMES
    - Family AULOSTOMIDAE
        - ***Aulostomus chinensis*** **(Linnaeus, 1766)**
            - 1966 Wass, 1967
            - 1977 Lewis, 1980
            - 1977 Brock et al., 1979
            - 1977 Brock, 1982
    - Family SYNGNATHIDAE
        - ***Doryrhamphus excisus*** **Kaup, 1856**
            - 1966 Wass, 1967 (as *Doryrhamphus melanopleura*)
            - 1977 Lewis, 1980 (as *Doryrhamphus melanopleura*)
            - 1977 Brock, 1982 (as *Doryrhamphus melanopleura*)
            - 1977 Brock et al., 1979 (as *Doryrhamphus melanopleura*)
        - ***Dunckerocampus baldwini*** **Herald and Randall, 1972**
            - 1969 BPBM-I 7783
        - ***Fistularia commersonii*** **Rüppell, 1836**
            - 1966 Wass, 1967 (as *F. petimba*)
            - 1977 Environmental Consultants Inc., 1977 (as *F. petimba*)
            - 1982 AECOS, 1982 (as *F. petimba*)
        - ***Hippocampus fisheri*** **Jordan and Evermann, 1903**
            - none BPBM-I 15398
            - 1968 BPBM-I 15390
            - 1968 BPBM-I 15438
            - 1971 BPBM-I 12058
- Order SCORPAENIFORMES
    - Family SCORPAENIDAE
        - ***Dendrochirus barberi*** **(Steindachner, 1900)**
            - 1937 Pietschman, 1938 (as *Dendrochirus chloreus*)
            - 1967 BPBM-I 5849
            - 1969 BPBM-I 7821
        - ***Dendrochirus brachypterus***
            - 1966 Wass, 1967
            - 1977 Brock, 1982
            - 1977 Brock et al., 1979
            - 1977 Lewis, 1980
        - ***Pterois sphex*** **Jordan and Evermann, 1903**

- 1968 BPBM-I 7883
- 2000 Present study

***Scorpaenodes kelloggi* (Jenkins, 1903)**
- 1937 Pietschman, 1938 (as Scorpaena kellogi)

***Scorpaenopsis brevifrons* Eschmeyer and Randall, 1975**
- 1970 BPBM-I 10182
- 1971 BPBM-I 10958
- 1991 BPBM-I 35431

***Scorpaenopsis cacopsis* Jenkins, 1901**
- 1977 Brock, 1982
- 1977 Lewis, 1980
- 1977 Brock et al., 1979

***Scorpaenopsis diabolus* Cuvier, 1829**
- 1982 AECOS, 1982

Scorpaenopsis gibbosa
- 1977 Brock et al., 1979
- 1977 Lewis, 1980
- 1977 Brock, 1982

***Sebastapistes ballieui* (Sauvage, 1875)**
- 1964 BPBM-I 28139

***Sebastapistes coniorta* Jenkins, 1903**
- 1964 BPBM-I 28137
- 1966 Wass, 1967 (as *Scorpaena corniota*)
- 1977 Brock, 1982 (as *Scorpaena corniota*)
- 1977 Lewis, 1980 (as *Scorpaena corniota*)
- 1977 Brock et al., 1979 (as *Scorpaena corniota*)

***Sebastapistes fowleri* (Pietschmann, 1934)**
- 1964 BPBM-I 28138
- 1965 BPBM-I 28141

***Taenianotus triacanthus* Lacepède, 1802**
- 1966 Wass, 1967
- 1991 BPBM-I 35432
- 2000 Present study

Scorpaenidae sp.
- 1968 BPBM-I 22652

Family CARACANTHIDAE

Caracanthus maculatus
- 1964 BPBM-I 28140

Order PERCIFORMES

Family LABRIDAE

***Anampses chrysocephalus* Randall, 1958**
- 1968 BPBM-I 7359

***Anampses cuvier* Quoy and Gaimard, 1824**
- 1969 BPBM-I 7388
- 2000 Present study

***Bodianus bilunulatus* (Lacepède, 1802)**
- 1966 Wass, 1967
- 1967 BPBM-I 6015
- 1977 Brock, 1982
- 1977 Brock et al., 1979
- 1977 Lewis, 1980
- 2000 Present study

***Cheilio inermis* (Forsskål, 1775)**
- 1977 Environmental Consultants Inc., 1977
- 1978 AECOS, 1982
- 1993 BPBM-I 37077
- 2000 Present study

***Coris flavovittata* (Bennett, 1829)**
- 2000 Present study

***Coris venusta* Vaillant and Sauvage, 1875**
- 1969 BPBM-I 31322

***Enneapterygius atriceps* (Jenkins, 1904)**
- 1969 BPBM-I 8514
- 1975 BPBM-I 19658

1991 BPBM-I 37266
***Gomphosus varius* Lacepède, 1801**
1966 Wass, 1967
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1977 Environmental Consultants Inc., 1977
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982
1978 AECOS, 1982
2000 Present study
***Halichoeres ornatissimus* (Garrett, 1863)**
2000 Present study
***Labroides phthirophagus* Randall, 1958**
1957 Randall, 1958
1965 Youngbluth, 1968
1966 Wass, 1967
1969 Losey, 1971
1970 Losey, 1972
1972 Losey and Margules, 1974
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1976 Gorlick, 1984
1976 Gorlick, 1978
1977 Environmental Consultants Inc., 1977
1977 Losey, 1977
1978 Gorlick, 1980
1978 Losey, 1979
1994 Barry and Hawtshyn, 1999
2000 Present study
***Macropharyngodon geoffroyi* (Quoy and Gaimard, 1824)**
1977 Brock et al., 1979
1977 Brock, 1982
1977 Lewis, 1980
***Moolgarda engeli* (Bleeker, 1858)** **Introduced**
1966 BPBM-I 6206
***Mugil cephalus* Linnaeus, 1758**
1937 Mainland, 1939
1959 Helfrich and Banner, 1960
1959 Martin, 1960
1959 Nandi and Bern, 1960
1966 Wass, 1967
1977 Environmental Consultants Inc., 1977
1990 Leber et al., 1996
1990 Leber and Lee, 1997
1990 Leber, 1995
1990 Leber and Arce, 1996
1990 Leber, 1995
1990 Leber et al., 1997
1990 Leber et al., 1997
1990 Leber et al., 1996b
1990 Leber et al., 1996a
1993 Leber et al., 1995
2000 Present study
***Neomyxus leuciscus* (Günther, 1871)**
1959 Helfrich and Banner, 1960 (as *Neomyxus chaptali*)
***Ophicephalus striatus* Bloch, 1797**
1937 Mainland, 1939
***Oxycheilinus bimaculatus* (Valenciennes, in Cuvier and**
1966 Wass, 1967 (as *Cheilinus bimaculatus*)
1971 BPBM-I 10957
***Oxycheilinus unifasciatus* (Streets, 1877)**
1966 Wass, 1967 (as *Cheilinus rhodochrous*)
1977 Lewis, 1980 (as *Cheilinus rhodochrous*)

1977 Brock et al., 1979 (as *Cheilinus rhodochrous*)
1977 Brock, 1982 (as *Cheilinus rhodochrous*)

Polydactylus sexfilis **(Valenciennes, 1831)**
1974 May, 1976
1975 Santerre, 1976
1976 Santerre and May, 1977
1990 Leber and Lee, 1997

Pseudocheilinus evanidus **Jordan and Evermann, 1903**
1966 Wass, 1967

Pseudocheilinus octotaenia **Jenkins, 1901**
1966 Wass, 1967
1991 BPBM-I 35428

Stethojulis balteata **(Quoy and Gaimard, 1824)**
1966 Wass, 1967 (as *Stethojulis axilaris*)
1966 Wass, 1967
1969 BPBM-I 7377
1972 Key, 1973 (as *Stethojulis axilaris*)
1973 Environmental Consultants Inc., 1973 (as *Stethojulis axilaris*)
1977 Lewis, 1980 (as *Thalassoma balteata*)
1977 Brock, 1982 (as *Thalassoma balteata*)
1977 Brock et al., 1979
1977 Environmental Consultants Inc., 1977
1978 AECOS, 1982
1982 AECOS, 1982
1994 Marine Research Consultants, 1994
2000 Present study

Synchiropus rosulentus **Randall, 1998**
1991 BPBM-I 37260
1995 BPBM-I 38398
1996 BPBM-I 38399

Thalassoma ballieui **(Vaillant and Sauvage, 1875)**
1959 Martin, 1960
1966 Wass, 1967
1969 BPBM-I 7386
1971 BPBM-I 10956
1973 Environmental Consultants Inc., 1973
1992 Losey et al., 1994

Thalassoma duperrey **(Quoy and Gaimard, 1824)**
1966 Wass, 1967
1967 Nishimoto, 1967
1969 BPBM-I 7380
1973 Environmental Consultants Inc., 1973
1976 Brock, 1976
1977 Brock, 1982
1977 Brock et al., 1979
1977 Environmental Consultants Inc., 1977
1977 Brock et al., 1979
1977 Nakamura et al, 1989
1977 Lewis, 1980
1978 Gorlick, 1980
1978 Ross, 1984b
1978 Ross, 1984a
1978 Ross et al., 1983
1978 Ross, 1983
1978 AECOS, 1982
1979 Ross, 1987
1980 Ross, 1982
1980 Ross, 1981
1982 AECOS, 1982
1984 Ross, 1986
1984 Hoffman, 1987
1992 Losey et al., 1994
1994 Marine Research Consultants, 1994
1995 Mather et al, 1997

        - 1996 Morrey et al, 1998
        - 2000 Present study
    - ***Thalassoma purpureum*** **(Forsskål, 1775)**
        - 1966 Wass, 1967 (as *Thalassoma umbrostigma*)
        - 1972 Key, 1973 (as *Thalassoma umbrostigma*)
    - ***Thalassoma quinquevittatum*** **(Lay and Bennett, 1839)**
        - 2000 Present study
    - ***Thalassoma trilobatum*** **(Lacepède, 1801)**
        - 1984 Hoffman and Grau, 1989 (as *Thalassoma fuscus*)
    - ***Wetmorella albofasciata*** **Schultz and Marshall, 1954**
        - 1959 Gosline and Brock, 1960
- Family KUHLIIDAE
    - ***Kuhlia sandvicensis*** **(Steindachner, 1876)**
        - 1950 Morgan, 1951
        - 1951 Tester, 1952
        - 1952 Morgan, 1953
        - 1953 Tester and Trefz, 1954
        - 1955 Boroughs et al., 1956
        - 1961 Byrne, 1962
        - 1961 Walsh, 1967
        - 1965 Niimi, 1966
        - 1966 Bridges, 1967
        - 1967 Nakamota, 1968
        - 1970 Muir, 1972
        - 1973 Environmental Consultants Inc., 1973
        - 1994 Marine Research Consultants, 1994
    - ***Kuhlia xenura*** **Jordan and Gilbert,**
        - 1968 BPBM-I 22639
        - 1971 BPBM-I 11533
- Family ELEOTRIDAE
    - ***Eleotris fusca***
        - 1937 Mainland, 1939
    - ***Eleotris sandwicensis*** **Vaillant and Sauvage, 1875**
        - 1961 Walsh, 1967
- Family PRIACANTHIDAE
    - ***Heteropriacanthus cruentatus*** **(Lacepède, 1801)**
        - 1959 Martin, 1960 (as *Priacanthus cruentatus*)
        - 1966 Wass, 1967 (as *Priacanthus cruentatus*)
        - 1977 Brock et al., 1979 (as *Priacanthus cruentatus*)
        - 1977 Brock, 1982 (as *Priacanthus cruentatus*)
- Family APOGONIDAE
    - ***Apogon deetsie*** **Randall, 1997**
        - 1969 BPBM-I 37400
        - 1971 BPBM-I 13983
        - 1991 BPBM-I 37255
    - ***Apogon erythrinus*** **Snyder, 1904**
        - 1973 Environmental Consultants Inc., 1973
        - 1977 Lewis, 1980
        - 1977 Brock, 1982
        - 1977 Brock et al., 1979
        - 1979 AECOS, 1982
    - ***Apogon kallopterus*** **Bleeker, 1856**
        - 1966 Wass, 1967 (as *Apogon snyderi*)
        - 1977 Lewis, 1980 (as *Apogon snyderi*)
        - 1977 Brock, 1982 (as *Apogon snyderi*)
    - ***Apogon maculiferus*** **Garrett, 1863**
        - 1966 Wass, 1967
        - 1968 BPBM-I 7312
        - 1969 BPBM-I 7408
        - 1977 Brock et al., 1979
    - ***Apogon menesemus*** **Jenkins, 1903**
        - 1966 Wass, 1967
        - 1977 Brock et al., 1979
    - ***Apogonichthys perdix*** **Bleeker, 1854**

1975 BPBM-I 19656
1996 BPBM-I 37305

***Foa brachygramma* (Jenkins, 1904)**
1948 BPBM-I 15128
1966 Wass, 1967 (as *Apogon brachygrammus*)
1968 BPBM-I 6360
1968 BPBM-I 22651
1971 BPBM-I 10955
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1979 AECOS, 1982
1987 Kobayashi, 1987
1987 Kobayashi, 1989
1991 BPBM-I 37227

Foa fo
1937 Pietschman, 1938

***Pseudamiops diaphanes* Randall, 1997**
1991 BPBM-I 37256
1993 BPBM-I 37413

Family GOBIIDAE

***Asterropteryx semipunctatus* Rüppell, 1830**
1937 Mainland, 1939
1938 BPBM-I 5471
1966 Wass, 1967
1970 Henderson et al., 1976
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1976 Brock, 1976
1977 Brock et al., 1979
1977 Brock, 1982
1977 Lewis, 1980

Bathygobius coalitus
1939 BPBM-I 5490

***Bathygobius cocosensis* (Bleeker, 1854)**
1938 BPBM-I 5480
1938 BPBM-I 5484
1987 BPBM-I 33480

***Bathygobius cotticeps* (Steindachner, 1879)**
1966 Wass, 1967
1976 Brock, 1976
1977 Lewis, 1980
1977 Brock, 1982
1977 Brock et al., 1979

Bathygobius fuscus
1937 Mainland, 1939
1937 Pietschman, 1938
1975 Henderson et al., 1976
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980

***Cabillus* sp.**
1991 BPBM-I 37261

***Calotomus carolinus* (Valenciennes, 1839)**
1967 BPBM-I 5589
1969 BPBM-I 7385
1977 Brock, 1982 (as *C. sandvicensis*)
1993 BPBM-I 37073

***Chlorurus sordidus* (Forsskål, 1775)**
1966 Wass, 1967 (as *Scarus sordidus*)
1966 Wass, 1967 (as *Scarus sordidus*)
1976 Brock, 1976 (as *Scarus sordidus*)
1977 Brock et al., 1979 (as *Scarus sordidus*)

1977 Lewis, 1980 (as *Scarus sordidus*)
1977 Environmental Consultants Inc., 1977 (as *Scarus sordidus*)
1977 Brock, 1982 (as *Scarus sordidus*)
1977 Lewis, 1980
1978 AECOS, 1982 (as *Scarus sordidus*)
2000 Present study

***Coryphopterus neophytus* (Günther, 1877)**
1975 BPBM-I 19657

***Coryphopterus* sp.**
1991 BPBM-I 37258
1991 BPBM-I 35423
1991 BPBM-I 37262

***Eviota epiphanes* Jenkins, 1903**
1937 Pietschman, 1938 (as *Eleotris epiphanes*)
1937 Mainland, 1939 (as *Eleotris epiphanes*)
1938 BPBM-I 5472
1993 BPBM-I 38391
1996 BPBM-I 37307
1997 Greenfield and Randall, 1999

***Eviota rubra* Greenfield and Randall, 1999**
1991 BPBM-I 35424
1991 BPBM-I 35422
1991 BPBM-I 37257
1991 BPBM-I 38387
1991 BPBM-I 38388
1993 BPBM-I 38390
1997 Greenfield and Randall, 1999
1997 BPBM-I 38385
1997 BPBM-I 38386

***Eviota* sp.**
1971 BPBM-I 10954

***Eviota susanae* Greenfield and Randall, 1999**
1991 BPBM-I 38381
1991 BPBM-I 38382
1991 BPBM-I 38384
1996 BPBM-I 38383
1997 Greenfield and Randall, 1999
1997 BPBM-I 38379
1997 BPBM-I 38380

***Gnatholepis anjerensis* (Bleeker, 1850)**
1937 Mainland, 1939
1939 BPBM-I 5495
1949 BPBM-I 15042
1952 BPBM-I 15046
1967 BPBM-I 31319
1968 BPBM-I 7306
1968 BPBM-I 22642
1968 BPBM-I 31320
1968 BPBM-I 22649

***Lentipes concolor* (Gill, 1860)**
1967 BPBM-I 38475

***Mugilogobius cavifrons* (Weber, 1909)** **Introduced**
1988 BPBM-I 32749
1990 BPBM-I 33931

***Opua nephodes* (E.K. Jordan, 1925)**
1959 Gosline and Brock, 1960
1967 BPBM-I 17820
1968 BPBM-I 15383

***Oxyurichthys lonchotus* (Jenkins, 1903)**
1961 Walsh, 1967

***Priolepis aureoviridis* (Gosline, 1959)**
1991 BPBM-I 35425
1991 BPBM-I 37267

***Priolepis eugenius* (Jordan and Evermann, 1903)**

1991 BPBM-I 37263

***Priolepis farcimen* (Jordan and Evermann, 1903)**

1991 BPBM-I 35426
1996 BPBM-I 38477

***Priolepis limbatosquamis* (Gosline, 1959)**

1991 BPBM-I 35427
1991 BPBM-I 37264

***Psilogobius mainlandi* Baldwin, 1972**

none BPBM-I 5523
1939 BPBM-I 5525
1939 BPBM-I 5524
1939 BPBM-I 5522
1968 BPBM-I 22644
1970 Moehring, 1972
1970 Preston, 1978
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1976 BPBM-I 31323
1977 Environmental Consultants Inc., 1977
1987 Kobayashi, 1989
1987 Kobayashi, 1987
2000 Present study

***Scarus dubius* Bennett, 1828**

1961 Byrne, 1962
1966 Wass, 1967
1968 Byrne, 1970
2000 Present study

***Scarus perspicillatus* Steindachner, 1879**

1961 Byrne, 1962
1966 Wass, 1967
1968 Byrne, 1970
1969 BPBM-I 7387
1970 BPBM-I 10218
1976 Brock, 1976
1977 Brock et al., 1979
1977 Brock, 1982
2000 Present study

***Scarus psittacus* Forsskål, 1775**

1976 Brock, 1979 (as *S. taeniurus*)
1977 Brock, 1982 (as *S. taeniurus*)
1977 Brock et al., 1979 (as *S. taeniurus*)

***Scarus rubroviolaceus* Bleeker, 1849**

1977 Brock et al., 1979
1977 Brock, 1982 (as *Scarops rubroviolaceous*)

***Scarus sordidus* Forsskål, 1775**

1968 BPBM-I 22646

***Scarus* sp.**

2000 Present study

***Sicyopterus stimpsoni* (Gill, 1860)**

1922 Fowler, 1928
1922 Fowler, 1928 (as *Sicydium stimpsoni*)
1967 BPBM-I 22636

***Stenogobius hawaiiensis* Watson, 1991**

1961 Walsh, 1967 (as *Chonophorus genivittatus*)

***Trimma unisquamis* (Gosline, 1959)**

1991 BPBM-I 37265

***Zanclus cornutus* (Linnaeus, 1758)**

1966 Wass, 1967 (as *Z. canescens*)
1973 Environmental Consultants Inc., 1973 (as *Z. canescens*)
1977 Lewis, 1980 (as *Z. canescens*)
1977 Brock et al., 1979 (as *Z. canescens*)
1977 Brock, 1982 (as *Z. canescens*)
1994 Marine Research Consultants, 1994
2000 Present study

- Family CARANGIDAE
  - ***Alectis ciliaris* (Bloch, 1788)**
    - 1955 Burroughs et al., 1956 (as *Caranx ajax*)
  - ***Atule mate* (Cuvier, 1833)**
    - 1970 Watarai, 1973 (as *Caranx mate*)
    - 1971 Lee, 1973 (as *Caranx mate*)
    - 1971 Miller and Sumida, 1974 (as *Caranx mate*)
    - 1972 Cooney, 1973 (as *Caranx mate*)
    - 1973 Santerre, 1974 (as *Caranx mate*)
    - 1984 Clarke, 1986 (as *Caranx mate*)
    - 1991 Holland et al., 1992 (as *Caranx mate*)
  - ***Caranx ignobilis* (Forsskål, 1775)**
    - 1959 Gosline and Brock, 1960
    - 1977 Brock et al., 1979
  - ***Caranx melampygus* Cuvier, 1833**
    - 1956 Tester and Nakamura, 1957 (as *C. stellatus*)
    - 1966 Wass, 1967
    - 1977 Lewis, 1980
    - 1977 Brock, 1982
    - 1977 Brock et al., 1979
    - 1991 Holland et al., 1992
    - 1995 Holland et al., 1996
  - ***Seriola dumerili* (Risso, 1810)**
    - 1998 BPBM-I 38449
- Family ACANTHURIDAE
  - ***Acanthurus achilles* Shaw, 1803**
    - 2000 Present study
  - ***Acanthurus blochii* Valenciennes, 1835**
    - 1978 AECOS, 1982
    - 2000 Present study
  - ***Acanthurus dussumieri* Valenciennes, 1835**
    - 1966 Wass, 1967
    - 1972 Key, 1973
    - 1973 Environmental Consultants Inc., 1973
    - 1977 Environmental Consultants Inc., 1977
    - 2000 Present study
  - ***Acanthurus leucopareius* (Jenkins, 1903)**
    - 1982 AECOS, 1982
    - 2000 Present study
  - ***Acanthurus nigricans* (Linnaeus, 1758)**
    - 2000 Present study
  - ***Acanthurus nigrofuscus* (Forsskål, 1775)**
    - 1966 Wass, 1967
    - 1977 Environmental Consultants Inc., 1977
    - 1977 Brock et al., 1979
    - 1977 Brock, 1982
    - 1994 Marine Research Consultants, 1994
    - 2000 Present study
  - ***Acanthurus nigroris* Valenciennes, 1835**
    - 1977 Environmental Consultants Inc., 1977
    - 1978 AECOS, 1982
    - 2000 Present study
  - ***Acanthurus olivaceus* Bloch and Schneider, 1801**
    - 2000 Present study
  - ***Acanthurus triostegus* (Linnaeus, 1758)**
    - 1951 Miyake, 1952 (as *A. sandvicensis*)
    - 1960 Randall, 1961 (as *A. triostegus sandvicensis*)
    - 1961 Byrne, 1962 (as *A. sandvicensis*)
    - 1966 Wass, 1967 (as *A. sandvicensis*)
    - 1967 Sale, 1969 (as *A. triostegus sandvicensis*)
    - 1972 Key, 1973 (as *A. sandvicensis*)
    - 1973 Environmental Consultants Inc., 1973
    - 1974 Medvick and Miller, 1976 (as *A. triostegus sandvicensis*)
    - 1974 Medvick, 1976 (as *A. triostegus sandvicensis*)

1976 Brock, 1976 (as *A. triostegus sandvicensis*)
1977 Brock et al., 1979 (as *A. triostegus sandvicensis*)
1977 Brock, 1982 (as *A. triostegus sandvicensis*)
1977 Environmental Consultants Inc., 1977 (as *A. triostegus sandvicensis*)
1977 Lewis, 1980 (as *A. triostegus sandvicensis*)
1978 Gorlick, 1980
1978 AECOS, 1982
1982 AECOS, 1982 (as *A. sandwicensis*)
1994 Marine Research Consultants, 1994 (as *A. sandvicensis*)
2000 Present study

***Acanthurus xanthopterus* Valenciennes, 1835**
1976 Brock, 1976
1977 Environmental Consultants Inc., 1977
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980

***Ctenochaetus hawaiiensis* Randall, 1955**
2000 Present study

***Ctenochaetus strigosus* (Bennett, 1828)**
1959 Martin, 1960
1967 Wass, 1967
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982
1977 Environmental Consultants Inc., 1977
2000 Present study

***Naso brevirostris* (Valenciennes, 1835)**
1966 Wass, 1967
1966 Jones, 1968
1966 Jones, 1967
1977 Brock et al., 1979

***Naso lituratus* (Forster and Schneider, 1801)**
2000 Present study

***Naso unicornis* (Forsskål, 1775)**
1966 Jones, 1967
1966 Jones, 1968
1977 Environmental Consultants Inc., 1977
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982
2000 Present study

***Zebrasoma flavescens* (Bennett, 1828)**
1966 Wass, 1967
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1978 Gorlick, 1980
1978 Losey, 1979
1985 Jonasson, 1986
2000 Present study

***Zebrasoma veliferum* (Bloch, 1797)**
1954 Randall, 1955
1966 Lewis, 1980
1966 Brock, 1982
1966 Wass, 1967
1967 BPBM-I 5588
1969 BPBM-I 7824
1977 Environmental Consultants Inc., 1977

1977 Brock et al., 1979
2000 Present study
Family LUTJANIDAE
***Lutjanus fulvus* (Forster in Bloch and Schneider, 1801)**
Introduced
1960 Kami, 1961 (as *Lutianus vaigiensis*)
1973 Environmental Consultants Inc., 1973 (as *Lutianus vaigiensis*)
1977 Brock et al., 1979 (as *Lutianus vaigiensis*)
2000 Present study
***Lutjanus gibbus* (Forsskål, 1775)** **Introduced**
1961 Kami, 1962
1962 Hobson, 1963
***Lutjanus kasmira* (Forsskål, 1775)** **Introduced**
1977 Brock et al., 1979
2000 Present study
***Pristipomoides filamentosus* (Valenciennes, 1830)**
1994 Demartini et al., 1996
1994 Moffit and Parrish, 1996
Family LOBOTIDAE
***Lobotes surinamensis* (Bloch, 1790)**
1959 Gosline and Brock, 1960
Family MULLIDAE
***Mulloidichthys flavolineatus* (Lacepède, 1801)**
1959 Martin, 1960 (as *M. samoensis*)
1959 Helfrich and Banner, 1960 (as *M. samoensis*)
1961 Byrne, 1962 (as *M. samoensis*)
1966 Wass, 1967 (as *M. samoensis*)
1972 Key, 1973 (as *M. samoensis*)
1977 Brock, 1982
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1977 Brock et al., 1979
1979 AECOS, 1982
1991 Holland et al., 1993 (as M. samoensis)
1994 Marine Research Consultants, 1994
***Mulloidichthys vanicolensis* (Valenciennes, 1831)**
1977 Brock et al., 1979
1977 Brock, 1982
1977 Lewis, 1980
2000 Present study
***Parupeneus bifasciatus* (Lacepède, 1802)**
1977 Brock et al., 1979
2000 Present study
***Parupeneus cyclostomus* (Lacepède, 1801)**
1966 Wass, 1967 (as *Parupeneus chryserydros*)
2000 Present study
***Parupeneus multifasciatus* (Quoy and Gaimard, 1825)**
1961 Byrne, 1962
1966 Wass, 1967
1976 Brock, 1976
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1979 AECOS, 1982
1994 Marine Research Consultants, 1994
2000 Present study
***Parupeneus pleurostigma* (Bennett, 1831)**
1977 Brock et al., 1979
***Parupeneus porphyreus* (Jenkins, 1902)**
1961 Byrne, 1962
1968 Mahi, 1969
1972 Key, 1973
1977 Lewis, 1980

1977 Brock et al., 1979
1977 Brock, 1982
1979 AECOS, 1982
1982 AECOS, 1982
2000 Present study

***Upeneus arge* Jordan and Evermann, 1903**
1959 Helfrich and Banner, 1960
1966 BPBM-I 5590
1977 Brock et al., 1979
1994 Marine Research Consultants, 1994 (as *U. taeniopterus*)

Family SCOMBRIDAE

***Acanthocybium solandri* (Cuvier, 1831)**
1954 Tester et al., 1955
1956 Tester and Nakamura, 1957

Blenniidae sp.
1968 BPBM-I 22648
1968 BPBM-I 22647
1968 BPBM-I 22645

***Cirripectes obscurus* (Borodin, 1927)**
1966 Wass, 1967

***Cirripectes quagga* (Fowler and Ball, 1924)**
1993 BPBM-I 37078

***Cirripectes vanderbilti* (Fowler, 1938)**
1975 BPBM-I 19659

Cirripectes variolosus
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979

Enchelyurus ater
1937 Pietschman, 1938

***Enchelyurus brunneolus* (Jenkins, 1903)**
1937 Mainland, 1939 (as *Paraoxyurichthys edmondsoni*)
1945 Edmondson, 1946 (as *Paraoxyurichthys edmondsoni*)
1969 BPBM-I 7866
1996 BPBM-I 37306

***Entomacrodus marmoratus* (Bennett, 1828)**
1970 Henderson et al., 1976
1993 BPBM-I 37079

***Entomacrodus strasburgi* Springer, 1967**
1993 BPBM-I 37080

***Euthynnus affinis* (Cantor, 1849)**
1951 van Weel, 1952 (as *Euthynnus yaito*)
1951 Hsiao, 1952 (as *Euthynnus yaito*)
1951 Hsiao and Tester, 1955 (as *Euthynnus yaito*)
1951 Miyake, 1952 (as *Euthynnus yaito*)
1953 Tester et al., 1954
1954 Tester et al., 1955
1955 Boroughs et al., 1956 (as *Euthynnus yaito*)
1956 Tester and Nakamura, 1957 (as *Euthynnus yaito*)

***Istiblennius gibbifrons* (Quoy and Gaimard, 1824)**
1993 BPBM-I 37081

***Istiblennius zebra* (Vaillant and Sauvage, 1875)**
1975 Henderson et al., 1976
1977 Lewis, 1980
1977 Brock, 1982
1977 Brock et al., 1979

***Katsuwonus pelamis* (Linnaeus, 1758)**
1954 Tester et al., 1955
1956 Tester and Nakamura, 1957

***Omobranchus elongatus* (Peters, 1855)**
1955 Strasburg, 1956

***Omobranchus rotundiceps obliquus* (Garman, 1903)** **Introduced**
1965 BPBM-I 6205
1991 BPBM-I 37228

Thunnus albacares **(Bonnaterre, 1788)**
1951 van Weel, 1952
1951 Miyake, 1952
1951 Hsiao, 1952
1954 Tester et al., 1955
1956 Tester and Nakamura, 1957
1972 Miller, 1979

Family KYPHOSIDAE

Kyphosus bigibbus **Lacepède, 1801**
1997 BPBM-I 38443
2000 Present study

Kyphosus cinerascens **(Forsskål, 1775)**
1997 BPBM-I 38444

Sectator ocyurus **(Jordan and Gilbert, 1903)**
1904 Jordan and Everman, 1905 (as *Sectator azureus*)

Family SCORPIDIDAE

Microcanthus strigatus **(Cuvier, 1831)**
1966 Wass, 1967
1973 Environmental Consultants Inc., 1973

Family CHAETODONTIDAE

Chaetodon auriga **Forsskål, 1775**
1966 Wass, 1967
1972 Losey and Margules, 1974
1972 Losey, 1977
1973 Environmental Consultants Inc., 1973
1977 Brock et al., 1979
1977 Brock, 1982
1977 Lewis, 1980
1978 Gorlick, 1980
1978 Losey, 1979
1982 AECOS, 1982
1985 Jonasson, 1986
2000 Present study

Chaetodon fremblii **Bennett, 1828**
1966 Wass, 1967
2000 Present study

Chaetodon lineolatus **Cuvier, 1831**
1966 Wass, 1967
1967 BPBM-I 6013
2000 Present study

Chaetodon lunula **(Lacepède, 1803)**
1966 Wass, 1967
1966 Brock, 1982
1973 Environmental Consultants Inc., 1973
2000 Present study

Chaetodon lunulatus **Quoy and Gaimard, 1825**
1959 Gosline and Brock, 1960 (as *Chaetodon trifasciatus*)
1966 Wass, 1967 (as *Chaetodon trifasciatus*)
1968 BPBM-I 6991
1977 Environmental Consultants Inc., 1977 (as *Chaetodon trifasciatus*)
1997 Kosaki, 1999 (as *Chaetodon trifasciatus*)
2000 Present study

Chaetodon miliaris **Quoy and Gaimard, 1824**
1961 Byrne, 1962
1966 Wass, 1967
1967 BPBM-I 5803
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1974 Ralston, 1975
1975 Ralston, 1976
1976 Brock, 1976
1977 Brock, 1982
1977 Environmental Consultants Inc., 1977

1977 Lewis, 1980
1977 Brock et al., 1979
1979 AECOS, 1982
1982 AECOS, 1982
2000 Present study

***Chaetodon multicinctus* Garrett, 1863**
1990 Cox, 1991
1996 Aeby, 1998
2000 Present study

***Chaetodon ornatissimus* Solander in Cuvier, 1831**
1977 Lewis, 1980
1977 Brock, 1982
1977 Brock et al., 1979
1988 Fiedler, 1990
1990 Cox, 1991
1990 Cox, 1991
2000 Present study

***Chaetodon quadrimaculatus* Gray, 1831**
2000 Present study

***Chaetodon trifasciatus* Park, 1797**
1966 BPBM-I 7895

***Chaetodon unimaculatus* Bloch, 1787**
1977 Environmental Consultants Inc., 1977
1977 Brock et al., 1979
1983 Cox, 1986
1983 Cox, 1983
1985 Jonasson, 1986
1990 Cox, 1991
2000 Present study

***Forcipiger flavissimus* Jordan and McGregor, 1898**
1973 Environmental Consultants Inc., 1973 (as *F. longirostris*)
1977 Brock et al., 1979
2000 Present study

***Heniochus diphreutes* Jordan, 1903**
1977 Brock, 1982 (as *H. acuminatus*)
1977 Lewis, 1980 (as *H. acuminatus*)
1977 Brock et al., 1979 (as *H. acuminatus*)
2000 Present study

Family POMACANTHIDAE

Centropyge flavissimus
2000 Present study

***Centropyge loriculus* (Günther, 1860)**
2000 Present study

***Centropyge potteri* Jordan and Metz, 1912**
1967 Lutnesky, 1989
1977 Environmental Consultants Inc., 1977
2000 Present study

***Desmoholacanthus arcuatus* (Gray, 1831)**
1968 BPBM-I 7360

Family CICHLIDAE

***Oreochromis mossambicus* (Peters, 1852)** **Introduced**
1955 Boroughs et al., 1956a (as *Tilapia mossambicus*)
1955 Boroughs et al., 1956b (as *Tilapia mossambicus*)
1956 Boroughs et al., 1957 (as *Tilapia mossambicus*)
1957 Boroughs and Reid, 1958 (as *Tilapia mossambicus*)
1961 Bern and Takasugi, 1962 (as *Tilapia mossambicus*)
1961 Walsh, 1967 (as *Tilapia mossambicus*)
1986 Keneko et al., 1988 (as *Tilapia mossambicus*)
2000 Present study

***Sarotherodon melanotheron* Rüppell, 1852** **Introduced**
1983 BPBM-I 33444

Family POMACENTRIDAE

***Abudefduf abdominalis* (Quoy and Gaimard, 1824)**
1957 Helfrich, 1958

1963 Piyakarnchana, 1965
1965 Walters, 1967
1966 May, 1967
1966 Wass, 1967
1969 BPBM-I 7384
1972 Key, 1973
1972 Cooney, 1973
1973 Environmental Consultants Inc., 1973
1974 Medvick, 1976
1974 Medvick, 1979
1974 Medvick and Miller, 1979
1976 Brock, 1976
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Brock, 1982
1977 Environmental Consultants Inc., 1977
1979 AECOS, 1982
1982 Stanton, 1988
1982 AECOS, 1982
1983 Radtke, 1985
1985 Tyler, 1995
1986 Tyler, 1988
1986 Tyler and Stanton, 1995
1986 Tyler, 1989
1994 Marine Research Consultants, 1994
2000 Present study

***Abudefduf sordidus* (Forsskål, 1775)**
1982 Stanton, 1985
1994 Marine Research Consultants, 1994
2000 Present study

***Abudefduf vaigiensis* (Quoy and Gaimard, 1825)**
2000 Present study

***Chromis hanui* Randall and Swerdloff, 1973**
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Brock, 1982
2000 Present study

***Chromis ovalis* (Steindachner, 1900)**
1966 Swerdloff, 1970
1966 Wass, 1967
1972 Key, 1973
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
2000 Present study

***Chromis verater* Jordan and Metz, 1912**
1966 Swerdloff, 1970
2000 Present study

***Dascyllus albisella* Gill, 1862**
1964 Stevenson, 1965
1967 Wass, 1967
1967 BPBM-I 5577
1972 Key, 1973
1973 Environmental Consultants Inc., 1973
1974 Foster, 1975
1976 Brock, 1976
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1978 Gorlick, 1980
1979 AECOS, 1982
1986 Booth, 1995
1992 Danilowicz-Bret, 1997

1992 Danilowicz, 1997
1992 Danilowicz, 1995
1996 Mann and Lobel, 1998
2000 Present study

***Plectroglyphidodon imparipennis* (Vaillant and Sauvage, 1875)**
2000 Present study

***Plectroglyphidodon johnstonianus* Fowler and Ball, 1924**
1966 Wass, 1967
1974 Macdonald, 1976
1974 Macdonald, 1981
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979
1989 Gochfeld, 1991
2000 Present study

***Plectroglyphidodon sindonis* (Jordan and Evermann, 1903)**
2000 Present study

***Stegastes fasciolatus* (Ogilby, 1889)**
1966 Wass, 1967 (as *Pomacentrus jenkinsi*)
1967 Rosa, 1969 (as *Pomacentrus jenkinsi*)
1973 Environmental Consultants Inc., 1973 (as *Pomacentrus jenkensi*)
1974 Macdonald, 1981
1976 Brock, 1976 (as *Pomacentrus jenkensi*)
1977 Environmental Consultants Inc., 1977 (as *Pomacentrus jenkensi*)
1977 Lewis, 1980 (as *Eupomacentrus fasciolatus*)
1977 Brock, 1982 (as *Eupomacentrus fasciolatus*)
1977 Brock et al., 1979 (as *Eupomacentrus fasciolatus*)
1981 Losey, 1982
1983 Fitzhardinge, 1986 (as *Pomacentrus jenkensi*)
1983 Shaklee, 1984
1985 Harrington and Losey, 1990
2000 Present study

Family CHEILODACTYLIDAE

***Cheilodactylus vittatus* Garrett, 1864**
1967 BPBM-I 5584
2000 Present study

Family SERRANIDAE

***Cephalopholis argus* Bloch and Schneider, 1801 Introduced**
2000 Present study

***Epinephelus quernus* Seale, 1901**
1968 BPBM-I 6476

***Epinephelus* sp.**
1961 Kami, 1962 (as E. merra)

***Plectranthias nanus* Randall, 1980**
1991 BPBM-I 35433

***Pseudogramma polyacanthum hawaiiensis* Randall and Baldwin,**
1991 BPBM-I 35430

***Pseudogramma polyacanthum polyacanthum* (Bleeker, 1856)**
1966 Wass, 1967

***Suttonia* sp.**
1991 BPBM-I 37254

Order PLEURONECTIFORMES

Family BOTHIDAE

***Bothus mancus* (Brousonet, 1782)**
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979
1977 Environmental Consultants Inc., 1977

***Bothus pantherinus* (Rüppell, 1830)**
1968 BPBM-I 22643
1969 BPBM-I 31315
1993 BPBM-I 37072

2000 Present study

Family PLEURONECTIDAE

***Samariscus* sp.**

1971 BPBM-I 10953

***Samariscus triocellatus* Woods, 1966**

1966 Wass, 1967
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980

Family SOLEIDAE

***Aseraggodes borehami* Randall, 1996**

1969 BPBM-I 7834
1997 BPBM-I 37856

***Aseraggodes* sp.**

2000 BPBM-I 38745

***Aseraggodes therese* Randall, 1996**

1963 BPBM-I 31314
1991 BPBM-I 36794

Order TETRAODONTIFORMES

Family TETRAODONTIDAE

***Arothron hispidus* (Linneaus, 1758)**

1957 Martin, 1958 (as *Tetradon hispidus*)
1959 Martin, 1960 (as *Tetradon hispidus*)
1962 Helfrich, 1963
1962 Eger, 1963
1966 Wass, 1967
1977 Brock et al., 1979
2000 Present study

***Canthigaster amboinensis* (Bleeker, 1865)**

1969 BPBM-I 7376

***Canthigaster jactator* (Jenkins, 1901)**

1966 Wass, 1967
1973 Environmental Consultants Inc., 1973
1977 Environmental Consultants Inc., 1977
1977 Lewis, 1980
1977 Brock, 1982
1977 Brock et al., 1979
1982 Deardorff and Stanton, 1983
2000 Present study

***Canthigaster rivulata* (Schlegel, 1850)**

1977 Brock et al., 1979
1978 AECOS, 1982

Family DIODONTIDAE

***Diodon holocanthus* Linnaeus, 1758**

1967 BPBM-I 6014
1977 Brock, 1982
1977 Lewis, 1980
1977 Brock et al., 1979

***Diodon hystrix* Linnaeus, 1758**

1966 Brock, 1982
1966 Wass, 1967
1973 Environmental Consultants Inc., 1973
1977 Brock et al., 1979
1977 Lewis, 1980
1978 AECOS, 1982
2000 Present study

***Sufflamen bursa* (Bloch and Schneider, 1801)**

2000 Present study

***Sufflamen fraenatus* (Latrielle, 1804)**

2000 Present study

Family MONACANTHIDAE

***Cantherhines dumerilii* (Hollard, 1854)**

1966 Brock et al., 1979

***Cantherhines pardalis* (Rüppell, 1837)**

1966 Wass, 1967 (as *Amanses pardalis*)
1966 Wass, 1967 (as *Amanses sandwichiensis*)

Pervagor melanocephalus

1967 BPBM-I 5599

***Pervagor spilosoma* (Lay and Bennett, 1839)**

1966 Wass, 1967
1967 BPBM-I 5580
1973 Environmental Consultants Inc., 1973
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
1977 Environmental Consultants Inc., 1977
1978 AECOS, 1982
2000 Present study

Family OSTRACIIDAE

***Lactoria fornasini* (Bianconi, 1846)**

1962 Thomson, 1963
1966 Wass, 1967

***Ostracion lentiginosus* Bloch and Schneider, 1801**

1962 Thomson, 1963
1965 Boylan, 1966
1966 Wass, 1967

Ostracion meleagris

1966 Wass, 1967
1977 Brock, 1982
1977 Brock et al., 1979
1977 Lewis, 1980
2000 Present study

APPENDIX C

Station Records for Invertebrates and Fishes Collected or Observed in Kane`ohe Bay during 1999-2000

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Cyanophyta	Oscillatoriaceae	*Lyngbya majuscula*					x								x				x								
Chlorophyta	Cladophoraceae	*Cladophora sericea*												x													
Chlorophyta	Cladophoraceae	*Cladophora vagabunda*												x													
Chlorophyta	Valoniaceae	*Dictyosphaeria cavernosa*		x	x		x	x			x	x	x	x	x	x		x			x		x		x		
Chlorophyta	Valoniaceae	*Dictyosphaeria versluysii*			x		x	x	x		x				x		x	x				x	x		x	x	
Chlorophyta	Valoniaceae	*Valonia ventricosa?*						x			x				x												
Chlorophyta	Codiaceae	*Codium edule*	x					x							x	x										x	
Chlorophyta	Codiaceae	*Halimeda sp.*			x		x						x		x											x	
Chlorophyta	Siphonocladaceae	*Boodlea composita*												x													
Chlorophyta	Siphonocladaceae	*Cladophoropsis membranacea*					x																				
Chlorophyta	Siphonocladaceae	*Cladophoropsis sp*			x																						
Chlorophyta	Udoteaceae	*Rhipidosiphon javensis*	x																								
Chlorophyta	Siphonocladaceae	*Ventricaria ventricosa*					x	x					x														
Chlorophyta	Caulerpaceae	*Caulerpa racemosa*					x														x					x	
Chlorophyta	Caulerpaceae	*Caulerpa sertularioides*		x																	x						
Chlorophyta	Caulerpaceae	*Caulerpa taxifolia*		x									x								x						
Chlorophyta	Caulerpaceae	*Caulerpa verticillata*																			x						
Chlorophyta	Caulerpaceae	*Caulerpella ambigua*							x																		
Chlorophyta	Halimedaceae	*Halimeda discoidea*		x	x										x											x	
Chlorophyta	Halimedaceae	*Halimeda opuntia*	x																								
Chlorophyta	Dasycladaceae	*Bornetella sphaerica*		x									x														
Chlorophyta	Anadyomenaceae	*Microdictyon setchellianum*						x											x								
Chlorophyta	Bryopsidaceae	*Pseudobryopsis oahuensis*																								x	
Phaeophyta	Dictyotaceae	*Dictyota acutiloba*		x										x	x			x									
Phaeophyta	Dictyotaceae	*Dictyota ceylanica*		x																							
Phaeophyta	Dictyotaceae	*Dictyota friabilis*							x																		
Phaeophyta	Dictyotaceae	*Dictyota sandvicensis*													x												
Phaeophyta	Dictyotaceae	*Padina australis*		x																							
Rhodophyta	Dictyotaceae	*Padina japonica*		x						x	x				x	x			x		x	x	x				

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Phaeophyta	Dictyotaceae	*Padina sp.*													x	x											
Phaeophyta	Scytosiphonaceae	*Hydroclathrus clathratus*													x										x		
Phaeophyta	Sargassaceae	*Sargassum echinocarpum*	x	x									x														
Phaeophyta	Sargassaceae	*Sargassum obtusifolium*		x											x												
Phaeophyta	Sargassaceae	*Sargassum polyphyllum*												x													
Phaeophyta	Scytosiphonaceae	*Rosenvingea intricate*																x								x	
Phaeophyta	Sargassaceae	*Turbinaria ornata*													x												
Phaeophyta	Sphacelariaceae	*Sphacelaria novae-hollandiae*												x													
Rhodophyta	Ceramiaceae	*Falkenbergia hillebrandii*							x					x	x												
Rhodophyta	Ceramiaceae	*Aglaothamnion sp*	x															x									
Rhodophyta	Ceramiaceae	*Anotrichium tenue*											x			x		x							x	x	
Rhodophyta	Ceramiaceae	*Antithamnion antillanum*				x																					
Rhodophyta	Ceramiaceae	*Centroceras clavulatum*				x							x	x	x				x						x		
Rhodophyta	Ceramiaceae	*Ceramium clarionensis*	x	x																					x		
Rhodophyta	Ceramiaceae	*Ceramium flaccidum*											x		x										x	x	
Rhodophyta	Ceramiaceae	*Ceramium sp.*						x	x																		
Rhodophyta	Ceramiaceae	*Diplothamnion jolyi*																								x	
Rhodophyta	Ceramiaceae	*Griffithsia heteromorpha*													x			x									
Rhodophyta	Ceramiaceae	*Griffithsia sp.*																								x	
Rhodophyta	Ceramiaceae	*Herposiphonia crassa*						x																			
Rhodophyta	Ceramiaceae	*Herposiphonia nuda*											x														
Rhodophyta	Ceramiaceae	*Herposiphonia parca*													x												
Rhodophyta	Ceramiaceae	*Herposiphonia sp.*		x										x				x									
Rhodophyta	Ceramiaceae	*Polysiphonia sp.*																			x					x	
Rhodophyta	Ceramiaceae	*Spyridia filamentosa*	x	x									x	x													
Rhodophyta	Ceramiaceae	*Wrangelia elegantissima*													x										x	x	
Rhodophyta	Champiaceae	*Champia parvula*							x						x											x	

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Rhodophyta	Rhodomelaceae	*Acanthophora spicifera*		x				x					x	x	x	x	x		x		x						
Rhodophyta	Rhodomelaceae	*Chondracanthus acicularis*		x																							
Rhodophyta	Rhodomelaceae	*Chondria simpliciuscula*											x	x													
Rhodophyta	Rhodomelaceae	*Laurencia sp.*		x									x														
Rhodophyta	Rhodomelaceae	*Laurencia yamadana*													x												
Rhodophyta	Rhodomelaceae	*Neosiphonia sp*		x																							
Rhodophyta	Rhodomelaceae	*Tolypiocladia glomerulata*													x										x	x	
Rhodophyta	Rhodomelaceae	*Ululania stellata*											x														
Rhodophyta	Solieriaceae	*Eucheuma demticulatum*																					x				
Rhodophyta	Solieriaceae	*Kappaphycus alvarezii*								x							x										
Rhodophyta	Solieriaceae	*Kappaphycus sp.*		x				x		x	x			x	x	x	x	x					x				
Rhodophyta	Solieriaceae	*Kappaphycus striatum*		x						x					x	x							x				
Rhodophyta	Dasyaceae	*Heterosiphonia crispella*							x																		
Rhodophyta	Corallinaceae	*Amphiroa sp.*					x																				
Rhodophyta	Corallinaceae	*Hydrolithon reinboldii*						x																			
Rhodophyta	Corallinaceae	*Jania micarthrodia*												x												x	
Rhodophyta	Corallinaceae	*Lithophyllum sp.*					x																				
Rhodophyta	Corallinaceae	*Porolithon gardineri*					x								x								x				
Rhodophyta	Corallinaceae	*Porolithon onkodes*									x		x														
Rhodophyta	Corallinaceae	*Sporolithon erythraeum*				x																					
Rhodophyta	Delesseriaceae	*Martensia fragilis*			x										x			x									
Rhodophyta	Delesseriaceae	*Neomartensia flabelliformis*																								x	
Rhodophyta	Delesseriaceae	*Taenioma perpusillum*											x		x	x											
Rhodophyta	Galaxauraceae	*Galaxaura subverticillata*						x					x			x											
Rhodophyta	Gelidiellaceae	*Gelidiella machrisiana*																							x		
Rhodophyta	Gracilariaceae	*Gracilaria salicornia*		x				x		x			x	x	x	x	x	x	x		x		x		x		
Rhodophyta	Gracilariaceae	*Gracilaria coronopifolia*													x												

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Rhodophyta	Gracilariaceae	*Gracilaria parvispora*		x																							
Rhodophyta	Hypneaceae	*Hypnea chordacea*	x																								
Rhodophyta	Hypneaceae	*Hypnea musciformis*			x		x						x	x	x												
Rhodophyta	Hypneaceae	*Hypnea pannosa*			x				x																		
Rhodophyta	Hypneaceae	*Hypnea sp.*								x									x								
Rhodophyta	Hypneaceae	*Hypnea spinella*		x		x	x	x																			
Rhodophyta	Hypneaceae	*Hypneocolax stellaris*		x																							
Rhodophyta	Lomentariaceae	*Lomentaria hakodatensis*																								x	
Rhodophyta	Rhizophyllidaceae	*Desmia portieria*	x																								
Rhodophyta	Rhizophyllidaceae	*Portieria hornemannii*	x		x																						
Rhodophyta	Rhodymeniaceae	*Botryocladia skottsbergi*																								x	
Rhodophyta	Rhodymeniaceae	*Chrysymenia okamurae*																								x	
Rhodophyta	Kallymeniaceae	*Kallymenia sessilis*			x				x																		
		Total Algae	10	24	10	4	12	14	9	6	6	1	20	17	32	11	5	11	7	0	9	2	8	0	11	20	0
Spermatophyta	Hydrocharitaceae	*Halophila hawaiana*											x		x	x											
Spermatophyta	Hydrocharitaceae	*Halophila australis*								x			x			x									x		
Spermatophyta	Rhizophoraceae	*Rhizophora mangle*		x														x									
		Spermatophyta	0	1	0	0	0	0	0	1	0	0	2	0	1	2	0	1	0	0	0	0	0	0	1	0	0
Calcarea	Heteropiidae	*Heteropia glomerosa*												1													
Demospongiae	Plakinidae	*Plakortis sp.*	x																								
Demospongiae	Chondrillidae	*Chondrosia sp.*							x																		x
Demospongiae	Spirastrellidae	*Spheciospongia vagabunda*													x		x						x		x		
Demospongiae	Suberitidae	*Suberites zeteki*															x		x	x		x					
Demospongiae	Tethyidae	*Tethya sp.*			x		x													x						x	
Demospongiae	Microcionidae	*Clathria sp. (orange)*							x			x															x
Demospongiae	Microcionidae	*Clathria sp. (red)*	x																								x
Demospongiae	Coelosphaeridae	*Lissodendoryx Hawaiiana*					x	x							x		x							x			
Demospongiae	Crellidae	*Naniupi ula*	x									x															
Demospongiae	Phoriospongiidae	*Strongylacidon Kane`ohe*																						x			

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Demospongiae	Tedaniidae	*Tedania sp.*							x								x		x			x					
Demospongiae	Desmacellidae	*Biemna sp.*												x						x	x						
Demospongiae	Desmacididae	*Iotrochota sp.*										x		x	x	x	x				x				x		
Demospongiae	Mycalidae	*Mycale armata*															x		x			x			x		
Demospongiae	Mycalidae	*Mycale cecilia*	x							x						x	x		x			x				x	
Demospongiae	Mycalidae	*Mycale sp.*														x											
Demospongiae	Mycalidae	*Mycale sp.3*																								x	
Demospongiae	Mycalidae	*Mycale sp.4*																					x				
Demospongiae	Mycalidae	*Mycale sp.5*																						x			
Demospongiae	Mycalidae	*Stylinos sp.*														x											
Demospongiae	Mycalidae	*Zygomycale parishii*															x					x					
Demospongiae	Axinellidae	*Hymerhabdia sp.*	x																								
Demospongiae	Halichondriidae	*Axinyssa sp.*																									x
Demospongiae	Halichondriidae	*Halichondria melanadocia*															x			x							
Demospongiae	Halichondriidae	*Halichondria sp.*																	x			x					
Demospongiae	Callyspongiidae	*Callyspongia diffusa*									x						x										
Demospongiae	Callyspongiidae	*Callyspongia sp.*	x																		x						
Demospongiae	Chalinidae	*Adocia sp. (orange)*															x										
Demospongiae	Chalinidae	*Chalinidae n.sp. (purple)*	x							x							x			x							
Demospongiae	Chalinidae	*Haliclona permollis*														x											
Demospongiae	Chalinidae	*Haliclona sp.*																									x
Demospongiae	Chalinidae	*Sigmadocia caerulea*								x							x		x				x				
Demospongiae	Chalinidae	*Toxadocia sp.*																		x	x	x					
Demospongiae	Chalinidae	*Toxiclona sp.*													x												
Demospongiae	Chalinidae	*Toxochalina sp.1*													x												
Demospongiae	Chalinidae	*Toxochalina sp.2*	x				x	x			x																
Demospongiae	Niphatidae	*Gelliodes fibrosa*													x	x	x		x	x		x	x				
Demospongiae	Niphatidae	*Gelliodes sp.*												x					x	x							
Demospongiae	Niphatidae	*Gellius sp.1*														x			x								
Demospongiae	Niphatidae	*Gellius sp.2*														x	x										
Demospongiae	Dysideidae	*Dysidea arenaria*														x											
Demospongiae	Dysideidae	*Dysidea avara*																						x		x	
Demospongiae	Dysideidae	*Dysidea sp.*								x						x	x	x	x		x	x			x		
Demospongiae	Dysideidae	*Dysidea sp.1*	x								x	x		x					x	x						x	
Demospongiae	Dysideidae	*Dysidea sp.2*																						x		x	
Demospongiae	Dysideidae	*Dysidea sp.3*																								x	

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Demospongiae	Darwinellidae	*Aplysilla sp.*									x					x											
Demospongiae	Dictyodendrillidae	*Dictyodendrilla sp.*														x											
		Total Porifera	9	0	1	0	3	2	3	4	4	4	0	5	6	12	16	1	11	9	5	9	4	5	4	7	5
Hydrozoa	Agalopheniidae	*Lytocarpia niger*																									x
Hydrozoa	Campanulariidae	*Campanularia sp.*																									x
Hydrozoa	Campanulariidae	*Clytia latitheca*														x											
Hydrozoa	Campanulariidae	*Obelia bidentata*								x							x										
Hydrozoa	Campanulariidae	*Obelia dichotoma*																								x	
Hydrozoa	Clavidae	*Turritopsis nutricula*															x		x			x					
Hydrozoa	Haleciidae	*Halecium sp.*																								x	
Hydrozoa	Halopterididae	*Antennella secundaria*	x						x																		
Hydrozoa	Halocordylidae	*Pennaria disticha*				x	x	x		x				x		x	x		x		x		x	x		x	
Hydrozoa	Kirchenpaueriidae	*Ventromma halecioides*								x																	
Hydrozoa	Lafoeidae	*Anthohebella parasitica*																									x
Hydrozoa	Plumulariidae	*Halopteris polymorpha*	x																								x
Hydrozoa	Plumulariidae	*Halopteris sp.*	x							x				x	x												
Hydrozoa	Plumulariidae	*Plumularia floridana*			x																						
Hydrozoa	Plumulariidae	*Plumularia strictocarpa*	x						x							x											x
Hydrozoa	Sertulariidae	*Dynamena crisioides*																								x	
Hydrozoa	Sertulariidae	*Sertularella areyi*																									x
Hydrozoa	Sertulariidae	*Sertularella tongensis*																									x
Hydrozoa	Sertulariidae	*Sertularia ligulata*					x																				
Hydrozoa	Sertulariidae	*Sertularia sp.*					x																				
Hydrozoa	Sertulariidae	*Tridentata humpferi*							x																		
	Syntheciidae	*Synthecium megathecum*							x																		x
		Total Hydrozoa	4	0	1	1	3	1	4	4	0	0	0	2	1	3	3	0	2	0	1	1	1	1	0	4	8
Anthozoa	Clavulariidae	*Carijoa riisei*														x										x	
Anthozoa	Alcyoniidae	*Sinularia abrupta*																									x
Anthozoa	Xeniidae	*Anthelia edmondsoni*	x		x		x																				
Anthozoa	Xeniidae	*Sarcothelia n. sp.*			x	x	x																				
Anthozoa	Aiptasiidae	*Aiptasia pulchella*													x												x
Anthozoa	Acroporidae	*Montipora capitata*	x		x	x	x	x	x	x		x	x		x	x	x		x	x	x		x	x	x	x	x

															Station												
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Anthozoa	Acroporidae	*Montipora flabellata*					x	x	x		x				x		x	x				x				x	x
Anthozoa	Acroporidae	*Montipora patula*	x				x	x																			x
Anthozoa	Agariciidae	*Pavona varians*										x															
Anthozoa	Dendrophylliidae	*Tubastraea coccinea*									x					x											
Anthozoa	Faviidae	*Cyphastrea ocellina*									x																
Anthozoa	Faviidae	*Leptastrea purpurea*																									x
Anthozoa	Fungiidae	*Fungia scutaria*						x			x	x			x											x	
Anthozoa	Pocilloporidae	*Pocillopora damicornis*			x		x	x		x	x	x		x	x	x	x		x		x	x			x	x	
Anthozoa	Pocilloporidae	*Pocillopora eydouxi*	x						x																		
Anthozoa	Pocilloporidae	*Pocillopora meandrina*	x				x		x																		x
Anthozoa	Poritidae	*Porites compressa*	x		x		x	x	x	x	x	x			x	x	x		x		x	x	x		x	x	
Anthozoa	Poritidae	*Porites lobata*	x				x	x								x											x
Anthozoa	Zoanthidae	*Palythoa tuberculosa*																									x
		Total Anthozoa	7	0	5	2	9	7	5	3	6	5	1	1	6	6	4	1	3	1	3	3	2	1	3	6	9
Sipuncula	Aspidosiphonidae	*Aspidosiphon elegans*	x																		x						
Sipuncula	Phascolosomatidae	*Phascolosoma stephensoni*	x			x	x	x											x							x	
Sipuncula	Phascolosomatidae	*Phascolosoma scolops*	x																						x		
Sipuncula	Themistidae	*Themiste langeniformis*		x						x										x	x		x		x		
		Sipuncula	3	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	2	0	1	0	2	1	0
Polychaeta	Polynoidae	*Iphione muricata*	x					x																			
Polychaeta	Polynoidae	*Paralepidonotus ampulliferus*						x					x	x					x								
Polychaeta	Polynoidae	*Thormora atrata*	x		x				x				x									x					
Polychaeta	Polynoidae	*unid. Polynoidae*									x	x	x		x	x	x	x	x		x	x	x	x	x		x
Polychaeta	Chrysopetalidae	*Paleanotus sp.*	x		x																						x
Polychaeta	Amphinomidae	*Eurythoe complanata*							x					x	x				x					x	x		
Polychaeta	Phyllodocidae	*Eulalia sanguinea*															x							x			
Polychaeta	Phyllodocidae	*Phyllodoce sp.*										x							x								x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Polychaeta	Phyllodocidae	*Prophyllodoce Hawai`ia*			x																						
Polychaeta	Phyllodocidae	*unid. Phyllodocidae*				x			x		x			x	x		x	x	x		x		x	x			x
Polychaeta	Syllidae	*Branchiosyllis exilis*	x	x			x			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x
Polychaeta	Syllidae	*Exogone verugera*	x	x	x		x			x		x		x	x	x	x	x									
Polychaeta	Syllidae	*Haplosyllis spongicola*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Polychaeta	Syllidae	*Langerhansia cornuta*	x														x							x			
Polychaeta	Syllidae	*Myrianida crassicirrata*																				x		x			
Polychaeta	Syllidae	*Syllidae sp.15*				x																		x			
Polychaeta	Syllidae	*Syllidae sp.16*												x	x												x
Polychaeta	Syllidae	*Syllidae sp.17*								x			x														
Polychaeta	Syllidae	*Syllidae sp.6*	x							x										x							
Polychaeta	Syllidae	*Trypanosyllis hawaiiensis*																									x
Polychaeta	Syllidae	*Trypanosyllis zebra*	x				x		x	x		x		x	x		x	x	x							x	x
Polychaeta	Syllidae	*Typosyllis hyalina*	x		x							x															
Polychaeta	Syllidae	*Typosyllis prolifera*			x	x											x	x	x								
Polychaeta	Syllidae	*Typosyllis sp.*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Polychaeta	Syllidae	*Typosyllis sp.1*			x	x			x									x	x					x	x		x
Polychaeta	Syllidae	*unid. Syllidae*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Polychaeta	Nereididae	*Ceratonereis tentaculata*	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Polychaeta	Nereididae	*Nereididae sp.3*		x			x	x							x			x				x	x			x	
Polychaeta	Nereididae	*Platynereis sp.*															x		x								
Polychaeta	Nereididae	*unid. Nereididae*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Polychaeta	Eunicidae	*Eunice afra*		x	x		x						x		x				x								
Polychaeta	Eunicidae	*Eunice antennata*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Polychaeta	Eunicidae	*Eunice australis*							x	x	x			x			x	x	x				x				
Polychaeta	Eunicidae	*Eunice cariboea*	x	x	x		x		x	x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x
Polychaeta	Eunicidae	*Eunice filamentosa*	x		x									x						x	x	x	x	x		x	x
Polychaeta	Eunicidae	*Lysidice ninetta*	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x
Polychaeta	Eunicidae	*Nematonereis unicornis*	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Polychaeta	Eunicidae	*Palola siciliensis*		x																							
Polychaeta	Lumbrineridae	*Lumbrineris sp.*	x	x	x		x		x	x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Polychaeta	Dorvilleidae	*Dorvillea sp.*	x	x	x		x	x	x	x	x	x			x	x	x	x	x		x				x		x
Polychaeta	Spionidae	*unid. Spionidae*			x		x								x												
Polychaeta	Cirratulidae	*Cirriformia punctata*									x	x		x	x	x	x	x			x	x	x			x	
Polychaeta	Cirratulidae	*Cirriformia sp.*	x	x			x	x	x	x		x	x			x	x		x			x		x			x
Polychaeta	Chaetopteridae	*Chaetopterus sp.*	x	x					x	x	x	x	x		x	x	x	x	x	x	x	x	x	x			
Polychaeta	Sternaspidae	*Sternaspis sp.*			x	x	x	x			x	x			x					x			x			x	
Polychaeta	Terebellidae	*Loimia medusa*								x						x	x						x			x	
Polychaeta	Terebellidae	*Loimia medusa*	x																								
Polychaeta	Sabellidae	*Branchiomma nigromaculata*							x	x				x	x	x	x	x	x	x		x					
Polychaeta	Sabellidae	*Megalomma intermedium*										x				x	x					x			x		
Polychaeta	Sabellidae	*Sabellastarte spectabilis*						x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Polychaeta	Sabellidae	*unid. Sabellidae*	x	x			x		x	x		x	x	x	x	x			x	x		x					x
Polychaeta	Serpulidae	*Hydroides brachyacantha*																									x
Polychaeta	Serpulidae	*Hydroides elegans*																			x	x		x			
Polychaeta	Serpulidae	*Pomatoleios kraussii*																		x	x			x			
Polychaeta	Serpulidae	*Pseudovermilia occidentalis*							x																		
Polychaeta	Serpulidae	*Salmacina dysteri*														x			x					x			
Polychaeta	Serpulidae	*Serpula sp.*								x	x			x	x		x			x	x					x	
Polychaeta	Serpulidae	*Spirobranchus giganteus corniculatus*															x										x
Polychaeta	Serpulidae	*unid. Serpulidae*																x									
Polychaeta	Serpulidae	*Vermiliopsis sp.1*			x																						
Polychaeta	Serpulidae	*Vermiliopsis torquata*		x					x		x				x			x	x								
Polychaeta	Spirorbidae	*unid. Spirorbidae*	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x		x	x		x			
		Total Polychaeta	26	21	24	10	21	14	24	25	21	25	19	25	29	24	30	27	31	17	21	25	20	27	17	17	22
Gastropoda	Scissurellidae	*Sinezona insignis*	x		x																						x
Gastropoda	Fissurellidae	*Diodora granifera*			x								x			x		x	x								x
Gastropoda	Fissurellidae	*Diodora octagona*	x							x		x	x					x			x		x		x		

			Station																								
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Gastropoda	Fissurellidae	*Diodora ruppelli*	x																								
Gastropoda	Fissurellidae	*Diodora sp.*	x		x		x		x			x	x	x	x		x	x	x				x		x		x
Gastropoda	Fissurellidae	*Diodora sp. cf. quadriradiata*										x	x										x				
Gastropoda	Phasianellidae	*Tricolia (Hiloa) variabilis*	x						x																		x
Gastropoda	Skeneidae	*Lophocochlias minutissimus*	x																								
Gastropoda	Skeneidae	*Lophocochlias sp.*							x																		
Gastropoda	Stomatellidae	*Synaptocochlea concinna*			x		x	x	x		x	x															x
Gastropoda	Trochidae	*Euchelus gemmatus*	x		x		x						x		x		x				x						
Gastropoda	Trochidae	*Gibbula marmorea*	x						x																		x
Gastropoda	Trochidae	*Alcyna ocellata*	x				x																				x
Gastropoda	Trochidae	*Alcyna sp.*			x				x																		
Gastropoda	Trochidae	*Trochus intextus*	x				x					x		x	x		x		x		x						x
Gastropoda	Trochidae	*Trochus sp.*	x				x																		x		
Gastropoda	Trochidae	*Leptothyra rubricincta*	x		x		x		x				x	x	x	x			x								x
Gastropoda	Trochidae	*Leptothyra verruca*					x																				
Gastropoda	Trochidae	*Turbo sandwicensis*																									x
Gastropoda	Neritidae	*Nerita picea*																									x
Gastropoda	Neritidae	*Smaragdia bryanae*											x														
Gastropoda	Phenacolepadidae	*Phenacolepas scobinata*											x				x		x		x						
Gastropoda	Cerithiidae	*Bittium impendens*									x																
Gastropoda	Cerithiidae	*Bittium parcum*			x								x	x			x										x
Gastropoda	Cerithiidae	*Cerithium boeticum*			x		x				x	x	x				x		x		x		x				
Gastropoda	Cerithiidae	*Cerithium columna*					x																				
Gastropoda	Cerithiidae	*Cerithium egenum*																									x
Gastropoda	Cerithiidae	*Cerithium nesioticum*	x											x	x												
Gastropoda	Cerithiidae	*Cerithium rostratum*											x														
Gastropoda	Cerithiidae	*Cerithium sp.*			x								x														

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gastropoda	Cerithiidae	*Cerithium zebrum*			x					x			x	x	x						x				x		
Gastropoda	Dialidae	*Cerithidium perparvulum*	x														x										
Gastropoda	Dialidae	*Diala semistriata*	x									x															
Gastropoda	Obtortionidae	*Finella pupoides*											x								x						
Gastropoda	Obtortionidae	*Finella sp.*												x	x												
Gastropoda	Littorinidae	*Littoraria pintado*																									x
Gastropoda	Littorinidae	*Littoraria scabra*	x				x							x					x	x		x		x		x	
Gastropoda	Littorinidae	*Littoraria undulata*																									x
Gastropoda	Littorinidae	*Peasiella tantilla*								x																	x
Gastropoda	Eatoniellidae	*Eatoniella (Caveatoniella) janetaylorae*									x		x				x								x		
Gastropoda	Assimeneidae	*Assiminea nitida*															x										
Gastropoda	Barleeidae	*Barleeia calcarea*																									x
Gastropoda	Caecidae	*Caecum arcuatum*																x									x
Gastropoda	Caecidae	*Caecum glabriformis*					x																				
Gastropoda	Caecidae	*Caecum sepimentum*	x																								
Gastropoda	Rissoidae	*Alvinia isolata*																									x
Gastropoda	Rissoidae	*Vitricithna marmorata*	x						x				x	x	x												x
Gastropoda	Rissoidae	*Isselia hiloense*	x																								
Gastropoda	Rissoidae	*Merelina sp.*	x																								
Gastropoda	Rissoidae	*Rissoina ambigua*	x				x								x												
Gastropoda	Rissoidae	*Rissoina cerithiiformis*	x		x		x		x		x	x	x	x	x		x	x	x								x
Gastropoda	Rissoidae	*Rissoina costata*	x										x	x													
Gastropoda	Rissoidae	*Schwartziella ephamilla*																									x
Gastropoda	Rissoidae	*Schwartziella triticea*	x																								x
Gastropoda	Rissoidae	*Zebina sp.*										x															
Gastropoda	Rissoidae	*Zebina tridentata*	x					x			x																
Gastropoda	Hipponicidae	*Hipponix (Antisabia) foliaceus*	x	x			x				x		x					x	x		x						x

			Station																								
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Gastropoda	Hipponicidae	*Hipponix (Pilosabia) pilosus*	x	x	x		x			x	x	x	x	x	x	x	x	x	x	x	x		x				
Gastropoda	Hipponicidae	*Hipponix australis*																									x
Gastropoda	Hipponicidae	*Hipponix sp.*									x		x		x												
Gastropoda	Calyptraeidae	*Cheilea equestris*																						x			
Gastropoda	Calyptraeidae	*Crepidula aculeata*	x	x	x	x	x		x	x	x	x		x		x	x	x	x	x	x		x	x			x
Gastropoda	Calyptraeidae	*Crepidula sp.*														x											
Gastropoda	Calyptraeidae	*Crucibulum spinosum*				x				x							x		x	x	x						
Gastropoda	Vermetidae	*Cephalaspidea sp.*															x							x			x
Gastropoda	Vermetidae	*Dendropoma platypus*																									x
Gastropoda	Vermetidae	*Dendropoma psarocephala*		x																							
Gastropoda	Vermetidae	*Dendropoma sp.*					x																				
Gastropoda	Vermetidae	*Eualetes tulipa*		x						x				x			x		x		x			x		x	
Gastropoda	Vermetidae	*Petaloconchus keenae*	x											x			x		x		x						
Gastropoda	Vermetidae	*Serpulorbis variabilis*															x										
Gastropoda	Cypraeidae	*Cypraea minoridens*																									x
Gastropoda	Triviidae	*Trivia edgari*									x																
Gastropoda	Triviidae	*Trivia hordacea*					x	x																			
Gastropoda	Triviidae	*Trivia pellucida*									x																
Gastropoda	Triviidae	*Trivia sp.*	x				x																				
Gastropoda	Naticidae	*Natica gualteriana*											x														
Gastropoda	Cerithiopsidae	*Joculator sp.*			x		x					x															
Gastropoda	Cerithiopsidae	*Joculator uveanum*																			x						
Gastropoda	Triphoridae	*Iniforis aemulans*																	x								x
Gastropoda	Triphoridae	*Cautor intermissa*	x				x																				
Gastropoda	Triphoridae	*Litharium oceanida*																	x								
Gastropoda	Triphoridae	*Mastonia cingulifera*																									x
Gastropoda	Triphoridae	*Viriola fallax*					x		x																		x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gastropoda	Triphoridae	*Viriola flammulata*																	x								
Gastropoda	Triphoridae	*Metaxia albicephala*	x																								
Gastropoda	Triphoridae	*Triphora coralina*																									x
Gastropoda	Triphoridae	*Triphora pallida*	x				x		x																		
Gastropoda	Triphoridae	*Triphora sp.*																									x
Gastropoda	Epitoniidae	*Cycloscala hyalina*												x	x	x	x	x	x		x						
Gastropoda	Epitoniidae	*Epitonium fucatum*									x																
Gastropoda	Epitoniidae	*Epitonium paumotensis*			x																						
Gastropoda	Epitoniidae	*Epitonium sp.*	x																								
Gastropoda	Epitoniidae	*Laeviscala sp.*																			x						
Gastropoda	Eulimidae	*Balcis acanthyllis*	x				x		x					x	x												
Gastropoda	Eulimidae	*Balcis aciculata*													x	x											
Gastropoda	Eulimidae	*Balcis conoidalis*												x			x										
Gastropoda	Eulimidae	*Balcis inflexa*												x													
Gastropoda	Eulimidae	*Balcis kanaka*													x												
Gastropoda	Eulimidae	*Balcis sp.*	x						x				x			x			x					x			
Gastropoda	Eulimidae	*Balcis thaanumi*										x						x									
Gastropoda	Eulimidae	*Eulima metcalfei*	x																								
Gastropoda	Buccinidae	*Caducifer decapitata*																									x
Gastropoda	Buccinidae	*Engina albocincta*																									x
Gastropoda	Buccinidae	*Prodotia ignea*											x														x
Gastropoda	Columbellidae	*Anachis miser*																									x
Gastropoda	Columbellidae	*Mitrella loyaltensis*							x				x								x				x		
Gastropoda	Columbellidae	*Mitrella margarita*																									x
Gastropoda	Columbellidae	*Mitrella rorida*					x																				x
Gastropoda	Columbellidae	*Mitrella sp.*															x										
Gastropoda	Columbellidae	*Seminella peasei*	x				x		x		x	x	x	x	x	x		x	x		x		x	x			x
Gastropoda	Columbellidae	*Seminella smithi*																									x
Gastropoda	Columbellidae	*Seminella sp.*	x						x						x												
Gastropoda	Coralliophilidae	*Quoyula madreporarum*																									x
Gastropoda	Fasciolariidae	*Peristernia chlorostoma*											x						x								

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gastropoda	Muricidae	*Muricodrupa funiculus*																	x								
Gastropoda	Thaididae	*Drupa (Drupa) ricina*																									x
Gastropoda	Thaididae	*Maculotriton sp.*												x													
Gastropoda	Thaididae	*Morula dumosa*																									x
Gastropoda	Thaididae	*Morula foliacea*																									x
Gastropoda	Thaididae	*Morula uva*																									x
Gastropoda	Costellariidae	*Vexillum (Pusia) lautum*																									x
Gastropoda	Costellariidae	*Vexillum (Pusia) tusum*																									x
Gastropoda	Marginellidae	*Cystiscus huna*																					x				
Gastropoda	Marginellidae	*Granula sandwicensis*	x																								
Gastropoda	Marginellidae	*Volvarina fusiformis*					x																				
Gastropoda	Mitridae	*Mitra (Nebularia) cucumerina*																									x
Gastropoda	Mitridae	*Mitra (Nebularia) luctuosa*																									x
Gastropoda	Mitridae	*Mitra (Strigatella) litterata*					x																				
Gastropoda	Mitridae	*Mitra (Strigatella) saltata*																									x
Gastropoda	Conidae	*Conus rattus*																									x
Gastropoda	Conidae	*Conus sp.*																									x
Gastropoda	Terebridae	*Terebra cerithina*																					x				
Gastropoda	Turridae	*Carinapex minutissima*	x																								
Gastropoda	Turridae	*Clavus (Tylotiella) sp.*												x													
Gastropoda	Turridae	*Clavus sp.*																	x								
Gastropoda	Turridae	*Daphnella interrupta*							x																		
Gastropoda	Turridae	*Mitrolumna metula*																									x
Gastropoda	Orbitestellidae	*Orbitestella regina*	x																								
Gastropoda	Orbitestellidae	*Orbitestella sp.*													x												
Gastropoda	Rissoellidae	*Rissoella confusa confusa*																									x
Gastropoda	Rissoellidae	*Rissoella longispira*	x				x		x			x			x		x										

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gastropoda	Pyramidellidae	*Herviera gliriella*					x		x		x	x		x	x		x				x						
Gastropoda	Pyramidellidae	*Hinemoa indica*	x				x		x	x	x	x		x	x	x					x						
Gastropoda	Pyramidellidae	*Miralda paulbartschi*	x																								
Gastropoda	Pyramidellidae	*Odostomia sp.*															x										
Gastropoda	Pyramidellidae	*Odostomia stearnsiella*	x		x				x		x	x		x		x	x				x						
Gastropoda	Pyramidellidae	*Pyramidella sulcata*												x													
Gastropoda	Pyramidellidae	*Pyrgulina oodes*	x										x				x										
Gastropoda	Pyramidellidae	*Pyrgulina sp.*												x													
Gastropoda	Pyramidellidae	*Turbonilla lirata*														x											
Gastropoda	Hamineidae	*Atys debilis*								x																	
Gastropoda	Hamineidae	*Atys kuhnsi*										x											x		x		
Gastropoda	Hamineidae	*Atys semistriata*	x		x					x	x	x	x	x	x	x	x	x	x			x		x			
Gastropoda	Hamineidae	*Atys sp.*								x																	
Gastropoda	Hamineidae	*Haminoea sp.*													x		x										
Gastropoda	Aglajidae	*Philine sp.*												x													
Gastropoda	Scaphandridae	*Acteocina hawaiensis*																			x						
Gastropoda	Scaphandridae	*Cylichna pusilla*	x																								
Gastropoda	Aplysiidae	*Aplysia sp.*												x	x												
Gastropoda	Aplysiidae	*Stylocheilus longicaudatus*												x	x												
Gastropoda	Juliidae	*Julia exquisita*	x																								
Gastropoda	Plakobranchidae	*Plakobranchus ocellatus*																			x						
Gastropoda	Hexabranchidae	*Hexabranchus sp.*									x																
Gastropoda	Siphonariidae	*Siphonaria normalis*								x				x		x					x		x	x			
Gastropoda	Siphonariidae	*Williamia radiata*																									x
		Tot. Gastropoda	50	5	18	2	32	3	22	12	19	20	29	32	26	14	27	12	24	4	24	2	11	9	7	2	57
Bivalvia	Mytilidae	*Adipicola crypta*	x				x																				
Bivalvia	Mytilidae	*Brachidontes crebristriatus*		x		x	x			x				x					x	x			x	x	x		
Bivalvia	Mytilidae	*Crenella sp.*	x		x				x		x				x				x								
Bivalvia	Mytilidae	*Musculus aviarius*	x									x															
Bivalvia	Mytilidae	*Septifer bryanae*	x																								x
Bivalvia	Arcidae	*Barbatia (Acar) divaricata*	x																								
Bivalvia	Arcidae	*Barbatia nuttingi*							x		x				x			x									

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Bivalvia	Arcidae	*Barbatia sp.*			x		x								x				x								
Bivalvia	Isognomonidae	*Isognomon californicum*				x												x		x							
Bivalvia	Isognomonidae	*Isognomon incisum*														x											
Bivalvia	Isognomonidae	*Isognomon legumen*					x														x						
Bivalvia	Isognomonidae	*Isognomon perna*					x	x		x				x				x									
Bivalvia	Isognomonidae	*Isognomon sp.*				x				x				x		x											x
Bivalvia	Malleidae	*Malleus regula*								x																	x
Bivalvia	Pteriidae	*Pinctada margaritifera*														x			x								
Bivalvia	Pteriidae	*Pinctada sp.*			x																						
Bivalvia	Ostreidae	*Crassostrea gigas*								x										x							
Bivalvia	Ostreidae	*Crassostrea virginica*														x											
Bivalvia	Ostreidae	*Dendostrea sandvicensis*		x	x	x	x		x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x
Bivalvia	Pectinidae	*Chlamys coruscans hawaiensis*																									x
Bivalvia	Pectinidae	*Chlamys irregularis*																			x						
Bivalvia	Propeamusiidae	*Chlamydella incubata*																									x
Bivalvia	Propeamusiidae	*Chlamydella sp.*	x				x		x		x				x												
Bivalvia	Propeamusiidae	*Chlamydella tenuissima*			x																						
Bivalvia	Spondylidae	*Spondylus violacescens*																									x
Bivalvia	Anomiidae	*Anomia nobilis*															x			x							
Bivalvia	Chamidae	*Chama fibula*	x													x			x			x	x				
Bivalvia	Chamidae	*Chama iostoma*																			x						
Bivalvia	Lucinidae	*Ctena bella*										x							x		x						
Bivalvia	Lucinidae	*Ctena transversa*					x																				
Bivalvia	Lucinidae	*Epicodakia pygmaea*							x										x								
Bivalvia	Lucinidae	*Epicodakia sp.*																					x				
Bivalvia	Hiatellidae	*Hiatella arctica*																									x
Bivalvia	Teredinidae	*Teredo sp.*															x										
Bivalvia	Veneridae	*Irus sp.*										x															

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Bivalvia	Veneridae	*Lioconcha hieroglyphica*										x		x			x		x				x				
Bivalvia	Veneridae	*Venerupis philippinarum*																	x								
Bivalvia	Galeommatidae	*Scintilla hiloa*					x																		x		
Bivalvia	Galeommatidae	*Scintillona stigmatica*					x																				
Bivalvia	Lasaeidae	*Kellia hawaiensis*	x																								x
Bivalvia	Lasaeidae	*Kellia sp.*					x																				
Bivalvia	Lasaeidae	*Lasaea hawaiensis*					x		x	x						x			x		x			x			
Bivalvia	Lasaeidae	*Radobornia bryani*			x																						
Bivalvia	Cardiidae	*Fragum (Fragum) mundum*																									x
Bivalvia	Carditidae	*Cardita aviculina*	x																								
Bivalvia	Tellinidae	*Macoma (Scissulina) dispar*					x											x									
Bivalvia	Tellinidae	*Tellina (Arcopagia) robusta*								x			x														
Bivalvia	Tellinidae	*Tellina (Quidnipagus) palatam*																	x								
Bivalvia	Mesodesmatidae	*Ervilia bisculpta*					x																				
Bivalvia	Mesodesmatidae	*Ervilia sandwichensis*					x																				
Bivalvia	Nuculidae	*Nucula hawaiensis*					x																				
		Total Bivalvia	9	2	6	4	16	1	6	8	4	5	1	5	4	7	4	5	12	5	6	2	5	3	3	1	10
Polyplacophora	Acanthochitonidae	*Acanthochiton sp.*								x							x	x	x								
Polyplacophora	Ischnochitonidae	*Ischnochiton sp.*	x		x			x	x																		x
		Polyplacophora	1	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1
Pycnogonida	Ammotheidae	*Ammothella pacifica*	x						x																		
Pycnogonida	Ammotheidae	*Tanystylum rehderi*																									x
Pycnogonida	Callipallenidae	*Callipallene sp.*							x																		
Pycnogonida	Callipallenidae	*Pigrogromitus timsanus*															x										

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Pycnogonida	Phoxichilidiidae	*Anoplodactylus arescus*													x												
Pycnogonida	Phoxichilidiidae	*Anoplodactylus californicus*				x																					
Pycnogonida	Phoxichilidiidae	*Anoplodactylus digitatus*					x																				
Pycnogonida	Phoxichilidiidae	*Anoplodactylus marshallensis*												x		x											
Pycnogonida	Phoxichilidiidae	*Anoplodactylus pycnosoma*																									x
Pycnogonida	Phoxichilidiidae	*Anoplodactylus sp.*															x										
		Pycnogonida	3	0	2	1	1	2	4	1	0	0	0	1	1	1	3	1	1	0	0	0	0	0	0	0	4
Cirrepedia	Balanidae	*Balanus amphitrite*			x													x		x							
Cirrepedia	Balanidae	*Balanus eburneus*																		x							
Cirrepedia	Balanidae	*Balanus trigonus*				x				x						x			x	x				x			
Cirrepedia	Chthamalidae	*Chthamalus proteus*		x						x				x		x			x		x	x		x		x	
Cirrepedia	Chthamalidae	*Nesochthamalus intertextus*																									x
		Cirrepedia	0	1	1	1	0	0	0	2	0	0	0	1	0	2	0	1	2	3	1	1	0	2	0	1	1
Peracarida	Amphilochidae	*Amphilochus menehune*																								x	
Peracarida	Amphilochidae	*Amphilochus sp.*	x	x				x	x		x		x	x	x	x	x	x									
Peracarida	Ampithoidae	*Ampithoe spp.*										x				x			x				x	x		x	
Peracarida	Ampithoidae	*Ampithoe waialua*																									x
Peracarida	Anamixidae	*Anamixis moana*		x			x	x	x		x	x		x	x			x					x		x		
Peracarida	Aoridae	*Bemlos spp.*	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x		x		x				
Peracarida	Aoridae	*Bemlos waipio*																								x	
Peracarida	Colomastigidae	*Colomastix kapiolani*																								x	
Peracarida	Colomastigidae	*Colomastix lunalilo*	x	x	x	x				x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Peracarida	Colomastigidae	*Colomastix pusilla*	x			x	x	x	x	x		x				x	x	x	x	x			x	x			
Peracarida	Corophiidae	*Corophium spp.*				x				x									x	x							
Peracarida	Corophiidae	*Ericthonius brasiliensis*		x		x		x																			
Peracarida	Eusiridae	*Eursiroides diplonyx*															x										x
Peracarida	Gammaridae	*Eriopisa hamakua*																								x	

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Peracarida	Isaeidae	*Photis hawaiensis*	x			x			x						x											x	x
Peracarida	Ischyroceridae	*Leucothoe hyhelia*	x	x	x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	
Peracarida	Ischyroceridae	*Leucothoe micronesiae*						x	x	x		x						x						x		x	
Peracarida	Ischyroceridae	*Leucothoe sp.*															x										
Peracarida	Ischyroceridae	*Leucothoe tridens*	x					x						x	x		x		x				x	x	x	x	
Peracarida	Leucothoidae	*Paraleucothoe flindersi*												x		x						x	x	x		x	
Peracarida	Liljeborgiidae	*Liljeborgia heeia*		x						x	x	x						x	x		x			x			x
Peracarida	Lysianassidae	*Lysianassa ewa*	x	x			x																				
Peracarida	Melitidae	*Elasmopus rapax*																								x	
Peracarida	Melitidae	*Elasmopus spp.*	x				x		x		x	x		x			x								x	x	
Peracarida	Melitidae	*Maera insignis*	x	x					x				x	x	x	x		x							x	x	
Peracarida	Melitidae	*Maera pacifica*	x		x		x	x	x	x	x	x						x		x		x	x		x		
Peracarida	Melitidae	*Maera quadrimana*									x			x	x										x		x
Peracarida	Melitidae	*Maera serrata*			x		x		x		x	x		x	x			x					x			x	
Peracarida	Ochelesidae	*Ochlesis alii*	x																								
Peracarida	Stenothoidae	*Stenothoe gallensis*																								x	
Peracarida	Stenothoidae	*Stenothoe sp.*				x													x								x
Peracarida	Stenothoidae	*Stenothoe valida*																								x	
Peracarida	Anthuridae	*Apanthura sp.*	x				x	x						x	x	x											
Peracarida	Anthuridae	*Mesanthura sp.*	x											x	x	x	x	x									x
Peracarida	Anthuridae	*Pendanthura sp.*	x																								
Peracarida	Paranthuridae	*Paranthura sp.*	x		x									x	x												x
Peracarida	Cirolanidae	*Cirolana sp.*					x		x	x					x			x									x
Peracarida	Cirolanidae	*Metacirolana sphaeromiformia*	x				x		x					x													
Peracarida	Limnoriidae	*Limnoria sp.*				x											x										x
Peracarida	Sphaeromatidae	*Neonaesa rugosa*	x		x		x		x		x	x			x			x									x
Peracarida	Sphaeromatidae	*Paracerceis sculpta*		x						x				x							x						
Peracarida	Sphaeromatidae	*Paradella dianae*																				x					
Peracarida	Sphaeromatidae	*unid. Sphaeromatidae*														x								x			
Peracarida	Janiridae	*Carpias algicola*	x	x	x		x	x	x		x		x	x	x	x		x	x				x		x	x	x
Peracarida	Janiridae	*Carpias sp.*							x																		

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Peracarida	Joeropsidae	*Joeropsis sp.*	x		x		x																				x
Peracarida	Munnidae	*Munna n.sp.*												x	x												x
Peracarida	Paramunnidae	*Paramunna sp.*	x						x																		
Peracarida	Stenetriidae	*Stenetrium sp.*	x		x		x		x		x	x			x	x											x
Peracarida	Nannastacidae	*Vaunthompsoni n. sp.*	x																								
Peracarida	Nannastacidae	*Scherocumella n. sp.*												x													
Peracarida	Nannastacidae	*Nannastacus n. sp.*																	x								
		Total Peracarida	22	11	10	8	15	10	17	10	13	12	5	18	18	13	11	15	10	5	5	5	11	9	8	18	16
Decapoda	Gonodactylidae	*Gonodactylaceus falcatus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x			x	x		x
Decapoda	Gonodactylidae	*Gonodactylellus hendersoni*	x	x																							
Decapoda	Pseudosquillidae	*Pseudosquilla ciliata*											x		x												
Decapoda	Stenopodidae	*Stenopus hispidus*										x															
Decapoda	Alpheidae	*Alpheus brevipes*	x				x	x																			x
Decapoda	Alpheidae	*Alpheus clypeatus*	x				x						x														x
Decapoda	Alpheidae	*Alpheus collumianus*	x		x									x													
Decapoda	Alpheidae	*Alpheus diadema*	x																						x		
Decapoda	Alpheidae	*Alpheus gracilipes*			x	x		x		x	x			x				x	x								
Decapoda	Alpheidae	*Alpheus lobidens*		x									x	x	x			x							x		
Decapoda	Alpheidae	*Alpheus mackayi*		x																							
Decapoda	Alpheidae	*Alpheus paracrinatus*	x									x		x	x												
Decapoda	Alpheidae	*Alpheus paralcyone*	x																							x	
Decapoda	Alpheidae	*Alpheus pugnax*							x									x									
Decapoda	Alpheidae	*Alpheus rapax*							x																		
Decapoda	Alpheidae	*Alpheus rapicida*							x																		
Decapoda	Alpheidae	*Metalpheus paragracilis*	x				x			x								x									x
Decapoda	Alpheidae	*Synalpheus bituberculatus*								x						x		x	x		x	x	x	x		x	
Decapoda	Alpheidae	*Synalpheus paraneomeris*					x			x																	x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Decapoda	Alpheidae	*Synalpheus streptodactylus*	x			x				x	x	x		x	x	x	x		x	x	x	x	x	x		x	
Decapoda	Cryptochiridae	*Hapalocarcinus marsupialis*													x												
Decapoda	Grapsidae	*Grapsus grapsus*				x																x					
Decapoda	Grapsidae	*Percnon abbreviatum*																									x
Decapoda	Grapsidae	*Percnon planissimum*																									x
Decapoda	Grapsidae	*Plagusia tuberculata*										x													x		
Decapoda	Portunidae	*Thalamita edwardsi*				x							x		x	x	x		x		x	x			x		
Decapoda	Portunidae	*Thalamita integra*		x								x	x	x			x										
Decapoda	Portunidae	*Thalamita sp.*								x																	
Decapoda	Pilumnidae	*Pilumnus longicornis*														x						x		x			x
Decapoda	Pilumnidae	*Pilumnus oahuensis*	x	x		x				x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
Decapoda	Trapeziidae	*Domecia hispida*																									x
Decapoda	Trapeziidae	*Jonesius triunguiculatus*					x																				
Decapoda	Trapeziidae	*Trapezia intermedia*							x																		x
Decapoda	Panopeidae	*Panopeus pacificus*				x														x		x					
Decapoda	Xanthidae	*Chlorodiella cytherea*			x	x				x	x	x	x	x	x	x	x	x	x		x	x	x		x		
Decapoda	Xanthidae	*Chlorodiella laevissima*	x		x		x		x	x	x	x			x			x									x
Decapoda	Xanthidae	*Etisus electra*													x	x	x	x			x						
Decapoda	Xanthidae	*Etisus laevimanus*		x								x	x		x		x		x		x				x		
Decapoda	Xanthidae	*Liocarpilodes biunguis*						x			x							x									
Decapoda	Xanthidae	*Liocarpilodes integerrimus*					x																				x
Decapoda	Xanthidae	*Liomera bella*	x	x	x		x	x		x	x	x	x	x	x			x									
Decapoda	Xanthidae	*Lophozozymus pulchellus*							x																		
Decapoda	Xanthidae	*Lybia edmondsoni*	x																								
Decapoda	Xanthidae	*Paramedaeus simplex*						x										x									

															Station												
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Decapoda	Xanthidae	*Paraxanthias notatus*																									x
Decapoda	Xanthidae	*Phymodius monticulosus*					x	x			x	x	x	x	x		x	x					x		x		
Decapoda	Xanthidae	*Phymodius nitidus*					x																				
Decapoda	Xanthidae	*Phymodius sp.*	x						x							x											
Decapoda	Xanthidae	*Phymodius ungulatus*	x					x		x		x			x	x		x					x				
Decapoda	Xanthidae	*Pilodius areolatus*	x				x		x						x										x		
Decapoda	Xanthidae	*Platypodia eydouxii*	x		x		x			x		x															
Decapoda	Xanthidae	*Platypodia semigranosa*																									x
Decapoda	Xanthidae	*Platypodia sp.*							x									x	x				x			x	
Decapoda	Xanthidae	*Pseudoliomera variolosa*	x																								x
Decapoda	Xanthidae	*Tweedieia laysani*																									x
Decapoda	Xanthidae	*unid. Xanthidae*	x				x																				
Decapoda	Xanthidae	*Xanthias canaliculatus*																									x
Decapoda	Xanthidae	*Xanthias latifrons*																									x
Decapoda	Dromiidae	*Cryptodromiopsis tridens*							x																		
Decapoda	Dynomeniidae	*Dynomene hispida*																									x
Decapoda	Majidae	*Hyastenus tenuicornis*	x																								
Decapoda	Majidae	*Perinea tumida*																									x
Decapoda	Majidae	*Schizophorida hilensis*	x			x						x		x			x										x
Decapoda	Majidae	*Simocarcinus simplex*			x										x												
Decapoda	Majidae	*Trigonothir sp.*					x																				
Decapoda	Leucosiidae	*Nucia sp.*							x																		
Decapoda	Callianassidae	*Callianassa sp.*		x																							
Decapoda	Galatheidae	*Galathea spinosorostris*			x																						x
Decapoda	Porcellanidae	*Petrolisthes sp.*																									x
		Total Decapoda	22	9	9	9	15	8	12	13	9	15	10	12	17	10	10	16	9	3	8	8	7	5	10	5	23

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gymnolaemata	Beaniidae	*Beania discodermiae*							x																		
Gymnolaemata	Bugulidae	*Bugula neritina*																						x			
Gymnolaemata	Bugulidae	*Bugula robusta*				x						x		x	x	x	x		x	x	x			x			
Gymnolaemata	Bugulidae	*Bugula sp.*														x											
Gymnolaemata	Bugulidae	*Bugula vectifera*				x																					
Gymnolaemata	Bugulidae	*Caulibugula dendrograpta*	x																								
Gymnolaemata	Celleporidae	*Celleporaria aperta*		x	x																						
Gymnolaemata	Celleporidae	*Celleporaria fusca*						x																			
Gymnolaemata	Celleporidae	*Celleporaria pilaefera*								x																	
Gymnolaemata	Celleporidae	*Celleporaria sp.*	x		x		x		x		x	x															
Gymnolaemata	Celleporidae	*Celleporaria vagans*	x		x			x																			
Gymnolaemata	Chorizoporidae	*Rhamphostomella argentea*							x		x																
Gymnolaemata	Scrupocellariidae	*Caberia boryi*	x					x																			
Gymnolaemata	Cleidochasmatidae	*Cleidochasma laterale*			x																						
Gymnolaemata	Cleidochasmatidae	*Diaperoforma sp.*	x		x		x	x	x	x	x																
Gymnolaemata	Cleidochasmatidae	*Hippoporella calyciformis*									x																
Gymnolaemata	Scrupocellariidae	*Scrupocellaria maderensis*	x						x																		x
Gymnolaemata	Hippopodinidae	*Cosciniopsis fusca*							x		x																
Gymnolaemata	Margarettidae	*Margaretta gracilior*	x				x	x	x		x				x												
Gymnolaemata	Margarettidae	*Margaretta tenuis*					x																				
Gymnolaemata	Margarettidae	*Margaretta watersi*	x						x																		
Gymnolaemata	Savignyellidae	*Savignyella lafontii*													x		x			x							
Gymnolaemata	Schizoporellidae	*Schizomavella sp.*																									x
Gymnolaemata	Schizoporellidae	*Schizoporella cf. errata*				x				x									x		x	x				x	
Gymnolaemata	Schizoporellidae	*Schizoporella decorata*																									x
Gymnolaemata	Schizoporellidae	*Schizoporella sp.*				x				x					x	x	x		x	x		x	x	x		x	

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gymnolaemata	Sertellidae	*Reteporellina denticulata*																									x
Gymnolaemata	Sertellidae	*Rhynchozoon sp.*													x	x											
Gymnolaemata	Smittinidae	*Parasmittina sp.*						x								x			x								
Gymnolaemata	Tetraplariidae	*Tetraplaria ventricosa*	x		x		x		x									x									x
Gymnolaemata	Watersiporidae	*Watersipora edmondsoni*			x		x	x	x									x						x			x
Gymnolaemata	Vesiculariidae	*Amathia distans*				x				x				x					x	x		x		x			
Gymnolaemata	Thalamoporellidae	*Thalamoporella sp.*						x																			x
Gymnolaemata	Aeteidae	*Aetea sp.*																		x							
Gymnolaemata	Scrupariidae	*Scruparia sp.*																									x
Stenolaemata	Crisiidae	*Crisia circinata*																									x
Stenolaemata	Crisiidae	*Crisia sp.*																									x
Stenolaemata	Crisinidae	*Crisina radians*																									x
Stenolaemata	Lichenoporidae	*Lichenopora sp.*							x																		
		Total Ectoprocta	9	1	7	5	6	8	11	5	6	2	0	2	5	5	3	2	5	5	2	3	1	5	0	2	11
Articulata	Laqueidae	*Frenulina sanguinolenta*						x	x				x		x												
		Brachiopoda	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Asterinidae	*Asterina anomala*	x						x			x					x				x		x				
Ophiuroidea	Ophiocomidae	*Ophiocoma erinaceus*																									x
Ophiuroidea	Ophiocomidae	*Ophiocomella sexradia*	x		x						x	x	x		x	x		x							x		
Ophiuroidea	Ophiodermatidae	*Distichophis clarkii*	x																								
Ophiuroidea	Amphiuridae	*Amphiodia sp.x*						x				x															
Ophiuroidea	Amphiuridae	*Amphipholis squamata*		x	x	x				x			x	x	x												x
Ophiuroidea	Amphiuridae	*Amphiura immira*	x				x	x																			
Ophiuroidea	Amphiuridae	*Amphiura sp.2*																x									
Ophiuroidea	Amphiuridae	*Amphiura sp.4*										x															
Ophiuroidea	Amphiuridae	*Amphiura sp.5*									x								x				x				
Ophiuroidea	Ophiactidae	*Ophiactis modesta*													x			x					x				
Ophiuroidea	Ophiactidae	*Ophiactis savignyi*	x	x							x	x			x	x	x		x	x			x	x	x		
Ophiuroidea	Ophiactidae	*Ophiactis sp. (red-spotted)*				x			x	x	x			x		x			x				x				x

			Station																						
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Echinoidea	Cidaridae	*Eucidaris metularia*																									x
Echinoidea	Diadematidae	*Diadema paucispinum*	x																					x			
Echinoidea	Toxopneustidae	*Tripneustes gratilla*	x				x												x								
Echinoidea	Echinometridae	*Echinometra mathaei*						x																			
Echinoidea	Echinometridae	*Heterocentrotus mammillatus*																									x
Holothuroidea	Holothuriidae	*Actinopyga mauritiana*													x												
Holothuroidea	Holothuriidae	*Actinopyga obesa*													x												
Holothuroidea	Holothuriidae	*Holothuria (Halodeima) atra*													x												
Holothuroidea	Holothuriidae	*Holothuria (Halodeima) edulis*									x	x				x			x								
Holothuroidea	Holothuriidae	*Holothuria difficilis*											x	x			x										
Holothuroidea	Holothuriidae	*Holothuria (Thymiosycia) hilla*											x			x	x	x	x						x		
Holothuroidea	Holothuriidae	*Holothuria (Thymiosycia) impatiens*	x																								
Holothuroidea	Synaptidae	*Opheodesoma spectabilis*												x		x					x		x				
		Total Echinodermata	8	2	2	2	2	3	2	2	5	6	4	4	7	6	4	4	6	1	2	0	6	2	3	0	5
Ascidiacea	Didemnidae	*Didemnum perlucidum*									x	x				x									x		
Ascidiacea	Didemnidae	*Diplosoma listerianum*		x	x		x	x			x	x	x	x	x	x								x			x
Ascidiacea	Polyclinidae	*Aplidium sp.*	x				x		x																		x
Ascidiacea	Polyclinidae	*Polyclinum constellatum*	x								x													x			
Ascidiacea	Ascidiidae	*Ascidia archaia*																	x								
Ascidiacea	Ascidiidae	*Ascidia melanostoma*											x														
Ascidiacea	Ascidiidae	*Ascidia sp.A*	x				x		x						x				x		x				x	x	
Ascidiacea	Ascidiidae	*Ascidia sp.B*	x					x	x	x	x					x			x		x						
Ascidiacea	Ascidiidae	*Ascidia sydneiensis*				x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	
Ascidiacea	Ascidiidae	*Phallusia nigra*								x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Ascidiacea	Corellidae	*Corella minuta*													x	x		x									
Ascidiacea	Styelidae	*Botryllus sp.*					x					x															
Ascidiacea	Styelidae	*Cnemidocarpa areolata*		x						x	x				x	x			x				x				
Ascidiacea	Styelidae	*Eusynstyela hartmeyeri*	x																x			x	x				
Ascidiacea	Styelidae	*Polyandrocarpa sagamiensis*								x				x					x	x		x	x			x	
Ascidiacea	Styelidae	*Polyandrocarpa zooritensis*										x															
Ascidiacea	Styelidae	*Polycarpa aurita*	x					x			x	x		x			x		x						x		
Ascidiacea	Styelidae	*Polycarpa sp.*	x													x											
Ascidiacea	Styelidae	*Styela canopus*						x											x								
Ascidiacea	Pyuridae	*Herdmania pallida*	x			x	x		x	x		x	x	x	x	x			x	x	x	x	x	x	x		
Ascidiacea	Pyuridae	*Herdmania sp.*	x					x																			
Ascidiacea	Pyuridae	*Microcosmus exasperatus*	x				x		x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x
		Total Ascidiacea	10	2	1	2	7	6	6	7	9	9	3	7	7	10	4	4	12	5	6	5	7	6	7	5	3
Osteichthyes	Dasyatidae	*Dasyatis latus*									x																
Osteichthyes	Engraulidae	*Encrasicholina purpurea*												x													
Osteichthyes	Muraenidae	*Gymnomuraena zebra*													x												
Osteichthyes	Muraenidae	*Gymnothorax flavimarginatus*																									x
Osteichthyes	Muraenidae	*Gymnothorax meleagris*	x																								
Osteichthyes	Synodontidae	*Saurida sp.*												x													
Osteichthyes	Holocentridae	*Myripristes sp.*																									x
Osteichthyes	Holocentridae	*Neoniphon sammara*	x																								
Osteichthyes	Scorpaenidae	*Pteros sphex*																			x						
Osteichthyes	Scorpaenidae	*Taenianotus tricanthus*													x									x			
Osteichthyes	Atherinidae	*Pranesus insularum*																						x			
Osteichthyes	Lutjanidae	*Lutjanus fulvus*			x	x	x		x																		
Osteichthyes	Lutjanidae	*Lutjanus kasmira*																									x
Osteichthyes	Mullidae	*Mulloidichthys vanicolensis*	x																x								
Osteichthyes	Mullidae	*Parupeneus bifasciatus*																									x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Osteichthyes	Mullidae	*Parupeneus cyclostomus*	x																								
Osteichthyes	Mullidae	*Parupeneus multifasciatus*	x		x			x	x																	x	
Osteichthyes	Mullidae	*Parupeneus porphyreus*																					x			x	
Osteichthyes	Kyphosidae	*Kyphosus bigibbus*																									x
Osteichthyes	Chaetodontidae	*Chaetodon multicinctus*	x		x		x	x	x																		
Osteichthyes	Chaetodontidae	*Chaetodon ornatissimus*			x				x																		
Osteichthyes	Chaetodontidae	*Chaetodon quadrimaculatus*										x															
Osteichthyes	Chaetodontidae	*Chaetodon auriga*	x				x	x	x			x				x	x						x			x	
Osteichthyes	Chaetodontidae	*Chaetodon fremblii*	x																								
Osteichthyes	Chaetodontidae	*Chaetodon lineolatus*																								x	
Osteichthyes	Chaetodontidae	*Chaetodon lunula*	x					x	x							x										x	
Osteichthyes	Chaetodontidae	*Chaetodon lunulatus*			x		x	x	x		x					x	x		x							x	
Osteichthyes	Chaetodontidae	*Chaetodon miliaris*									x	x			x			x	x							x	
Osteichthyes	Chaetodontidae	*Chaetodon unimaculatus*			x							x															
Osteichthyes	Chaetodontidae	*Forciper flavissimus*	x						x																		
Osteichthyes	Chaetodontidae	*Heniochus diphreutes*																									x
Osteichthyes	Cichlidae	*Oreochromis mossambicus*																		x				x			
Osteichthyes	Pomacentridae	*Abudefduf abdominalis*	x			x	x	x	x	x		x			x	x		x	x			x		x	x	x	
Osteichthyes	Pomacentridae	*Abudefduf sordidus*	x		x											x				x							
Osteichthyes	Pomacentridae	*Abudefduf vaigensis*	x																							x	
Osteichthyes	Pomacentridae	*Centropyge flavissimus*							x		x																
Osteichthyes	Pomacentridae	*Chromis hanui*							x			x															
Osteichthyes	Pomacentridae	*Chromis ovalis*																									x
Osteichthyes	Pomacentridae	*Chromis verater*																									x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Osteichthyes	Pomacentridae	*Dascyllus albisella*	x				x	x		x	x	x			x	x	x	x	x				x		x	x	
Osteichthyes	Pomacentridae	*Plectroglyphidodon imparipennis*																									x
Osteichthyes	Pomacentridae	*Plectroglyphidodon johnstonianus*	x		x				x			x														x	
Osteichthyes	Pomacentridae	*Plectroglyphidodon sindonis*	x		x		x	x																			
Osteichthyes	Pomacentridae	*Stegastes fasciolatus*										x															
Osteichthyes	Cheilodactylidae	*Cheilodactylus vittatus*																									x
Osteichthyes	Serranidae	*Cephalopholis argus*					x		x																		
Osteichthyes	Mugilidae	*Mugil cephalus*															x										
Osteichthyes	Labridae	*Anampses cuvier*																									x
Osteichthyes	Labridae	*Bodianus bilunulatus*	x		x		x	x				x															
Osteichthyes	Labridae	*Chelio inermis*																								x	
Osteichthyes	Labridae	*Coris flavovitta*										x															
Osteichthyes	Labridae	*Gomphosus varius*			x		x	x	x		x	x			x											x	
Osteichthyes	Labridae	*Halichoeres ornatissimus*																									x
Osteichthyes	Labridae	*Labroides phthirophagus*	x		x			x	x						x				x							x	
Osteichthyes	Labridae	*Stethojujulis balteata*	x												x			x									
Osteichthyes	Labridae	*Thalassoma duperrey*	x		x			x	x	x		x			x	x	x	x									
Osteichthyes	Labridae	*Thalassoma quinquevittam*																									x
Osteichthyes	Scaridae	*Acanthurus blochii*	x		x		x	x	x	x	x	x			x	x		x	x	x	x	x	x		x	x	
Osteichthyes	Scaridae	*Chlorurus sordidus*			x			x	x		x	x			x	x	x	x	x				x			x	
Osteichthyes	Scaridae	*Scarus dubius*																									x
Osteichthyes	Scaridae	*Scarus juv.*	x		x			x	x		x	x				x	x	x	x		x		x	x	x	x	
Osteichthyes	Scaridae	*Scarus perspicillatus*	x					x																			
Osteichthyes	Gobiidae	*Psilogobius mainlandi*																				x			x		
Osteichthyes	Acanthuridae	*Acanthurus achilles*																									x

			Station																								
Taxa	**Family**	**Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Osteichthyes	Acanthuridae	*Acanthurus dussimeri*	x				x		x																		
Osteichthyes	Acanthuridae	*Acanthurus leucopareius*							x							x											
Osteichthyes	Acanthuridae	*Acanthurus nigricans*																									x
Osteichthyes	Acanthuridae	*Acanthurus nigrofuscus*	x																								
Osteichthyes	Acanthuridae	*Acanthurus nigroris*																									x
Osteichthyes	Acanthuridae	*Acanthurus olivaceus*																									x
Osteichthyes	Acanthuridae	*Acanthurus triostegus*	x		x		x	x	x						x	x	x	x		x	x		x		x	x	
Osteichthyes	Acanthuridae	*Ctenochaetus hawaiiensis*	x																								
Osteichthyes	Acanthuridae	*Ctenochaetus strigosus*	x		x		x	x	x		x	x						x								x	
Osteichthyes	Acanthuridae	*Naso lituratus*																									x
Osteichthyes	Acanthuridae	*Naso unicornis*							x			x															
Osteichthyes	Acanthuridae	*Zebrasoma flavescens*	x		x		x	x	x		x	x			x		x								x	x	
Osteichthyes	Acanthuridae	*Zebrasoma veliferum*														x			x				x		x	x	
Osteichthyes	Balistidae	*Sufflamen bursa*																									x
Osteichthyes	Balistidae	*Sufflamen fraenatus*																									x
Osteichthyes	Holocanthidae	*Centropyge loricula*														x											
Osteichthyes	Holocanthidae	*Centropyge potteri*										x															
Osteichthyes	Zanclidae	*Zanclus cornutus*	x						x		x	x				x	x										
Osteichthyes	Bothidae	*Bothus pantherinus*												x													
Osteichthyes	Monocanthidae	*Pervagor spilosoma*									x															x	
Osteichthyes	Ostraciontidae	*Ostracion meleagris*	x				x									x											
Osteichthyes	Tetraodontidae	*Arothron hispidus*						x							x												
Osteichthyes	Tetraodontidae	*Canthigaster jactator*	x						x	x		x								x							
Osteichthyes	Diodontidae	*Diodon hystrix*	x								x	x					x						x				
		Total Fishes	33	0	19	2	16	20	27	5	14	23	0	3	14	16	11	10	10	5	4	3	9	5	8	22	21

APPENDIX D

Station Records for Cryptogenic or Nonindigenous Species Collected or Observed in Kane`ohe Bay during 1997-98

				Station																								
Taxa	**Family**	**Species**	**Status**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Rhodophyta	Rhodomelaceae	*Acanthophora spicifera*	Introduced		x				x					x	x	x	x	x		x		x						
Rhodophyta	Gracilariaceae	*Gracilaria salicornia*	Introduced		x				x		x			x	x	x	x	x	x	x		x		x				
Rhodophyta	Hypneaceae	*Hypnea musciformis*	Introduced		x	x		x						x	x	x												
Rhodophyta	Solieriaceae	*Kappaphycus alvarezii*	Introduced		x				x		x	x			x	x	x	x	x					x				
Rhodophyta	Solieriaceae	*Kappaphycus striatum*	Introduced		x						x					x	x							x				
Rhodophyta	Solieriaceae	*Eucheuma denticulatum*	Introduced																				x					
		Total Algae		0	5	1	0	1	3	0	3	1	0	3	4	5	4	3	2	2	0	2	0	3	0	0	0	0
Spermatophyta	Rhizophoraceae	*Rhizophora mangle*	Introduced	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Porifera	Heteropiidae	*Heteropia glomerosa*	Cryptogenic												x													
Porifera	Desmacellidae	*Biemna sp.*	Cryptogenic												x						x	x						
Porifera	Callyspongiidae	*Callyspongia diffusa*	Cryptogenic									x						x										
Porifera	Chalinidae	*Chalinidae n.sp. (purple)*	Cryptogenic	x							x							x			x							
Porifera	Dysideidae	*Dysidea arenaria*	Cryptogenic														x											
Porifera	Dysideidae	*Dysidea avara*	Cryptogenic																						x		x	
Porifera	Dysideidae	*Dysidea sp.*	Introduced								x						x	x	x	x		x	x			x		
Porifera	Niphatidae	*Gelliodes fibrosa*	Introduced													x	x	x		x	x		x	x				
Porifera	Halichondriidae	*Halichondria melanadocia*	Introduced															x			x							
Porifera	Mycalidae	*Mycale armata*	Introduced															x		x			x			x		
Porifera	Mycalidae	*Mycale cecilia*	Introduced	x							x						x	x		x			x				x	
Porifera	Chalinidae	*Sigmadocia caerulea*	Introduced								x							x		x				x				
Porifera	Suberitidae	*Suberites zeteki*	Introduced															x		x	x		x					
Porifera	Chalinidae	*Toxiclona sp.*	Cryptogenic													x												
Porifera	Mycalidae	*Zygomycale parishii*	Introduced															x					x					
		Total Porifera		2	0	0	0	0	0	0	4	1	0	0	2	2	4	10	1	6	5	2	6	2	1	2	2	0
Hydrozoa	Halopterididae	*Antennella secundaria*	Cryptogenic	1						1																		
Hydrozoa	Plumulariidae	*Halopteris polymorpha*	Cryptogenic	x																								x
Hydrozoa	Sertulariidae	*Dynamena crisioides*	Cryptogenic																								x	
Hydrozoa	Campanulariidae	*Obelia bidentata*	Introduced								x							x										
Hydrozoa	Campanulariidae	*Obelia dichotoma*	Introduced																								x	
Hydrozoa	Halocordylidae	*Pennaria disticha*	Introduced				x	x	x		x				x		x	x		x		x		x	x		x	
Hydrozoa	Plumulariidae	*Plumularia strictocarpa*	Cryptogenic	x						x							x											x
Hydrozoa	Sertulariidae	*Sertularella areyi*	Cryptogenic																									x
Hydrozoa	Sertulariidae	*Sertularella tongensis*	Cryptogenic																									x
Hydrozoa	Sertulariidae	*Sertularia ligulata*	Cryptogenic					x																				
Hydrozoa	Syntheciidae	*Synthecium megathecum*	Introduced							x																		x
Hydrozoa	Sertulariidae	*Tridentata humpferi*	Cryptogenic							x																		
Hydrozoa	Clavidae	*Turritopsis nutricula*	Introduced															x		x			x					
Hydrozoa	Campanulariidae	*Clytia latitheca*	Cryptogenic														x											
Hydrozoa	Kirchenpaueriidae	*Ventromma halecioides*	Cryptogenic								x																	

				Station																								
Taxa	**Family**	**Species**	**Status**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Hydrozoa	Plumulariidae	*Plumularia floridana*	Cryptogenic			x																						
Hydrozoa	Lafoeidae	*Anthohebella parasitica*	Cryptogenic																									x
		Total Hydrozoa		3	0	1	1	2	1	4	3	0	0	0	1	0	3	3	0	2	0	1	1	1	1	0	3	6
Anthozoa	Clavulariidae	*Carijoa riisei*	Introduced														x										x	
Anthozoa	Xeniidae	*Sarcothelia n. sp.*	Cryptogenic			x	x	x																				
		Total Anthozoa		0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Sabellidae	*Branchiomma nigromaculata*	Cryptogenic							x	x				x	x	x	x	x	x	x		x					
Polychaeta	Chaetopteridae	*Chaetopterus sp.*	Cryptogenic	x	x					x	x	x	x	x		x	x	x	x	x	x	x	x	x	x			
Polychaeta	Phyllodocidae	*Eulalia sanguinea*	Introduced															x							x			
Polychaeta	Serpulidae	*Hydroides brachyacantha*	Introduced																									x
Polychaeta	Serpulidae	*Hydroides elegans*	Introduced																			x	x		x			
Polychaeta	Serpulidae	*Pomatoleios kraussii*	Introduced																		x	x			x			
Polychaeta	Sabellidae	*Sabellastarte spectabilis*	Introduced						x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Polychaeta	Serpulidae	*Salmacina dysteri*	Introduced														x			x					x			
Polychaeta	Serpulidae	*Serpula vermicularis*	Cryptogenic								x	x			x	x		x			x	x					x	
		Total Polychaeta		1	1	0	0	0	1	2	4	3	2	2	3	3	4	5	3	4	5	5	4	2	6	1	2	1
Gastropoda	Calyptraeidae	*Crepidula aculeata*	Introduced	x	x	x	x	x		x	x	x	x		x		x	x	x	x	x	x		x	x			x
Gastropoda	Calyptraeidae	*Crucibulum spinosum*	Introduced				x				x							x		x	x	x						
Gastropoda	Fissurellidae	*Diodora ruppelli*	Introduced	x																								
Gastropoda	Vermetidae	*Eualetes tulipa*	Introduced		x						x				x			x		x		x			x		x	
Gastropoda	Pyramidellidae	*Hinemoa indica*	Introduced	x				x		x	x	x	x		x	x	x					x						
Gastropoda	Hipponicidae	*Hipponix australis*	Cryptogenic																									x
Gastropoda	Pyramidellidae	*Pyrgulina oodes*	Cryptogenic	x										x				x										
		Total Gastropoda		4	2	1	2	2	0	2	4	2	2	1	3	1	2	4	1	3	2	4	0	1	2	0	1	2
Bivalvia	Anomiidae	*Anomia nobilis*	Introduced															x			x							
Bivalvia	Chamidae	*Chama fibula*	Cryptogenic	x													x			x			x	x				
Bivalvia	Chamidae	*Chama macerophylla*	Introduced																		x							
Bivalvia	Ostreidae	*Crassostrea gigas*	Introduced								x										x							
Bivalvia	Ostreidae	*Crassostrea virginica*	Introduced														x											
Bivalvia	Hiatellidae	*Hiatella arctica*	Introduced																									x
Bivalvia	Teredinidae	*Teredo sp.*	Introduced														x											
Bivalvia	Veneridae	*Venerupis philippinarum*	Introduced																	x								
		Total Bivalvia		1	0	0	0	0	0	0	1	0	0	0	0	0	3	1	0	2	3	0	1	1	0	0	0	1
Pycnogonida	Phoxichilidiidae	*Anoplodactylus arescus*	Introduced													x												
Pycnogonida	Phoxichilidiidae	*Anoplodactylus californicus*	Cryptogenic				x																					
Pycnogonida	Phoxichilidiidae	*Anoplodactylus digitatus*	Cryptogenic					x																				

Taxa	Family	Species	Status	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Pycnogonida	Phoxichilidiidae	*Anoplodactylus marshallensis*	Cryptogenic												x		x											
Pycnogonida	Callipallenidae	*Callipallene sp.*	Cryptogenic							x																		
Pycnogonida	Callipallenidae	*Pigrogromitus timsanus*	Introduced															x										
Pycnogonida	Ammotheidae	*Tanystylum rehderi*	Cryptogenic																									x
		Total Pycnogonida		0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1
Cirripedia	Balanidae	*Balanus amphitrite*	Introduced			x													x		x							
Cirripedia	Balanidae	*Balanus eburneus*	Introduced																		x							
Cirripedia	Chthamalidae	*Chthamalus proteus*	Introduced		x						x				x		x			x		x	x		x		x	
		Total Cirrepedia		0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	1	1	2	1	1	0	1	0	1	0
Peracarida	Corophiidae	*Corophium spp.*	Introduced				x				x									x	x							
Peracarida	Melitidae	*Elasmopus rapax*	Introduced																								x	
Peracarida	Corophiidae	*Ericthonius brasiliensis*	Introduced		x		x		x																			
Peracarida	Ischyroceridae	*Leucothoe micronesiae*	Introduced						x	x	x		x						x						x		x	
Peracarida	Anthuridae	*Mesanthura sp.*	Introduced	x											x	x	x	x	x									x
Peracarida	Sphaeromatidae	*Paracerceis sculpta*	Introduced		x						x				x							x						
Peracarida	Leucothoidae	*Paraleucothoe flindersi*	Introduced												x		x						x	x	x		x	
Peracarida	Isaeidae	*Photis hawaiensis*	Cryptogenic	x			x			x						x											x	x
Peracarida	Stenothoidae	*Stenothoe gallensis*	Introduced																								x	
Peracarida	Stenothoidae	*Stenothoe valida*	Cryptogenic																								x	
		Total Peracarida		2	2	0	3	0	2	2	3	0	1	0	3	2	2	1	2	1	1	1	1	1	2	0	4	2
Decapoda	Gonodactylidae	*Gonodactylaceus falcatus*	Introduced	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x			x	x		x
Decapoda	Panopeidae	*Panopeus pacificus*	Introduced				x														x		x					
Decapoda	Pilumnidae	*Pilumnus oahuensis*	Introduced	x	x		x				x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
		Decapoda		2	2	1	3	1	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	2	1	1
Gymnolaemata	Vesiculariidae	*Amathia distans*	Introduced				x				x				x					x	x		x		x			
Gymnolaemata	Bugulidae	*Bugula neritina*	Introduced																						x			
Gymnolaemata	Bugulidae	*Bugula robusta*	Introduced				x						x		x	x	x	x		x	x	x			x			
Gymnolaemata	Scrupocellariidae	*Caberia boryi*	Cryptogenic	x					x																			
Gymnolaemata	Bugulidae	*Caulibugula dendrograpta*	Introduced	x																								
Gymnolaemata	Savignyellidae	*Savignyella lafontii*	Introduced													x		x			x							
Gymnolaemata	Schizoporellidae	*Schizoporella cf. errata*	Introduced				x				x									x		x	x				x	
Gymnolaemata	Watersiporidae	*Watersipora edmondsoni*	Introduced			x		x	x	x									x						x			x
		Total Ectoprocta		2	0	1	3	1	2	1	2	0	1	0	2	2	1	2	1	3	3	2	2	0	4	0	1	1
Ascidiacea	Ascidiidae	*Ascidia sp.A*	Introduced	x				x		x						x				x		x				x	x	
Ascidiacea	Ascidiidae	*Ascidia sp.B*	Introduced	x					x	x	x	x					x			x		x						
Ascidiacea	Ascidiidae	*Ascidia sydneiensis*	Introduced				x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	
Ascidiacea	Corellidae	*Corella minuta*	Introduced													x	x		x									
Ascidiacea	Didemnidae	*Didemnum perlucidum*	Introduced									x	x				x									x		
Ascidiacea	Didemnidae	*Diplosoma listerianum*	Introduced		x	x		x	x			x	x	x	x	x	x								x			x

				Station																								
Taxa	**Family**	**Species**	**Status**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Ascidiacea	Styelidae	*Eusynstyela hartmeyeri*	Introduced	x																x			x	x				
Ascidiacea	Pyuridae	*Herdmania pallida*	Introduced	x			x	x		x	x		x	x	x	x	x			x	x	x	x	x	x	x		
Ascidiacea	Pyuridae	*Herdmania sp.*	Introduced	x					x																			
Ascidiacea	Pyuridae	*Microcosmus exasperatus*	Introduced	x				x		x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x
Ascidiacea	Ascidiidae	*Phallusia nigra*	Introduced								x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	
Ascidiacea	Styelidae	*Polyandrocarpa sagamiensis*	Introduced								x				x					x	x		x	x			x	
Ascidiacea	Styelidae	*Polyandrocarpa zooritensis*	Introduced										x															
Ascidiacea	Polyclinidae	*Polyclinum constellatum*	Introduced	x								x													x			
Ascidiacea	Styelidae	*Styela canopus*	Introduced						x											x								
		Total Ascidiacea		7	1	1	2	5	5	5	6	7	7	2	6	6	8	3	4	9	5	6	5	6	6	6	5	2
Osteichthyes	Holocanthidae	*Centropyge flavissimus*	Introduced							x		x																
Osteichthyes	Serranidae	*Cephalopholis argus*	Introduced					x		x																		
Osteichthyes	Lutjanidae	*Lutjanus fulvus*	Introduced			x	x	x		x																		
Osteichthyes	Lutjanidae	*Lutjanus kasmira*	Introduced																									x
Osteichthyes	Cichlidae	*Oreochromis mossambicus*	Introduced																		x				x			
		Total Fish		0	0	1	1	2	0	3	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1
		Total Taxa		23	14	9	20	16	17	19	37	16	15	9	29	24	38	35	17	37	31	27	24	18	27	11	24	18

APPENDIX E

Supplementary Information for Nonindigenous and Cryptogenic Species Observed or Collected in Kane`ohe Bay During 1999-2000 Surveys

Status: PR, I: Previously reported, Nonindigenous; NR, R: New report, Nonindigenous; PR, C: Previously reported, Cryptogenic; NR, C: New report, Cryptogenic

ID: EA: Eastern Atlantic, CA: Caribbean, WA: Western Atlantic, EP: Eastern Pacific, IP: Indo-Pacific, WIP: Western Indo-Pacific, RS: Red Sea, WW: Tropical or Temperate World Wide.

Family	Genus and Species	Status	Status Authority	1st Rept.	Source &/or Comment	Origin and/or Previous Range	ID
Macroalgae							
Rhodomelaceae	*Acanthophora spicifera*	PR, I	Doty, 1962	1952	Pearl Harbor, introduced on barge fouling	Guam-Australia (Doty, 1961)	WIP
Solieriaceae	*Eucheuma denticualtum*	PR, I	Russell, 1993	1970	Kane`ohe Bay and Honolulu Harbor	Philippines	WIP
Hypneaceae	*Hypnea musciformis*	PR, I	Russell, 1993	1974	Kane`ohe Bay, introduced into for aquaculture experiments	Florida	CA
Gracilariaceae	*Gracilaria salicornia*	PR, I	Smith et al. in press	pre-1950	Kane`ohe Bay & Waikiki in 1971, previously in Hilo Bay pre-1950	Philippines?	WIP
Solieriaceae	*Kappaphycus alvarezii*	PR, I	Russell, 1994	1974	Kane`ohe Bay, introduced into for aquaculture experiments	Philippines	WIP
Solieriaceae	*Kappaphycus striatum*	PR, I	Russell, 1995	1974	Kane`ohe Bay, introduced into for aquaculture experiments	Philippines	WIP
Rhizophoraceae	*Rhizophora mangle*	PR, I	Wester 1981	1902	Molokai and O`ahu, introduced for erosion control	Florida	CA
Porifera							
Desmacellidae	*Biemna* sp.	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a as *B. fistulosa*)	Zanzibar-West Central Pacific (Kelly-Borges and DeFelice, Unpublished)	IP
Callyspongiidae	*Callyspongia diffusa*	PR, I	Kelly-Borges & Defelice, ms	1947	Kane`ohe Bay (de Laubenfels, 1950)	Uncertain	
Chalinidae	Chalinidae n.sp. (purple)	PR, I	Kelly-Borges & Defelice, ms	1997	Keehi Lagoon (Coles et al. 1999b)	Uncertain	
Dysideidae	*Dysidea cf. arenaria*	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Palau	IP
Dysideidae	*Dysidea cf. avara*	PR, I	Kelly-Borges & Defelice, ms	1948	Kane`ohe Bay (de Laubenfels, 1950)	Mediterannean, Worldwide	WW
Dysideidae	*Dysidea n. sp.*	PR, I	DeFelice, pers. comm.	1997	Honolulu Harbor, Keehi Lagoon (Coles et al. 1999b)		
Niphatidae	*Gelliodes fibrosa*	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Philippines (Kelly-Borges and DeFelice, Unpublished)	WIP
Halichondriidae	*Halichondria melanadocia*	PR, I	Kelly-Borges & Defelice, ms	pre -967	Kane`ohe Bay (Berquist 1967)	Caribbean (Kelly-Borges and DeFelice, Unpublished)	CA
Heteropiidae	*Heteropia glomerosa*	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)		
Mycalidae	*Mycale (Aegogropila) armata*	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Indo-Malaysia - Central Pacific (Kelly-Borges and DeFelice, Unpublished)	IP
Mycalidae	*Mycale (Carmia) cecilia*	PR, I	Kelly-Borges & Defelice, ms	1947	Kane`ohe Bay (de Laubenfels, 1950)	Caribbean (Kelly-Borges and DeFelice, Unpublished)	CA
Chalinidae	*Sigmadocia caerulea*	PR, I	Kelly-Borges & Defelice, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Caribbean (Kelly-Borges and DeFelice, Unpublished)	CA
Suberitidae	*Suberites zeteki*	PR, I	Kelly-Borges & Defelice, ms	1947	Kane`ohe Bay (de Laubenfels, 1950)	Panama-Caribbean (Kelly-Borges and DeFelice, Unpublished)	CA
Chalinidae	*Toxiclona sp.*	PR, I	Kelly-Borges & Defelice, ms	1997	Honolulu Harbor (Coles et al. 1999b)		
Mycalidae	*Zygomycale parishii*	PR, I	Kelly-Borges & Defelice, ms	1947	Kane`ohe Bay (de Laubenfels, 1950)	Indo-Pacific (Kelly-Borges et al., ms.)	IP

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Hydrozoa							
Halopterididae	*Antennella secundaria*	NR, C	Calder, pers. comm.	2000	First Hawai`i report, present study	Tropical Worldwide	WW
Lafoeidae	*Anthohebella parasitica*	NR, C	Calder, pers. comm.	2000	First Hawai`i report, present study	Tropical Worldwide	WW
Campanulariidae	*Clytia latitheca*	NR, C	Calder, pers. comm.	2000	First Hawai`i report, present study	Tropical Worldwide	WW
Sertulariidae	*Dynamena crisioides*	PR, C	Carlton & Eldredge, ms	1977	Kewalo Basin and Honolulu Harbor	Tropical Worldwide	WW
Plumulariidae	*Halopteris polymorpha*	NR, C	Calder, pers. comm.	2000	First Hawai`i report, present study	Tropical Worldwide	WW
Campanulariidae	*Obelia bidentata*	PR, I	Carlton & Eldredge, ms	1946	Hawaiian Islands, as *Laomedea bicuspidata* by Vervoort 1946	Atlantic or Worldwide	WW
Campanulariidae	*Obelia dichotoma*	PR, I	Carlton & Eldredge, ms	1972	Kane`ohe Bay, BPBM Spec D 458	Atlantic or Worldwide	WW
Halocordylidae	*Pennaria disticha*	PR, I	Carlton & Eldredge, ms	1929	Pearl Harbor, BPBM Spec D 183	European Atlantic, Worldwide (Cooke 1977)	EA
Plumulariidae	*Plumularia floridana*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Plumulariidae	*Plumularia strictocarpa*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Sertulariidae	*Sertularella areyi*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Sertulariidae	*Sertularella tongensis*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Western Pacific	WIP
Sertulariidae	*Sertularia ligulata*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Syntheciidae	*Synthecium megathecum*	PR, I	Carlton & Eldredge, ms	1977	Kane`ohe Bay, (Cooke, 1977)	Tropical Worldwide	WW
Sertulariidae	*Tridentata humpferi*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Clavidae	*Turritopsis nutricula*	PR, I	Carlton & Eldredge, ms	1946	Waikiki Reef and Pearl Harbor (Cooke 1977)	Western Atlantic, Worldwide (Cooke 1977)	WA
Kirchenpaueriidae	*Ventromma halecioides*	NR, C	Calder, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Tropical Worldwide	WW
Anthozoa							
Clavulariidae	*Carijoa (Telesto) riisei*	PR, I	Carlton & Eldredge, ms	1972	Pearl Harbor, BPBM Spec D-454	Florida-Brazil (Bayer, 1961)	CA
Xeniidae	*Sarcothelia* n. sp.	NR, C	P. Alderslade, Pers. Comm.	2000	Kane`ohe Bay, first Hawai`i report, present study	Unknown	
Polychaeta							
Sabellidae	*Branchiomma nigromaculata*	PR, C	Carlton & Eldredge, ms	1852	Hawaiian Islands, as *Sabella havaica* (Kinberg)	Tropical Worldwide	WW
Chaetopteridae	*Chaetopterus* sp.	PR, C	Carlton & Eldredge, ms	1960	Kane`ohe Bay, BPBM Spec R 260	Tropical Worldwide	WW
Phyllodocidae	*Eulalia sanguinea*	PR, C	Carlton & Eldredge, ms	1966	Pearl Harbor, living in *C. virginica* oysters (Hartmann 1966)	Worldwide	WW

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Serpulidae	*Hydroides brachyacantha*	PR, I	Carlton & Eldredge, ms	1939	Hawaiian Islands, BPBM Spec 1228,	W. Mexico to E. Australia (Bailey-Brock and Hartman, 1987)	IP
Serpulidae	*Hydroides elegans*	PR, I	Carlton & Eldredge, ms	1929	Pearl Harbor, BPBM Spec D-1101 as *H. norvegica*	Worldwide (Bailey-Brock and Hartman and Hartman, 1987)	WW
Serpulidae	*Pomatoleios kraussii*	PR, I	Carlton & Eldredge, ms	1976	Pearl Harbor, Grovhoug and Rastetter (1980)	Tropical Indo-West Pacific (Bailey-Brock and Hartman, 1987)	WIP
Serpulidae	*Sabellastarte spectabilis*	PR, C	Carlton & Eldredge, ms	1976	Pearl Harbor as S. sabellastarte, Grovhoug and Rastetter (1980)	Tropical Worldwide	WW
Serpulidae	*Salmacina dysteri*	PR, I	Carlton & Eldredge, ms	1972	Kane`ohe Bay, BPBM Spec R 1219	Tropical Worldwide (Bailey-Brock and Hartman, 1987)	WIP
Serpulidae	*Serpula* sp. cf. *vermicularis*	PR, C	Carlton & Eldredge, ms	1938	Kane`ohe Bay, BPBM Spec R 1218 as *Serpula vermicularis*	Worldwide	WW
Gastropoda							
Fissurellidae	*Diodora ruppelli*	PR, I	Carlton & Eldredge, ms	1962	Kay (1979)	Tropical Indo-West Pacific -Red Sea (Kay, 1979)	WIP
Pyramidellidae	*Crepidula aculeata*	PR, I	Carlton & Eldredge, ms	1913	Pearl Harbor, BPBM Spec MO-231366	Worldwide (Kay, 1979)	WW
Anomiidae	*Crucibulum spinosum*	PR, I	Carlton & Eldredge, ms	1946	Honolulu Harb. (Edmondson, 1946)	Worldwide (Kay, 1979)	WW
Vermetidae	*Eualetes tulipa*	PR, I	Carlton & Eldredge, ms	1972	Kane`ohe Bay and Pearl Harbor as *Vermetus alii* (Hadfield et al. 1972)	Florida (Hadfield, pers. comm. in Carlton & Eldredge, ms)	WA
Pyramidellidae	*Hinemoa indica*	PR, C	Carlton & Eldredge, ms	1918	Waikiki, as *Odostomia indica* (Pisbry 1918)	Indian Ocan	WIP
Hipponicidae	*Hipponix australis*	PR, C	Carlton & Eldredge, ms	pre 1979	Kay (1979) as *Sabia conica*	Throughout Indo-West Pacific	WIP
Pyramidellidae	*Pyrgulina oodes*	PR, C	Carlton & Eldredge, ms	pre 1980	Kay (1979)	Nothwest Australia, Indo Pacific	WIP
Bivalvia							
Anomiidae	*Anomia nobilis*	PR, C	Carlton & Eldredge, ms	1912	Pearl Harbor, BPBM Spec MO-68170	Japan, Indo-West Pacific	WIP
Ostreidae	*Crassostrea gigas*	PR, I	Carlton & Eldredge, ms	1926	Kane`ohe Bay, Kalihi (Brock, 1952)	Japan, Indo-West Pacific	WIP
Ostreidae	*Crassostrea virginica*	PR, I	Carlton & Eldredge, ms	1866	Pearl Harbor, (Kay 1979)	Eastern N. America, Worldwide	WA
Ostreidae	*Chama macerophylla*	PR, I	Paulay, pers. comm.	1996	Pearl Harbor (Coles et al. 1997, 1999a as *C. elatensis*)	Caribbean (Paulay, pers. comm.)	CA
Chamidae	*Chama fibula*	PR, I	Carlton & Eldredge, ms	1915	Pearl Harbor, as Chama hendersoni (Dall et al. 1938)	Philippines-Australia (Carlton & Eldredge, ms)	WIP
Hiatellidae	*Hiatella arctica*	PR, I	Carlton & Eldredge, ms	1938	Honolulu Harbor as *Saxicava hawaiiensis*	Worldwide	WW
Teredinidae	*Teredo* sp.	PR, I	Carlton & Eldredge, ms	1920s	Kane`ohe Bay, Pearl aand Honolulu Harbors, various *Teredo* species	Worldwide	WW
Veneridae	*Venerupis philippinarum*	PR, I	Carlton & Eldredge, ms	1918	Pearl harbor, Dall et al. (1938)	Japan, Indo-West to East Pacific	WIP
Pycnogonida							
Phoxichilidiidae	*Anoplodactylus arescus*	PR, I	Child, pers. comm.	1998	Barber's Point Harbor (Coles et al. 1999b)	Brazil, E. Africa to Samoa	IP

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Phoxichilidiidae	*Anoplodactylus californicus*	NR, C	Child, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Phoxichilidiidae	*Anoplodactylus digitatus*	NR, C	Child, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Phoxichilidiidae	*Anoplodactylus marshallensis*	NR, C	Child, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Callipallenidae	*Callipallene sp.*	NR, C	Child, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Callipallenidae	*Pigrogromitus timsanus*	PR, I	Child, pers. comm.	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Suez Canal, Tropical Worldwide	WW
Ammotheidae	*Tanystylum rehderi*	NR, C	Child, pers. comm.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Cirrepedia							
Ischyroceridae	*Balanus amphitrite*	PR, I	Carlton & Eldredge, ms	1913	Pearl Harbor, BPBM Spec B 233, Pilsbry (1928)	Worldwide (Carlton & Eldredge, ms)	WW
Podoceridae	*Balanus eburneus*	PR, I	Carlton & Eldredge, ms	1929	Pearl Harbor, BPBM Spec. B 271,	Western N. Atlantic, Worldwide (Carlton & Eldredge, ms)	WA
Chthamalidae	*Chthamalus proteus*	PR, I	Southward et al. 1998	1995	Kane`ohe Bay (Hoover 1998)	Caribbean (Newman. pers. comm.)	CA
Isopoda							
Anthuridae	*Mesanthura sp.*	PR, C	Carlton & Eldredge, ms	1996	Pearl Harbor (Coles et al. 1997, 1999a)		
Sphaeromatidae	*Paracerceis sculpta*	PR, I	Carlton & Eldredge, ms	1943	Pearl and Hilo Harbors (Miller 1968)	Eastern Pacific	EP
Amphipoda							
Corophiidae	*Corophium* spp.	PR, I	Carlton & Eldredge, ms	1947-67	*C. acheruscium* (1947), *C, insidiosum* (1959), *C. baconi* (1967)	Worldwide	WW
Melitidae	*Elasmopus rapax*	PR, I	Carlton & Eldredge, ms	1937	Kane`ohe Bay (Barnard, 1955)	Tropical Worldwide (Bernard, 1970)	WW
Corophiidae	*Ericthonius brasiliensis*	PR, I	Carlton & Eldredge, ms	1935	Kane`ohe Bay (Barnard 1955)	Tropical and Temperate Worldwide (Muir, pers. comm.)	WW
Ischyroceridae	*Leucothoe micronesiae*	PR, I	Carlton & Eldredge, ms	1997	Keehi Lagoon (Coles et al. 1999b)	Indo Pacific	IP
Leucothoidae	*Paraleucothoe flindersi*	PR, C	Muir, 1997	1996	Pearl Harbor (Coles et al. 1997, 1999a)	Australia	WIP
Isaeidae	*Photis hawaiensis*	PR, C	Carlton & Eldredge, ms	1937	Kane`ohe Bay, BPBM Spec S 6011		
Stenothoidae	*Stenothoe gallensis*	PR, I	Carlton & Eldredge, ms	1935	Kane`ohe Bay, BPBM Spec S 5968	Tropical Worldwide (Bernard, 1970)	WW
Stenothoidae	*Stenothoe valida*	PR, C	Carlton & Eldredge, ms	1967	East coast O`ahu (Barnard, 1970)	Tropical Worldwide (Bernard, 1970)	WW
Decapoda							
Gonodactylidae	*Gonodactylaceus falcatus*	PR, I	Carlton & Eldredge, ms	1954	Kane`ohe Bay and Waikiki as *Gonodactylus falcatus* (Kinzie, 1968)	Eastern Pacific- Phillipines (Kinzie, 1968)	WIP
Panopeidae	*Panopeus pacificus*	PR, I	Carlton & Eldredge, ms	1929	Pearl Harbor, BPBM Spec. S 3435	Unknown	
Pilumnidae	*Pilumnus oahuensis*	PR, I	Carlton & Eldredge, ms	1929	Pearl Harbor, BPBM Spec. S 3436	Unknown	

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Ectoprocta							
Vesiculariidae	*Amathia distans*	PR, I	Carlton & Eldredge, ms	1935	Kane`ohe Bay (Edmondson and Ingram 1939)	Tropical Worldwide (Carlton & Eldredge, ms)	WW
Bugulidae	*Bugula neritina*	PR, I	Carlton & Eldredge, ms	1921	Pearl Harbor, BPBM Spec K 235	Tropical Worldwide (Soule & Soule, 1967)	WW
Bugulidae	*Bugula robusta*	PR, I	C. Zabin, pers. comm.	1997	Honolulu and Barber's Point Harbors	Tropical Worldwide (C. Zabin, pers. comm.)	WW
Scrupocellariidae	*Caberia boryi*	PR, C	Carlton & Eldredge, ms	1966	Kane`ohe Bay (Soule and Soule 1987)	Worldwide	WW
Bugulidae	*Caulibugula dendrograpta*	PR, I	C. Zabin, pers. comm.	1997	Honolulu and Barber's Point Harbors	Western Indo-Pacific (C. Zabin, pers. comm.)	WIP
Savignyellidae	*Savignyella lafontii*	PR, I	Carlton & Eldredge, ms	1935	Kane`ohe Bay (Edmondson and Ingram 1939)	Tropical Atlantic (Carlton & Eldredge, ms)	CA
Schizoporellidae	*Schizoporella cf. errata*	PR, I	Carlton & Eldredge, ms	1935	Kane`ohe Bay as *S. errata*. Poss. pre 1933 (Edmondson, 1933)	Worldwide	WW
Watersiporidae	*Watersipora edmondsoni*	PR, I	Carlton & Eldredge, ms	1966	Ala Wai (Soule and Soule, 1967)	Tropical-Subtropical Pacific (Carlton & Eldredge, ms)	IP
Acidiacea							
Ascidiidae	*Ascidia sp. A*	PR, I	Carlton & Eldredge, ms		Kane`ohe Bay (Abbott et al. 1997), date unspecified		
Ascidiidae	*Ascidia sp. B*	PR, I	Carlton & Eldredge, ms		Kane`ohe Bay (Abbott et al. 1997), date unspecified		
Ascidiidae	*Ascidia sydneiensis*	PR, I	Carlton & Eldredge, ms	1976	Pearl Harbor, BPBM Spec Y 244,	Tropical Worldwide (Abbott et al. 1997)	WW
Corellidae	*Corella minuta*	PR, C	Carlton & Eldredge, ms		Kane`ohe Bay (Abbott et al. 1997), date unspecified	Caribbean to Westen Pacific	WW
Didemnidae	*Didemnum perlucidum*	PR, I	Godwin & Lambert 2000	1998	Keehi Lagoon (Godwin & Lambert 2000)	Tropical Worldwide	WW
Didemnidae	*Diplosoma listerianum*	PR, I	Carlton & Eldredge, ms	1977	Kane`ohe Bay, Rastetter and Cooke (1979)	Worldwide (Lambert and Lambert 1998)	WW
Styelidae	*Eusynstyela hartmeyeri*	PR, I	Godwin & Lambert Pers. Com.	1996	Pearl Harbor, as *Eusynstyela aliena* Monniot (Godwin and Lambert 2000)		
Pyuridae	*Herdmania pallida*	PR, I	Carlton & Eldredge, ms	1972	Pearl Harbor, as *Herdmania momus* Long (1974)	Tropical Worldwide (Abbott et al. 1997)	WW
Pyuridae	*Herdmania* sp.	NR, I	Godwin & Lambert Pers. Com.	2000	Kane`ohe Bay, first Hawai`i report, present study		
Pyuridae	*Microcosmus exasperatus*	PR, I	Carlton & Eldredge, ms	1996	Kane`ohe Bay (Abbott et al. 1997), 1st rept. date unspecified	Tropical Worldwide (Abbott et al. 1997)	WW
Ascidiidae	*Phallusia nigra*	PR, I	Carlton & Eldredge, ms	1975	Kane`ohe Bay, BPBM Spec Y 241 as *Ascidia nigra*	Worldwide (Abbott et al. 1997)	WW
Styelidae	*Polyandrocarpa sagamiensis*	PR, I	Carlton & Eldredge, ms		Kane`ohe Bay and Pearl Harbor (Abbott et al. 1997), date unspec.		
Styelidae	*Polyandrocarpa zorritensis*	PR, I	Carlton & Eldredge, ms		Kane`ohe Bay and Pearl Harbor (Abbott et al. 1997), date unspec.	Peru, Mediterranean, S. California (Abbott et al. 1997)	WW
Styelidae	*Polyclinum constellatum*	PR, I	Monniot & Monniot 1997	1973	Kane`ohe Bay, BPBM Spec Y 191	Tropical Worldwide (Abbott et al. 1997; Monniot and Monniot 1997)	WW
Styelidae	*Styela canopus*	PR, I	Carlton & Eldredge, ms		Kane`ohe Bay and Pearl Harbor (Abbott et al. 1997), date unspec.	Eastern North America (Lambert and Lambert 1998)	WA

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Osteichthyes							
Serranidae	*Cepaholophis argus*	PR, I	Maciolek, 1984; Randall, 1986	1956	Offshore O`ahu and Hawai`I, for fisheries "enhancement"	Tropical Indo-Pacific (Randall, 1987)	IP
Lutjanidae	*Lutjanus fulvus*	PR, I	Maciolek, 1984; Randall, 1987	1956	Kane`ohe Bay, in 1956 and 1959 for fisheries "enhancement"	Tropical Indo-Pacific (Randall, 1987)	IP
Lutjanidae	*Lutjanus fkasmira*	PR, I	Maciolek, 1984; Randall, 1987	1956	Kane`ohe Bay, in 1956 and 1960 for fisheries "enhancement"	Tropical Indo-Pacific (Randall, 1987)	IP
Holocanthidae	*Centropyge flavissima*	PR, I	R. Pyle, pers. comm.	1998	Ala Wai Harbor. However, undoc. reports for prev.10 years	Tropical Indo-Pacific R. Pyle, pers. comm.)	IP
Cichlidae	*Oreochromis mossambicus*	PR, I	Brock, 1952, 1960	1952	Around O`ahu, for aquaculture	East Africa, Tropical Worldwide (Randall, 1987)	IP