**SUMMARY:** As a result of the determination by the International Trade Commission (the ITC) that revocation of the antidumping duty (AD) order on silicomanganese from Brazil would not be likely to lead to the continuation or recurrence of material injury to an industry in the United States, the Department of Commerce (the Department) is revoking this AD order.

**DATES:** *Effective Date:* September 14, 2011.

**FOR FURTHER INFORMATION CONTACT:** Bryan Hansen or Minoo Hatten, AD/CVD Operations, Import Administration, International Trade Administration, U.S. Department of Commerce, 14th Street and Constitution Avenue NW., Washington, DC 20230; telephone: (202) 482–1690 or (202) 482–3683 respectively.

**SUPPLEMENTARY INFORMATION:**

## Background

On August 1, 2011, the Department initiated and the ITC instituted sunset reviews of the AD orders on silicomanganese from Brazil, the PRC, and Ukraine pursuant to sections 751(c) and 752 of the Tariff Act of 1930, as amended (the Act).[1] As a result of its reviews, the Department found that revocation of the AD orders would likely lead to continuation or recurrence of dumping and notified the ITC of the margins of dumping likely to prevail were the orders revoked.[2]

On October 31, 2012, the ITC published its determination, pursuant to section 751(c) of the Act, that revocation of the AD order on silicomanganese from Brazil would not be likely to lead to the continuation or recurrence of material injury within a reasonably foreseeable time.[3]

## Scope of the Order

The merchandise covered by the order is silicomanganese. Silicomanganese, which is sometimes called ferrosilicon manganese, is a ferroalloy composed principally of manganese, silicon and iron, and normally contains much smaller proportions of minor elements, such as carbon, phosphorus, and sulfur. Silicomanganese generally contains by weight not less than 4 percent iron, more than 30 percent manganese, more than 8 percent silicon, and not more than 3 percent phosphorous. All compositions, forms, and sizes of silicomanganese are included within the scope of the order, including silicomanganese slag, fines, and briquettes. Silicomanganese is used primarily in steel production as a source of both silicon and manganese.

Silicomanganese is currently classifiable under subheading 7202.30.0000 of the Harmonized Tariff Schedule of the United States (HTSUS). Some silicomanganese may also currently be classifiable under HTSUS subheading 7202.99.5040. The order covers all silicomanganese, regardless of its tariff classification. Although the HTSUS subheadings are provided for convenience and customs purposes, the written description of the order remains dispositive.

## Determination

As a result of the determination by the ITC that revocation of the AD order would not be likely to lead to continuation or recurrence of material injury to an industry in the United States, pursuant to section 751(d)(2) of the Act, the Department is revoking the AD order on silicomanganese from Brazil. Pursuant to section 751(d)(2) of the Act and 19 CFR 351.222(i)(2)(i), the effective date of revocation is September 14, 2011 (*i.e.,* the fifth anniversary of the effective date of publication in the **Federal Register** of the most recent notice of continuation of this order).[4]

The Department will notify U.S. Customs and Border Protection, 15 days after publication of this notice, to terminate suspension of liquidation and collection of cash deposits on entries of the subject merchandise, entered or withdrawn from warehouse, on or after September 14, 2011. Entries of subject merchandise prior to the effective date of revocation will continue to be subject to suspension of liquidation and antidumping duty deposit requirements.

This notice also serves as the only reminder to parties subject to administrative protective order (APO) of their responsibility concerning the return/destruction or conversion to judicial protective order of proprietary information disclosed under APO in accordance with 19 CFR 351.305(a)(3). Failure to comply is a violation of the APO which may be subject to sanctions.

This five-year (sunset) review and notice are in accordance with section 751(d)(2) of the Act and published pursuant to section 777(i)(1) of the Act.

Dated: November 1, 2012.

**Paul Piquado,**

*Assistant Secretary for Import Administration.*

[FR Doc. 2012–27285 Filed 11–6–12; 8:45 am]

**BILLING CODE 3510–DS–P**

[1] *See Initiation of Five-Year ("Sunset") Review,* 76 FR 45778 (August 1, 2011) and *Silicomanganese From Brazil, China, and Ukraine Institution of a Five-Year Review Concerning the Antidumping Duty Orders on Silicomanganese From Brazil, China, and Ukraine,* 76 FR 45856 (August 1, 2011).

[2] *See Silicomanganese From Brazil, the People's Republic of China, and Ukraine: Final Results of the Expedited Third Sunset Reviews of the Antidumping Duty Orders,* 76 FR 73587 (November 29, 2011).

[3] *See Silicomanganese From Brazil, China, and Ukraine,* 77 FR 65906 (October 31, 2012). *See also Silicomanganese from Brazil, China, and Ukraine* (Inv. Nos. 731–TA–671–673 (Third Review), USITC Publication 4354, October 2012).

[4] *See Silicomanganese from Brazil, Ukraine, and the People's Republic of China: Continuation of Antidumping Duty Orders,* 71 FR 54272 (September 14, 2006).

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# DEPARTMENT OF COMMERCE

## National Oceanic and Atmospheric Administration

**[Docket No. 100322160–2479–02]**

**RIN 0648–XV10**

## Endangered and Threatened Wildlife and Plants: Notice of 12-Month Finding on a Petition To List the Bumphead Parrotfish as Threatened or Endangered Under the Endangered Species Act (ESA)

**AGENCY:** National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

**ACTION:** Notice of twelve-month finding listing determination and availability of status review documents.

**SUMMARY:** We, NMFS, announce a twelve-month finding and listing determination on a petition to list the bumphead parrotfish (*Bolbometopon muricatum*) as threatened or endangered under the Endangered Species Act (ESA). We have completed a status review of the bumphead parrotfish in response to the petition submitted by WildEarth Guardians and considered the best scientific and commercial data available. The bumphead parrotfish is a coral reef-associated species that occurs in 45 countries in the Indo-Pacific area, including some U.S. Territories. After reviewing the best scientific and commercial data available, we have determined that the bumphead parrotfish is not warranted for listing under the ESA because the species still occupies its historical range, although at a lower and declining abundance, but with biological characteristics and management measures that support the population above the viability threshold. Based on these considerations, described in more detail in this notice, we conclude that the bumphead parrotfish is not currently in danger of extinction throughout all or a significant portion of its range, and not

likely to become so within the foreseeable future.

**DATES:** This finding was made on November 7, 2012.

**ADDRESSES:** The Bumphead parrotfish status review documents (Biological Review Team Report, Management Report) are available by submitting a request to the Regulatory Branch Chief, Protected Resources Division, NMFS Pacific Islands Regional Office, 1601 Kapiolani Blvd., Suite 1110, Honolulu, HI 96814, Attn: Bumphead Parrotfish 12-month Finding. The reports are also available electronically at: *http://www.fpir.noaa.gov/PRD/prd_esa_section_4.html.*

**FOR FURTHER INFORMATION CONTACT:** Lance Smith, NMFS Pacific Islands Regional Office, (808) 944–258; or Dwayne Meadows, NMFS, Office of Protected Resources (301) 427–8403.

**SUPPLEMENTARY INFORMATION:**

## Background

On January 4, 2010, we received a petition from WildEarth Guardians to list the bumphead parrotfish (*Bolbometopon muricatum*) as threatened or endangered under the Endangered Species Act of 1973. The petitioner also requested that critical habitat be designated for this species concurrent with listing under the ESA. The petition asserted that overfishing is a significant threat to bumphead parrotfish and that this species is declining across its range and is nearly eliminated from many areas. The petition also asserted that degradation of coral habitat through coral bleaching and ocean acidification threatens this species as coral is its primary food source. The petition also argued that biological traits (e.g., slow maturation and low reproductive rates), shrinking remnant populations and range reductions, effects from increasing human populations, and inadequate regulatory protection all further contribute to the risk of extinction for bumphead parrotfish. This species is listed as vulnerable by the International Union for the Conservation of Nature (IUCN; Chan *et al.,* 2007).

On April 2, 2010, we published a 90-day finding with our determination that the petition presented substantial scientific and commercial information indicating that the petitioned action may be warranted (75 FR 16713). We initiated a comprehensive status review of bumphead parrotfish to determine if the species warrants listing under the ESA. The 90-day finding requested scientific and commercial information from the public to inform a status review of the species. We received ten public responses to the 90-day Finding; the information we received was considered in the comprehensive status review as described below in the Biological Review section. The status review of bumphead parrotfish was completed jointly by our Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO). A Bumphead Parrotfish Biological Review Team (BRT) comprising Federal scientists from the Hawaii Cooperative Fishery Research Unit of the United States Geological Survey, and our Southwest and Pacific Islands Fisheries Science Centers completed a biological report on the species (hereafter ''BRT Report'', cited as Kobayashi *et al.,* 2011). PIRO staff completed a report on the regulatory mechanisms and conservation efforts affecting the species across its range (hereafter ''Management Report'', cited as NMFS, 2012). The BRT Report and Management Report together constitute the bumphead parrotfish status review. Both reports are available as described above [see **ADDRESSES**].

## Listing Determinations Under the ESA

We are responsible for determining whether the bumphead parrotfish is threatened or endangered under the ESA (16 U.S.C. 1531 *et seq.*). Section 4(b)(1)(A) of the ESA requires us to make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and after taking into account efforts being made by any state or foreign nation to protect the species. We have followed a four-step approach in making this listing determination for bumphead parrotfish: (1) Biological Review; (2) Threats Evaluation; (3) Extinction Risk Analysis; and (4) Listing Determination.

For the first step, the BRT completed a biological review of the taxonomy, distribution, abundance, life history and biology of the species (Kobayashi *et al.,* 2011). The BRT Report determined if the bumphead parrotfish is a ''species'' under the ESA. To be considered for listing under the ESA, a group of organisms must constitute a ''species,'' which is defined in section 3 of the ESA to include taxonomic species plus ''any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature.'' The BRT Report's results are summarized below under Biological Review.

For the second step, we assessed threats affecting the species' status. We did this by following guidance in the ESA that requires us to determine whether any species is endangered or threatened due to any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence (sections 4(a)(1)(A) through (E)). The BRT Report examined factors A, B, C, and E (Kobayashi *et al.,* 2011), and the Management Report examined factor D and conservation efforts as per section 4(b) (NMFS, 2012). Results of the BRT and Management Reports with regard to the five factors are summarized below under Threats Evaluation.

For the third step, we completed an extinction risk analysis to determine the status of the species. We asked the BRT to develop an extinction risk analysis approach based on the best available information for bumphead parrotfish. Extinction risk results in Kobayashi *et al.* (2011) are based on factors A, B, C, and E of section 4(a)(1) of the ESA. Factor D (''inadequacy of existing regulatory mechanisms''); Federal, state, and foreign conservation efforts were assessed in the Management Report (NMFS, 2012), and not considered by the BRT in its extinction risk analysis for the species. Thus, a final extinction risk analysis was done by determining whether results of the BRT's extinction risk analysis would be affected by conclusions made based on the contents of the Management Report, thereby addressing the five 4(a)(1) factors as well as conservation efforts that may mitigate the impacts of threats to the species' status. The Policy for Evaluation of Conservation Efforts When Making Listing Determinations, or PECE policy (68 FR 15100; March 28, 2003) provides direction for the consideration of protective efforts identified in conservation agreements, conservation plans, management plans, or similar documents (developed by Federal agencies, state and local governments, Tribal governments, businesses, organizations, and individuals) that have not yet been implemented, or have been implemented but have not yet demonstrated effectiveness. The evaluation of the certainty of an effort's effectiveness is made on the basis of whether the effort or plan: establishes specific conservation objectives; identifies the necessary steps to reduce threats or factors for decline; includes quantifiable performance measures for the monitoring of compliance and effectiveness; incorporates the principles of adaptive management; and is likely to improve the species' viability at the time of the listing determination. In addition, recognition through Federal government or state listing promotes public awareness and conservation actions by Federal, state, tribal governments, foreign nations, private organizations, and individuals.

For the fourth step, results of the biological review, threats evaluation, and extinction risk analysis are considered to determine whether the bumphead parrotfish qualifies for threatened or endangered status. Section 3 of the ESA defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species as one ''which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' Thus, in the context of the ESA, the Services interpret an ''endangered species'' to be one that is presently at risk of extinction. A ''threatened species,'' on the other hand, is not currently at risk of extinction but is likely to become so. In other words, a key statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either now (endangered) or within the foreseeable future (threatened). Thus, a species may be listed as threatened if it is likely to become in danger of extinction throughout all or a significant portion of its range within the foreseeable future.

Whether a species is ultimately protected as endangered or threatened depends on the specific life history and ecology of the species, the nature of threats, the species' response to those threats, and population numbers and trends. In determining whether the species meets the standard of endangered or threatened, we must consider each of the threats identified, both individually and cumulatively. For purposes of our analysis, the mere identification of factors that could impact a species negatively is not sufficient to compel a finding that ESA listing is appropriate. In considering those factors that might constitute threats, we look beyond mere exposure of the species to the factor to determine whether the species responds, either to a single threat or multiple threats in combination, in a way that causes actual impacts at the species level. In making this finding, we have considered and evaluated the best available scientific and commercial information, including information received in response to our 90-day finding.

**Biological Review**

This section provides a summary of the BRT Report (Kobayashi *et al.,* 2011). The BRT first reviewed the ten public comments received on the 90-day Finding and found that six of them reiterated other materials available to the BRT. Two comments argued for the existence of bumphead parrotfish DPSs in American Samoa and Guam, but no supporting biological information was provided. A DPS is evaluated for listing under the three following elements: (1) Discreteness of the population segment in relation to the remainder of the species to which it belongs; (2) The significance of the population segment to the species to which it belongs; and (3) The population segment's conservation status in relation to the Act's standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened?) (61 FR 4722: February 7, 1996). The BRT found insufficient information to conclude that a DPS designation was warranted for bumphead parrotfish. These two comments did, however, provide information substantiating information already available to the BRT regarding the role of fishing in the decline of bumphead parrotfish around heavily populated and/or visited areas.

The two remaining comments contained information pertinent to existing regulatory mechanisms throughout bumphead parrotfish range. This information was provided to the staff compiling the management report. Following are summaries of key biological information presented in Kobayashi *et al.* (2011).

*Species Description*

The bumphead parrotfish is a member of a conspicuous group of shallow-water fishes (parrotfishes in the family Scaridae, order Perciformes) that are closely associated with coral reefs (Bellwood, 1994; Randall *et al.,* 1997). Currently, 90 species in 10 genera are recognized in the parrotfish family (Bellwood, 1994; Parenti and Randall, 2000). Parrotfishes are distinguished from other fishes based on their unique dentition (dental plates derived from fusion of teeth), loss of predorsal bones, lack of a true stomach, and extended length of intestine (Randall, 2005).

The bumphead parrotfish is the largest member of the parrotfishes, growing to at least 110 cm total length (TL) (Kobayashi *et al.,* 2011) and a maximum total length of 130 cm and weighing up to 46 kg (Donaldson and Dulvy, 2004; Randall, 2005). Adults are primarily olive to blue green or grey in color with the anterior region near the head being yellow to pink in coloration (Randall, 2005). A prominent bulbous bump on the forehead, from whence the genus name is derived, is also a common feature observed in adults. The bump is sexually dimorphic, it slopes caudal to beak in females but is nearly parallel with the beak in males, and the entire bump is usually larger in males (Munoz et al., 2012). Bumphead parrotfish have been observed to reach sexual maturity at 55–65 cm TL for females and 47–55 cm TL for males (Hamilton *et al.,* 2007). Consequently, juvenile bumphead parrotfish are defined as any fish less than about 50 cm TL. Juveniles are greenish brown in color with two to three vertical rows of white spots along the flank (Bellwood and Choat, 1989; Randall, 2005). Bumphead parrotfish are distinguished from other parrotfish species by possessing two to four median predorsal scales, three rows of cheek-scales, 16–17 pectoral-fin rays, 16–18 gill rakers, and 12 precaudal vertebrae (Kobayashi *et al.,* 2011).

English common names include buffalo parrotfish, bumphead parrotfish, double-headed parrotfish, giant humphead parrotfish, green humphead parrotfish, and humphead parrotfish. Non-English common names in the Pacific include: Lendeke, Kitkita, Topa, Topa kakara, Perroquet bossu vert, Togoba, Uloto'i, Gala Uloto'i, Laea Uloto'i, Loro cototo verde, Berdebed, Kalia, Kemedukl, Kemeik, and Tanguisson. Several of these names are a reflection of the different size ranges of the fish used within a society (Adams and Dalzell, 1994; ASFIS, 2010; Aswani and Hamilton, 2004; Hamilton, 2004; Hamilton *et al.,* 2007; Helfman and Randall, 1973; Johannes, 1981).

Currently, there is no population genetic information on bumphead parrotfish. Regional variation in morphology, meristics, coloration, or behavior has not been observed. Based on modeling of pelagic egg and larvae transport, the species likely has an interconnected population structure throughout its current range, with the possible exception of both the eastern and western edges of the current range (Kobayashi *et al.,* 2011). While this conclusion is based on a single estimate of larval duration, this estimate is the best available information and is well within the range of values reported for labrids and scarids (Ishihara and Tachihara, 2011). Several empirical studies did not find a relationship between pelagic larval duration and genetic population structure (Bay *et al.,* 2006; Bowen *et al.,* 2006; Luiz *et al.,* 2012) however they and others (Saenz-Agudelo *et al.,* 2012; Treml *et al.,* 2012) all found evidence to some degree of relatively long range dispersal in species with a pelagic larval stage; as such, while pelagic larval duration is likely one of many factors that influence reef fish dispersal and connectivity, the existence of a pelagic larval life stage is likely to result in interconnected population structure to some degree. More recent work by Faurby and Barber (2012) asserts that pelagic larval duration may be a much stronger determinant of realized larval dispersal than suggested in empirical studies due to variation and uncertainty associated with calculating genetic structure. Without genetic information for bumphead parrotfish, it is impossible to confirm or deny this relationship. Additionally, Treml *et al.* (2012) found that broad-scale connectivity is strongly influenced by reproductive output and the length of pelagic larval duration across three coral reef species.

One year of current data (2009) was chosen for use in the pelagic transport simulation; although some interannual variability exists in ocean currents, PIFSC data available at Oceanwatch (*http://oceanwatch.pifsc.noaa.gov/equator_eof.html*) indicate that 2009 transitioned between high and low sea surface height anomalies and was not likely to be anomalous in any respect for the whole year considered. Although the simulation did not necessarily account for inter-annual variability of current data outside of 2009, its reliance on the entire year's current data, rather than a time-limited snapshot, increases our confidence in its projections. Sponaugle *et al.* (2012) provide a demonstration of significant agreement between modeled and observed settlement of a coral reef fish. The BRT found, and we agree, that the bumphead parrotfish is a single, well-described species that cannot be sub-divided into DPSs based on the currently available biological information (Kobayashi *et al.,* 2011). In addition to the criteria identified *supra,* DPSs may be delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of Section 4(a)(1)(D) of the ESA. Because this determination involves consideration of factors outside the technical and scientific expertise of the BRT, they were not charged with determining whether distinguishing DPSs based on international political boundaries is appropriate. This aspect of DPS designation is discussed further below in the Listing Determination.

*Habitat and Distribution*

Adult bumphead parrotfish are found primarily on shallow (1–15 m) barrier and fringing reefs during the day and rest in caves and shallow sandy lagoon habitats at night (Donaldson and Dulvy, 2004). Extensive reef structures on the Great Barrier Reef off the east coast of Australia with adjacent lagoons appear to provide an example of optimal habitat for bumphead parrotfish (Choat, personal communication). Lihou and Herald are two isolated islands in the Coral Sea approximately 1000 km from the Great Barrier Reef with little fishing pressure. Densities of bumphead parrotfish are over an order of magnitude higher on the Great Barrier Reef compared with these two island locations (see Figure 3 in Kobayashi *et al.,* 2011adapted from Choat, unpublished data). Thus, differences in abundance between locations may be related, at least in part, to habitat and biogeographic preferences (Kobayashi et al., 2011). This highlights the importance of exposed outer reef fronts with high structural complexity along a continuous reef system with adjacent lagoons as preferred habitat. Likely limiting factors for bumphead parrotfish abundance are sheltered lagoons for recruitment, high energy forereef foraging habitat for adults, and nighttime shelter (caves) for sleeping (Kobayashi *et al.,* 2011).

Based on limited information, juvenile bumphead parrotfish habitat is thought to consist mainly of mangrove swamps, seagrass beds, coral reef lagoons, and other benthic habitats that provide abundant cover (Kobayashi *et al.,* 2011). Juvenile bumphead parrotfish in the Solomon Islands were restricted to the shallow inner lagoon while larger individuals of adult size classes (>60 cm TL) occurred predominately in passes and outer reef areas (Aswani and Hamilton, 2004; Hamilton, 2004). Densities of juveniles (< 50 mm Fork Length (FL)) were an order of magnitude higher in the inner lagoon around Cocos-Keeling in the Indian Ocean than in the central lagoon; lower numbers of juveniles occurred on the forereef. Size distributions of bumphead parrotfish at Cocos-Keeling show a dominance of small individuals in the inner lagoon with the mode at 18 mm FL. The mid-lagoon shows a bimodal distribution with a mode of 24 mm FL and another mode at 72 mm FL. The forereef size distribution consists of larger juveniles with a mode at 66 mm FL (Choat, unpublished data).

Bumphead parrotfish are found in 45 countries in the Indo-Pacific as well as disputed areas in the South China Sea. The BRT divided this range into 63 strata, which are primarily country specific, but include subsections or regions within countries in some cases. Certain geographic strata are in or near the overall range polygon, but are not known to have bumphead parrotfish (e.g., Hawaii, Johnston Atoll, Cook Islands, Tokelau, Nauru, British Indian Ocean Territory, etc.). Although data are limited, we found no evidence to conclude that historical range was significantly different from current range. We therefore conclude that the historical and current ranges are equivalent (Kobayashi *et al.,* 2011). Surveys conducted in northern Tanzania and Bolinao, Philippines both reported no bumphead parrotfish observed, however they were conducted at only a few sites within each country and absence is likely based on limited survey data (see below). McClanahan et al. (1999) specifically note that in reef surveys in Tanzania, there was no evidence for species losses.

*Abundance and Density*

The bumphead parrotfish is thought to have been abundant throughout its range historically (Dulvy and Polunin, 2004). Numerous reports suggest that fisheries exploitation has reduced local densities to a small fraction of their historical values in populated or fished areas (Bellwood *et al.,* 2003; Dulvy and Polunin, 2004; Hamilton, 2004; Hoey and Bellwood, 2008). Estimates of abundance throughout the entire geographic range of bumphead parrotfish are unavailable. However, efforts have been made to document the abundance of reef fishes, including bumphead parrotfish, at specific locations (Jennings and Polunin, 1995; 1996; Dulvy and Polunin, 2004). Among the non-U.S. sites examined in these studies, Australia's Great Barrier Reef had the highest observed densities of bumphead parrotfish with an estimate of 3.05 fish per $km^2$, followed by the Solomon Islands (1.40 fish per $km^2$), and Fiji (0.03 fish per $km^2$). Reef fish surveys from northern Tanzania and Bolinao in the Philippines did not record any bumphead parrotfish, although it should be noted that in comparison to other locations for which data are presented, these two studies represent the lowest amount of survey effort (2 survey transects each) and the highest levels of exploitation. Studies have also shown that larger individuals of reef fish species began fleeing at great distances in areas where human activity such as spearfishing occurs (e.g., Kulbicki 1998; Bozec *et al.* 2011), making them less detectable in visual surveys, whereas in remote and/or protected areas, the large individuals are relatively easily observed. Bozec et al.'s large fish size begin at 30cm, only half of the average size of bumpheads; however, their results indicate a general trend of the larger the fish, the greater the fleeing distance. Their results also indicate that size and shyness have combined effects on fishes' reaction to observers, with large fish tending to be more shy. Where surveys focused on species of commercial importance, the corresponding detection profiles exhibited a marked diver avoidance since commercial species are usually larger and more likely to be frightened by divers. Heavy subsistence, artisanal, and commercial fisheries were reported at all locations where bumphead parrotfish densities were less that 1 fish per km$^2$. Interpretation of these results is complicated by several additional methodological concerns like limited depth range of surveys, comparability of results from different survey methods, comparability of results collected over a 13 year time span, and whether or not surveys conducted can be considered representative of the entire species range (Kobayashi *et al.,* 2001). As such, while we have some information on bumphead parrotfish abundance from a few areas within the species range, the results should be interpreted and compared cautiously.

Densities of bumphead parrotfish in the Indian Ocean show a biogeographic density gradient with the highest densities adjacent to the western Australian coast, and densities decreasing to the west (Choat, unpublished data; see Figure 9 in Kobayashi *et al.* 2011). Densities at Rowley Shoals off Western Australia are similar to high densities observed on the outer Great Barrier Reef, and highlight the importance of exposed outer reef habitats with adjacent lagoons and low population density and utilization. Densities of bumphead parrotfish in the western Indian Ocean (East Africa, Seychelles) are generally lower than those observed in Australia and the western Pacific, although some areas of the Seychelles such as Farquhar Atoll and Cousin Island (Jennings, 1998) are exceptions to the gradient described above and support large densities of bumphead parrotfish. Also, large numbers of bumphead parrotfish are found in some areas of Borneo and Malaysia (e.g., Sipadan; Kobayashi *et al.,* 2011).

Surveys conducted by the Secretariat of the Pacific Community (SPC) in their Pacific Regional Oceanic and Coastal Fisheries project in 2001–2008 revealed relatively high numbers of bumphead parrotfish in Palau with slightly more than 1.5 individuals per station. Numbers in New Caledonia were approximately half of those observed in Palau. Sites in Papua New Guinea and the Federated States of Micronesia also recorded modest numbers of individuals. Low numbers in Tonga, Fiji, and the Solomon Islands may reflect fishing pressure (e.g., Dulvey and Polunin, 2004; Hamilton, 2004), while their absence from a number of locations is likely the result of the lack of suitable lagoon habitats for recruitment (i.e., Niue, Nauru) (Kobayashi *et al.,* 2011). Based on SPC data, the maximum number of individuals per school was 120 individuals in Palau and 100 individuals in New Caledonia. Overall, the average number of individuals observed per school was 8.17 fish (Kobayashi *et al.,* 2011).

In the U.S. Pacific Islands, abundance of bumphead parrotfish has been assessed since 2000 as part of PIFSC's Reef Assessment and Monitoring Program. Bumphead parrotfish were most abundant at Wake Atoll in the Pacific Remote Island Areas (PRIAs) (~300 fish per km$^2$), followed by Palmyra Atoll in the PRIAs (5.22 fish per km$^2$), Pagan Island in the Commonwealth of the Northern Mariana Islands (1.62 fish per km$^2$), Jarvis Island in the PRIAs (1.26 fish per km$^2$), Ta'u Island in American Samoa (1.08 fish per km$^2$), and Tutuila Island in American Samoa (0.41 fish per km$^2$; Kobayashi *et al.,* 2011).

In summary, the abundance of bumphead parrotfish varies widely. Sites where bumphead parrotfish are found in abundance (densities as high as 300 fish per km$^2$) include portions of the Great Barrier Reef Marine Park (Bellwood *et al.,* 2003), sites in the Seychelles, Wake Atoll and Palmyra Atoll, U.S. Pacific Islands, Rowley Shoals Marine Park, isolated regions of Papua New Guinea, portions of the Red Sea, protected sites in Palau, and remote sites in the Solomon Islands (Kobayashi *et al.,* 2011). Alternatively, they are relatively uncommon in parts of Fiji, Samoa, Guam, Mariana Islands, Tonga, and Solomon Islands, with many other areas at intermediate levels of abundance. Also, the BRT was unable to find abundance information in many parts of the species' range (Kobayashi *et al.,* 2011).

### *Contemporary Global Population Abundance*

The BRT Report warns that ''There are inadequate data on bumphead parrotfish population dynamics, demography, and temporal/spatial variability to use even the most rudimentary of stock assessment models. The data simply do not exist to allow one to credibly estimate changes in population size, or even the magnitude of population size, structured over space and time in a proper framework of metapopulation dynamics and demographics'' for bumphead parrotfish. The BRT used the best available information on population density from recent (1997–2009) survey data to develop contemporary global estimates of adult bumphead parrotfish abundance. Contemporary global population estimates are based on the geographic range of bumphead parrotfish, amount of suitable adult bumphead parrotfish habitat within its range, and the density of adult bumphead parrotfish within the habitat. Population density data were available for 49 of 63 of the strata from SPC and ReefCheck underwater visual surveys. They then used a bootstrap resampling simulation approach to estimate global population density by randomly assigning from the actual density estimates one estimate to each stratum in each simulation model iteration (Kobayashi *et al.,* 2011). Uncertainty and variability are incorporated by the use of 5000 iterations of the simulation.

The BRT used the bootstrap modeling approach to develop three estimates of global abundance: (1) A ''regular-case'' estimate based on the methods described above and resulting in a best estimate of 3.9 million adults (95 percent confidence interval = 69,000–61,000,000 adults); (2) a ''worst-case'' estimate which decreased the estimated amount of available habitat and resulted in an abundance estimate of 2.2 million adults (95 percent confidence interval = 28,000–36,000,000 adults); and (3) a ''matched-case'' estimate where density estimates for the 49 strata where surveys had occurred were based on those survey data, and estimates for the other 13 strata were based on the randomization process used in the ''regular-case'' estimate. This third method resulted in an estimated abundance of 4.6 million adults (95 percent confidence interval = 17,000–67,000,000 adults). The BRT concluded, and we agree, that the regular-case estimate provides the most reliable estimate of current global abundance of bumphead parrotfish. However, all models involved large confidence intervals, and high uncertainty is associated with all three estimates. Accordingly, all population estimates are to be interpreted with caution.

*Global Abundance Trends*

Anecdotal accounts abound of past abundance and recent declines of bumphead parrotfish in many parts of its range (see literature cited in Kobayashi *et al.,* 2011 and NMFS, 2012). Data on appropriate spatial and temporal scales for both historical and contemporary abundances are needed to quantify historic global abundance trends. As described above, the BRT provided contemporary global abundance estimates. However, they found available historical data on such small spatial (e.g., Palau fisheries data, 1976–1990) and temporal (e.g., underwater visual data, 1997-present) scales that historical global population abundance cannot be quantitatively estimated with any reasonable confidence. In the absence of historical quantitative data, the BRT developed two estimates of historical global abundance of adult bumphead parrotfish based on the available contemporary survey data and assumptions regarding likely historic levels of density and that the amount of available habitat was the same as currently. One estimate, called the ''virgin-case'', is based on the assumption that historical density is reflected by the density of bumphead parrotfish in the transects surveys that had bumphead parrotfish present (7 percent of the 6,561 transects), while the other estimate, called ''historic-density'', assumes that historical density was 3 fish per 1000 m$^2$ which is derived from current densities in areas where bumphead parrotfish are considered abundant. The virgin-case estimate of historical abundance was 131.2 million adults (95 percent confidence interval = 66.5–434 million adults), while the historic-density estimate was 51 million (the BRT did not calculate estimates of precision for this estimate).

The BRT states that ''the estimates of virgin abundance and related inferences about degree of population reduction are highly speculative and subject to a great deal of uncertainty'' (Kobayashi *et al.*, 2011, p. 50). Uncertainty results from possible bias in assumed historical densities, lack of historical density data to validate the methodology on any spatial scale, the amount of habitat available historically may have been over- or under-estimated, historical ecological changes (e.g., reduction in bumphead parrotfish predators) reduce reliability, and density-dependant mechanisms may have affected bumphead parrotfish populations differently in historical times than in contemporary times (Kobayashi *et al.*, 2011; NMFS, 2011). However, the BRT's modeling results are the best available information on historical and current bumphead parrotfish population abundances. In the ''Status of Species'' conclusion, the BRT states that the global bumphead parrotfish population shows ''evidence of a large overall decline and continuing trend of decline despite lack of strong spatial coherence'' (Kobayashi *et al.*, 2011, p. 54). Based on the BRT's population modeling results and the uncertainty associated with them, we conclude that adult bumphead parrotfish have undergone a decline in historical population abundance but we are unable to quantify, with any degree of accuracy, the magnitude of that decline.

*Future Abundance*

In order to quantitatively predict likely future global abundance trends for adult bumphead parrotfish, spatially-explicit data on current and projected levels of the various threats to bumphead parrotfish for each strata would need to be incorporated into a population model because these threats are variable throughout the species range (e.g., some strata are unfished, some strata are heavily fished, some strata may be trending independently of human impact). These data are not currently available so we cannot reliably quantify how trends in current and future human activities and other threats will impact the population into the future. The BRT was not able to estimate future population trends by strata, and accordingly, did not attempt a future projection. As such, we conclude that future global population trends for adult bumphead parrotfish are unquantifiable at this time. However, based on the information provided in the BRT Report (Kobayashi *et al.,* 2011), we conclude that, qualitatively, the available evidence suggests a continuing trend of decline in the global abundance of bumphead parrotfish is likely to continue into the future.

*Age and Growth*

The bumphead parrotfish appears to have a reasonably well-characterized growth curve and approaches its maximum size at approximately 10–20 years of age with a longevity estimated at approximately 40 years. Most individuals seen in adult habitat are likely older than approximately 5 years (Kobayashi *et al.,* 2011). These estimates have been developed for bumphead parrotfish based on several studies from northeast Australia (Choat and Robertson, 2002), the western Solomon Islands (Hamilton, 2004), New Caledonia (Couture and Chauvet, 1994), and the Indo-Pacific region (Brothers and Thresher, 1985). Choat and Robertson (2002) estimated maximum age for bumphead parrotfish to be 40 years of age assuming that checks on otoliths are deposited annually, although others have estimated maximum age to range from the upper 20s to mid 30s (Hamilton, 2004). All of these estimates may be overly conservative as the largest and potentially oldest individuals observed may not have been included in the analysis (Choat and Robertson, 2002; Hamilton, 2004). In New Caledonia, Couture and Chauvet (1994) determined that bumphead parrotfish have a slow growth rate and in their sampling, the oldest individual was estimated at 16 years. With the exception of the study from New Caledonia, which used scale annuli increments, all ages were determined using otolith sections; some concern has been expressed that these two age determination methods are not equally valid. Based on limited sample size, lack of validation and/or disagreement between scale and otolith techniques, the potential exists to misestimate longevity, growth, and natural mortality for the species (Choat *et al.,* 2006).

Data collected in the western Solomon Islands suggest differential growth between sexes for bumphead parrotfish. Studies indicate that males attain a larger asymptotic size than females and growth is slow but continuous throughout life. In contrast, females exhibit more determinate growth characteristics with asymptotic size established at around age 15 years (Hamilton, 2004).

Age and growth characteristics of juvenile bumphead parrotfish are less well known than those of adults. Pelagic larval duration was estimated at 31 days using pre-transitional otolith increments from just one specimen (Brothers and Thresher, 1985).

The average size of individual bumphead parrotfish observed from SPC surveys was 59.7 cm TL (SD = 20.8), with the largest individual being 110 cm and the smallest being 14 cm. Notable size differences were observed at different locations. These size differences could reflect variable habitat-related growth conditions, recruitment problems, or some level of population structure, but more likely reflect differences in the intensity of harvest and the degree to which size structure of populations has been truncated (Kobayashi *et al.,* 2011).

*Feeding*

Parrotfishes as a family are primarily considered herbivores. A majority of parrotfishes inhabiting areas around rocky substrates or coral reefs use their fused beak-like jaws to feed on the benthic community. Based on differences in morphology, parrotfishes are separated into two distinct functional groups: scrapers and excavators (Bellwood and Choat, 1990; Streelman *et al.,* 2002). Scrapers feed by taking numerous bites, removing material from the surface of the substratum, while excavators take fewer bites using their powerful jaws to remove large portions of both the substrate and the attached material with each bite. As a result of even moderate levels of foraging, both scrapers and excavators can have profound impacts on the benthic community. Thus, it is widely recognized that parrotfishes play important functional roles as herbivores and bioeroders in reef habitats (Bellwood *et al.,* 2003; Hoey and Bellwood, 2008).

Bumphead parrotfish are classified as excavators feeding on a variety of benthic organisms including corals, epilithic algae, sponges, and other microinvertebrates (Bellwood *et al.,* 2003; Calcinai *et al.,* 2005; Randall, 2005; Hoey and Bellwood, 2008). A foraging bumphead parrotfish often leaves distinct deep scars where benthic organisms and substrate have been removed. As such, their contribution as a major bioeroder is significant. A single individual is estimated to ingest more than 5 tons (27.9 kg per $m^2$) of reef carbonate each year (Bellwood *et al.,* 2003); hence, even small numbers of bumphead parrotfish can have a large impact on the coral reef ecosystem.

Bumphead parrotfish show little evidence of feeding selectivity; however, a significant portion (up to 50 percent) of their diet consists of live coral (Bellwood and Choat, 1990; Bellwood *et al.,* 2003; Hoey and Bellwood, 2008). On the Great Barrier Reef, bumphead parrotfish are considered major coral predators. One study documented removal of up to 13.5 kg per $m^2$ of live coral per year, but also that slightly more foraging activity was directed towards algae than living coral (Bellwood *et al.,* 2003). Thus, adult bumphead parrotfish are not obligate corallivores but rather generalist benthic feeders. Juvenile bumphead parrotfish diet is not well documented but likely also includes a broad spectrum of softer benthic organisms. Live coral may be relatively unimportant due to the lack of high densities of corals in some juvenile habitats. Generally, bumphead parrotfish appear to be opportunistic foragers and would likely cope with ecosystem shifts in the coral reef community, based upon their behavior and ecology. For example, shifts in benthic species composition (changes in the breakdown of hard corals, soft corals, coralline algae, fleshy algae, sponges, bryozoans, tunicates, etc.) would likely not adversely affect bumphead parrotfish given their nonselective diet (Kobayashi *et al.,* 2011).

*Movements and Dispersal*

Adult bumphead parrotfish movement patterns are distinct between day and night. Diurnal movement patterns are characterized by groups of individuals foraging among forereef, reef flat, reef pass, and clear outer lagoon habitats at depths of 1–30 m (Donaldson and Dulvy, 2004). The bumphead parrotfish is a gregarious species that can be observed foraging during the day in schools of 20 to more than 100 individuals (Gladstone, 1986; Bellwood *et al.,* 2003). Groups of foraging parrotfish are highly mobile and often travel distances of several kilometers throughout the day. For example, a study of adult bumphead parrotfish movements and home ranges in the Solomon Islands demonstrated that adults range up to 6 km (3.7 mi) daily from nocturnal resting sites (Hamilton, 2004). At dusk, schools of parrotfish move to nocturnal resting sites found among sheltered forereef and lagoon habitats. Bumphead parrotfish remain motionless while resting, and use caves, passages, and other protected habitat features as refuges during the night. Although bumphead parrotfish travel considerable distances while foraging, they show resting site fidelity and consistently return to specific resting sites (Aswani and Hamilton, 2004).

Dispersal of bumphead parrotfish occurs primarily by passive dispersal of pelagic fertilized eggs and larvae. Many details of the early life history of the species are unknown. In other parrotfishes, eggs are pelagic, small, and spindle shaped (1.5–3 mm long and 0.5–1 mm wide; Leis and Rennis, 1983). Time to hatching is unknown, but is likely between 20 hours and 3 days, as for other reef fishes observed spawning on the shelf-edge (Colin and Clavijo, 1988). Bumphead parrotfish pelagic ecology is unknown, but successful settlement appears to be limited to shallow lagoon habitats characterized by low-energy wave action and plant life (e.g., mangroves, seagrass, or plumose algae) (Kobayashi *et al.,* 2011). High relief coral heads (e.g., *Turbinaria*) in sheltered areas also seem to be suitable juvenile habitat (Kobayashi *et al.,* 2011). Mechanisms by which settling bumphead parrotfish larvae find these locations are unknown, although recent research on other species of coral reef fish larvae suggests that a variety of potential cues could be used for active orientation (Leis, 2007).

Connectivity in bumphead parrotfish was examined by the BRT using a computer simulation of larval transport (Kobayashi *et al.,* 2011). Surface currents at a resolution of 1 degree of latitude and longitude were used with a simulated pelagic larval duration of 31 days (Brothers and Thresher, 1985) with a settlement radius of 25 km. This settlement radius estimate was used in previous simulation work (Kobayashi, 2006; Rivera et al., 2011). If propagule survivorship is the main value being estimated, settlement distance is important as well as swimming orientation and other behaviors at the settlement stage. However, for understanding geographic linkages (as in this application), settlement distance is not a key driver of results. As discussed above, much of the recent literature on the role of pelagic larval duration in determining realized dispersal distances has resulted in mixed conclusions. There is support that pelagic larval duration can be a strong predictor of dispersal distances (Shanks *et al.,* 2003) yet a poor predictor of genetic similarity (Bay *et al.,* 2006; Bowen *et al.,* 2006; Luiz *et al.,* 2011; Weersing and Toonen, 2009). As discussed previously, studies have shown that multiple factors add to the complexity of understanding larval dispersal but they all provide evidence of some level of exchange between sub-populations that are far apart, relative to the range of the species in question. Treml *et al.* (2012) in particular, found that broad-scale connectivity is strongly influenced by reproductive output and the length of pelagic larval duration. We are aware of no morphological, life history, or other variation that would suggest population structuring. In the absence of information on complicating factors for bumphead parrotfish, the BRT's simulation of pelagic larval dispersal is the best available information with regard to population connectivity for this species.

Single-generation and multi-generation connectivity probabilities were tested. A number of sites appear to have significant potential as stepping stones with a broad range of input and output strata interconnected in a multi-generational context. Most sites with significant seeding potential are located in close proximity to other sites (e.g., east Africa, central Indo-Pacific). The BRT concluded that bumphead parrotfish likely have an interconnected population structure due to oceanographic transport of pelagic eggs and larvae, with this effect being most pronounced near the center of the species range, but with some degree of isolation in both the eastern and western edges of the species range (Kobayashi *et al.,* 2011).

*Reproductive Biology*

Unlike most parrotfishes which are protogynous (sequential) hermaphrodites, bumphead parrotfish appear to be gonochoristic (unisexual). Females reach sexual maturity over a broad size range. While they begin to reach sexual maturity at about 500 mm TL, 100 percent of females attain maturity by about 700 mm TL and age 11 yrs. The size at which 50 percent of females have reached maturity is estimated at 550–650 mm TL at age 7–9 yrs (Hamilton, 2004; Hamilton *et al.,* 2007). Males also reach maturity over a wide size range similar to females, but males begin maturing at smaller sizes and younger ages than females. For example, the smallest mature male observed in age and growth studies was 470 mm TL and age 5 yrs., while the smallest mature female was 490 mm TL and age 6 yrs (Hamilton, 2004; Hamilton *et al.,* 2007).

Spawning may occur in most months of the year. Hamilton *et al.* (2007) found ripe males and females every month of an August through July sampling period in the Solomon Islands. However, females with hydrated ova, indicative of imminent spawning, were only found from February to July. Spawning may have a lunar periodicity, with most spawning occurring in the early morning around the full moon in reef passage habitats (Gladstone, 1986). Hamilton *et al.* (2007) found hydrated ova (Colin *et al.,* 2003) in females captured from reef passages and along the outer reef. Bumphead parrotfish are serial spawners with undocumented but presumably very large batch fecundity, considering the large body and gonad size coupled with small egg size (Kobayashi *et al.,* 2011).

Observations of spawning have involved a single male and female. In other parrotfishes, Thresher (1984) describes the establishment of temporary spawning territories by males, with females being courted by males as they passed through spawning territories, and an assemblage of individuals acting as a spawning school. Although Gladstone (1986) described a simple mobile group of bumphead parrotfish individuals from which pair spawning took place, others have described what appeared to be a dominant male spawning with females and smaller sneaker males attempting to participate in spawning. The putative dominant male displayed bright green coloration during spawning. The evidence that males grow to larger sizes than females (Hamilton, 2004) supports the existence of a nonrandom mating system where a reproductive advantage is conferred to larger dominant males (Ghiselin, 1969; Kobayashi *et al.,* 2011). Warner and Hoffman (1980) showed mating system and sexual composition in two parrotfish relatives is density dependent. Munoz et al. (2012) have documented male-male head-butting encounters that may serve to establish mating territories or dominance and confirm the presumed function of the larger bumps in males.

*Settlement and Recruitment*

As with many other aspects of bumphead parrotfish biology, little is known about the processes following settlement of larvae in the benthic environment. Juveniles appear to gradually work their way towards adult habitats on the forereef areas, but timing and duration of this movement are unknown. The smallest size at which bumpheads enter the adult population on forereef areas is approximately 40 cm TL. These large juveniles are not often seen in surveys and may remain cryptic until adopting the wide-ranging swimming and foraging behavior of adults. Certain areas, for example the Great Barrier Reef, do not appear to receive significant recruitment (Bellwood and Choat, 2011). Adults on the Great Barrier Reef are thought to originate from elsewhere (north), which may explain the latitudinal trend of decreasing abundance toward southern portions of the area (Kobayashi *et al.,* 2011).

*Ecosystem Considerations*

Despite typically low abundance, bumphead parrotfish can have a disproportionately large impact on their ecosystem as a result of their size and trophic role. Their role as non-selective, excavator feeders is likely important for maintaining species diversity of corals and other benthic organisms. For example, certain species of coral (i.e., plate-forming) and algae can quickly monopolize substrate if unchecked. Non-selective feeding prevents any one organism from dominating the benthic ecosystem. Hence the species may be a classic example of a keystone species. The role of bumphead parrotfish in bioerosion and sand generation is also of notable importance; this effect is clearly seen by the persistence of dead coral skeletons in areas where excavating herbivores have been reduced (Bellwood *et al.,* 2004).

*Carrying Capacity*

There is no evidence regarding limiting factors for bumphead parrotfish population growth, particularly under pristine conditions. Some likely limiting factors for past, present, and/or future bumphead parrotfish population growth include settlement and recruitment limitation factors (Doherty, 1983; Sale, 2004), juvenile habitat, adult sleeping habitat, requisite abundance of conspecifics for successful group foraging or reproduction, and human harvest. Most of these factors are likely to become more limiting over time (Kobayashi *et al.,* 2011).

**Threats Evaluation**

Threats Evaluation is the second step in the process of making an ESA listing determination for bumphead parrotfish as described above in ‘‘Listing Determinations Under the ESA’’. This step follows guidance in the ESA that requires us to determine whether any species is endangered or threatened due to any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence (sections 4(a)(1)(A) through (E)).

The BRT Report assessed 14 specific threats according to factors A, B, C, and E as follows: for factor (A), the BRT identified three threats: adult habitat loss or degradation, juvenile habitat loss or degradation, and pollution; for factor (B), the BRT assessed harvest or harvest-related adult mortality, and capture or capture-related juvenile mortality; for factor (C), the BRT identified five threats: competition, disease, parasites, predation, and starvation; and for factor (E), the BRT discussed four threats: global warming, ocean acidification, low population effect, and recruitment limitation or variability. The BRT determined the severity, scope, and certainty for these threats at three points in time—historically (40–100 years ago or as otherwise noted in the table), currently, and in the future (40–100 years from now; Kobayashi *et al.,* 2011). Each threat/time period combination was ranked as high/medium/low severity with plus or minus symbols appended to indicate values in the upper or lower ends of these ranges, respectively.

Of the 14 threats, the BRT Report determined that five had insufficient data to determine severity, scope, or certainty at any of the three points in time (competition, disease, parasites, starvation, and low population effect). We agree that sufficient information is not available to determine the severity of these threats. The remaining nine threats are described below by factor.

Factor D threats (related to inadequacy of existing regulatory mechanisms), were assessed in the Management Report (NMFS, 2012). Two public comments received in response to the 90-Day Finding contained information relevant to existing regulatory mechanisms that was considered in the Management Report. One comment provided information on cultural significance, harvest methods, and the importance of Marine Protected Areas (MPAs) and remote areas with limited access that may provide refuge for the species within a narrow portion of its range. The second comment provided information pertaining to existing regulatory mechanisms in some parts of the species range and the effectiveness of MPAs in providing some benefit to the species. In the Management Report, we summarized existing regulatory mechanisms in each of the 46 areas where bumphead parrotfish occur, including fisheries regulations and MPAs. Additionally, we developed a comprehensive catalog of protected areas containing coral reef and mangrove habitat within the range of the species (NMFS 2012, Appendix A–1 and A–2) and evaluated how the MPA network addresses threats to the species (NMFS 2012, Sections 2.1.2.1–46 and 4). The Management Report authors did not determine the severity, scope, and certainty for Factor D threats at three points in time—historically, currently, and in the future—as did the BRT. They compiled information on the presence of international, national, and local scale regulations and then discussed general themes and patterns that emerged in order to assess whether the inadequacy of existing regulatory mechanisms is a factor that changes the extinction risk analysis results provided by the BRT.

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Juvenile habitat loss or degradation was rated by the BRT as one of the two (along with adult harvest) most severe threats to bumphead parrotfish, rating its severity as ''medium'' historically and as ''high'' both currently and over a 40–100 year future time horizon. As described by the BRT, shallow mangrove, seagrass, and coral reef lagoon habitats are susceptible to pollution, modification, and increased harvest pressure, among other anthropogenic pressures. The juvenile habitat specificity of bumphead parrotfish highlights this phase of the life history as highly vulnerable (Kobayashi *et al.,* 2011).

In contrast to juvenile habitat, the BRT concluded that adult habitat loss and/or degradation is not a high priority concern, rating its severity as ''medium'' both currently and over a 40–100 year future time horizon (with a historical rating of low). Drastic morphological changes to coral reefs might impact bumphead parrotfish if high-energy zones were reduced or wave energy was diffused or if nocturnal resting/sleeping locations were no longer available (Kobayashi *et al.,* 2011). Both are quite possible under some scenarios for climate change where coral reef structures can't keep up with sea level rise and also die or experience decreased growth from increased temperature and then degrade and fail to be replaced by similar three-dimensional structure that creates both the high energy zones (reef crests) and sleeping structures. Adult bumphead parrotfish appear to be opportunistic foragers and would likely cope with ecosystem shifts in the coral reef community, based on their behavior and ecology. For example, shifts in benthic species composition (e.g., changes in the breakdown of hard corals, and the relative abundance of soft corals, coralline algae, fleshy algae, sponges, bryozoans, tunicates, etc.) would probably not adversely affect bumphead parrotfish given their nonselective diet. Some components of the coral reef ecosystem are likely more affected by the presence or absence of bumphead parrotfish than bumpheads are dependent on those ecosystem components.

The BRT concluded that pollution is not a high priority concern, rating its severity as ''low'' both historically and currently, and ''medium -'' over a 40–100 year future time horizon. Pollution events (e.g., oil spills) can be catastrophic to coral reef ecosystems. However, such events remain episodic, rare, and are usually localized in the context of a widely-distributed, mobile species. Habitat modification as a result of pollution is most likely to be an issue with juvenile habitat since it is more exposed to anthropogenic impacts because of proximity, shallowness, and tendency to be more contained (e.g., lagoons, as opposed to open coastal waters). The BRT Report expressed high concern about the effects of pollution on the quantity and quality of juvenile habitat, but expressed less concern about adult habitat since adult habitat is larger, spans a wider geographic range, and is typically a more open environment (Kobayashi *et al.,* 2011).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The BRT rated harvest of adults as one of the two most severe threats (along with juvenile habitat loss) to bumphead parrotfish, with severity rated as ''high'' historically, currently, and over a 40–100 year future time horizon. In contrast to adult harvest, the BRT concluded that juvenile harvest is less of a concern, rating its severity as ''medium'', both currently and over a 40–100 year future time horizon (rated as ''nil'' historically). While the BRT rated the threat of harvest differently by life stage, we first discuss general harvesting issues applicable to both life stages, then consider specific justifications for the different rankings.

Bumphead parrotfish are highly prized throughout their range. In addition to their commercial value, bumphead parrotfish are culturally significant for many coastal communities and used in feasts for specialized ceremonial rites (Severance, pers. comm.; Riesenberg, 1968). As such, fisheries for this species have been in place since human inhabitation of these coastal regions (Johannes, 1978; 1981). Following are descriptions of life history characteristics of the species that affect vulnerability to harvest, harvest gears and methods, and summaries of harvest data from the few locales where available.

*Life History Characteristics Relevant to Harvest*

Immature bumphead parrotfish (40–50 cm TL, sub-adults) recruit to adult habitat (coral reef forereefs); thus, the following descriptions of life history characteristics and methods/gears relate to sub-adults and adults. Several life history characteristics increase the vulnerability of sub-adult and adult bumphead parrotfish to harvest such as nocturnal resting behavior, diurnal feeding behavior, large size and conspicuous coloration. At night, bumphead parrotfish frequently remain motionless while resting in refuge sites and they consistently return to specific resting sites. Unlike other parrotfish species, bumphead parrotfish do not excrete a mucus cocoon to rest within. Thus, resting in shallow water in large groups and returning to the same unprotected resting sites all increase vulnerability of adult bumphead parrotfish to harvest at night (NMFS, 2012). Adult bumphead parrotfish schools effectively announce their presence by loud crunching noises associated with feeding activity, which can be heard at least several hundred meters away underwater. In addition, bumphead parrotfish may form spawning aggregations during the daytime. Thus, foraging in shallow water in schools, conspicuous foraging noise, and spawning behavior also all increase the vulnerability of adult bumphead parrotfish to harvest (NMFS, 2012).

It is likely that juvenile bumphead parrotfish are more vulnerable to harvest in populated regions based on their aggregating behavior and tendency to inhabit shallow lagoon environments. They suffer the same vulnerability from night time harvest as adults and sub-adults as they also use traditional nocturnal resting refuge sites.

*Harvest Methods and Gears*

Historically, fishing for bumpheads typically took place at night while fish were motionless in their nocturnal resting sites. Fishermen armed with hand spears would paddle wooden canoes or simply walk across shallow reef habitats using a torch assembled from dried coconut fronds in search of resting fish (Dulvy and Polunin, 2004). With the advent of dive lights, SCUBA, freezers, and more sophisticated spears and spear guns, the ability to exploit bumphead parrotfish has increased dramatically over the last several decades (Hamilton, 2003; Aswani and Hamilton, 2004).

Current Indo-Pacific coral reef fisheries are nearly as diverse as the species they target, and include many subsistence, commercial, and sport/recreational fisheries employing a vast array of traditional, modern, and hybrid methods and gears (Newton *et al.,* 2007; Wilkinson, 2008; Armada *et al.,* 2009; Cinner *et al.,* 2009; NMFS, 2012). This tremendous increase in fisheries using both selective and non-selective gears is a significant factor in the high severity of threat to adult bumphead parrotfish. In addition, even though many destructive gears and methods are illegal in most countries with coral reef habitat within their jurisdiction, they are still used within the range of bumphead parrotfish. Examples include blast fishing using explosives to kill or stun fish, and the use of poisons like bleach or cyanide. Blast fishing is very damaging to coral reef habitat and can result in significant time required for recovery (Fox and Caldwell, 2006).

*Summary of Harvest Data*

Data pertaining to harvest are sparse, incomplete, or lacking for a majority of regions across the range of bumphead parrotfish, though efforts have been made over the past 30 years to obtain fisheries harvest information at a few sites in the central and western Pacific. However, most of the available harvest data combine all parrotfish species into one category, making it difficult to identify bumphead parrotfish harvest amounts. Harvest data specific to bumphead parrotfish exist for Palau (Kitalong and Dalzell, 1994), Guam (NOAA, The Western Pacific Fisheries Information Network), Solomon Islands (Aswani and Hamilton, 2004; Hamilton, 2003), Fiji (Dulvy and Polunin, 2004), and Papua New Guinea (Wright and Richards, 1985).

In Palau, efforts to assess commercial landings of reef fishes were made from 1976 to 1990 (Kitalong and Dalzell, 1994). All harvest data were collected at the main commercial landing site and it is estimated that these data accounted for 50–70 percent of the total commercial catch. Overall, bumphead parrotfish represented 10 percent of reef fisheries landings in Palau, making it the second most important commercial reef fish. It was estimated that an average of 13 metric tons of bumphead parrotfish were sold annually during the study. The highest landings were recorded in the mid-1980s, with a maximum of 34 metric tons sold in 1984. Declines in total catch were observed following the mid-1980s, creating concern over the conservation status of bumphead parrotfish stocks. As a result, restrictions were put on the harvest of bumphead parrotfish in 1998 and it is now illegal to export, harvest, buy or sell with the intent to export bumphead parrotfish of any size in the waters of Palau.

Harvest data for Guam from creel surveys and commercial purchase records were obtained from the NOAA Western Pacific Fisheries Information Network. Creel survey data were collected from 1982 to 2009. Based on the results of the creel surveys, a total of 10 bumphead parrotfish (0.12 metric tons) were harvested in Guam during the survey period. No landings have been reported since 2001 from creel surveys. Data pertaining to commercial sales of parrotfish are provided for individual sales and, it is assumed, correspond to the same time period. As such, commercial sale data estimated a harvest of 9 fish or 0.45 metric tons from 1982 to 2009.

Solomon Islands (New Georgia Group) creel survey harvest data were obtained from August 2000 and July 2001 (Hamilton, 2003; Aswani and Hamilton, 2004). Bumphead parrotfish accounted for 60 percent of reef fish catch in Roviana lagoon (Kalikoqu). Total harvest of bumphead parrotfish was 0.63 metric tons. Fish caught ranged from 28.5 to 102.0 cm TL with a mean size of 62.7 cm TL; very few individuals were larger than 100 cm TL. There is currently a ban on harvest of any species while using SCUBA; however, there are no restrictions on the harvest of bumphead parrotfish using other extraction methods (FAO, 2006).

Harvest data for Fiji are based on the results of a fisheries development program at Kia Island carried out by the Fiji Department of Agriculture in 1970 and from the 1990 Fiji Fisheries Division Annual Report (Adams, 1969; Richards *et al.,* 1993). During the period of the fisheries development program, bumphead parrotfish accounted for 70 percent of the total reef fisheries catch and yielded 22.3 metric tons. In 1990 bumphead parrotfish accounted for 5 percent of total commercial landings and yielded 230 metric tons (Dulvy and Polunin, 2004).

In Papua New Guinea, harvest data were obtained from an assessment of a small-scale artisanal fishery conducted in the Tigak Islands (Wright and Richards, 1985). Harvest data were collected from the only commercial site for selling fish in Kavieng, New Ireland. A total of 636 bumphead parrotfish were collected during the survey period (13 months starting in November 1980) and represented 5 percent of total fisheries catch. The mean size of fish harvested was 57 cm TL.

Data pertaining to harvest of juvenile bumphead parrotfish are sparse. The BRT rated the severity of the threat of juvenile harvest as ''medium'' both currently and in the future because they define a ''medium'' level of certainty as having ''some published and unpublished data to support the conclusion this threat is likely to affect the species with the severity and geographic scope ascribed''. In other words, they felt that harvest is a legitimate threat for all size classes, however there is more evidence to support the conclusion that adult harvest is a high severity threat to the species both currently and in the future, as opposed to the lack of information available to make the same conclusion about juvenile harvest.

Bumphead parrotfish can be found in great local abundance at sites isolated from population centers or protected from exploitation (Dulvy and Polunin, 2004). Observations at remote sites, with minimal to no harvest, are not restricted to one specific geographic region but span across the geographic range of bumphead parrotfish. Sites with high human population densities and associated fisheries exploitation have lower densities of bumphead parrotfish compared to remote and uninhabited locations (Kitalong and Dalzell, 1994; Dulvy and Sadovy, 2003; Donaldson and Dulvy, 2004; Chan *et al.,* 2007; Hoey and Bellwood, 2008). Although fisheries harvest data are sparse, the implication is that lower densities of bumphead parrotfish in more heavily populated areas may be due to fishing and other human activities. Munoz et al. (2012) provide the first scientific documentation of aggressive headbutting behavior between male bumphead parrotfish. They propose that this dramatic aspect of the species' social and reproductive behavior has gone unnoticed until now for one of two reasons: because low population densities resulting from overfishing reduce competition for resources, or because headbutting contests are common, but negative responses to humans in exploited populations preclude observations of natural behavior. However, this behavior has not been reported in many other well-studied areas with densities approaching or exceeding that of this study site, so there is not enough information to conclude in what ways this behavior may be related to population density, if any.

*Harvest Conclusion*

Given their vulnerability based on life history characteristics and the sparse data on harvest, the BRT concluded that the severity of threat from harvest was medium for juveniles and high for adults.

C. Disease and Predation

There is very little information on the impacts of competition, disease, parasites, and predation on bumphead parrotfish. The BRT only had enough information to rate the threat of predation, rating its severity as ''low'' historically and ''low—'' both currently and over a 40–100 year future time horizon. The lack of habitat specificity or diet specificity by this species would likely reduce the role of competitive processes. An exception might be competition for adult sleeping habitat if other large organisms (sharks, wrasses, other parrotfishes, etc.) are vying for the same nighttime shelters. Occasional predation by sharks has been discussed in several parts of this report, but this is not thought to be important for bumphead parrotfish population dynamics. There is insufficient information to conclude that any of these issues will play a significant role individually or cumulatively in the short- or long-term outlook for bumphead parrotfish populations. There is not much known about egg/larval and juvenile biology, but it is likely that predation on these earlier phases of the life-history may be a more significant issue than for adults.

D. Inadequacy of Existing Regulatory Mechanisms

Of the nine threats that the BRT was able to assess, regulatory mechanisms have limited relevance to one of them (recruitment limitation or variability under Factor E below), because regulation cannot directly control this threat or its root cause. However, regulatory mechanisms are relevant to the other threats. For the purposes of evaluating Factor D, these eight threats are grouped and referred to as follows: Habitat (juvenile habitat loss/degradation, adult habitat loss/degradation, pollution); Harvest (adult harvest, juvenile harvest, predation (harvest regulation of potential bumphead parrotfish predators)); and Climate Change (global warming, ocean acidification). Habitat Loss/Degradation and Harvest threats are regulated much differently than Climate Change threats, and thus regulatory mechanisms for these are assessed and discussed separately.

*Assessment of Existing Regulatory Mechanisms Relevant to Habitat and Harvest Threats*

This section summarizes the assessment of regulatory mechanisms for Habitat Loss/Degradation and Harvest threats from the Management Report (NMFS, 2012).

Because habitat and harvest threats are generally due to localized human activities, and therefore controllable by regulatory mechanisms at the national or local levels, relevant regulatory mechanisms (laws, decrees, regulations, etc., for the management of fisheries, coastal habitats, and protected areas) were assessed for the 45 countries (and disputed areas) within the range of bumphead parrotfish. These mechanisms were grouped into two categories: (1) Regulatory mechanisms for fisheries and coastal management; and (2) Additional regulations within MPAs and other relevant protected areas (e.g., mangroves). Generally, the first category encompasses a broad array of laws and decrees across many jurisdictional scales from national to local, whereas the second level consists of additional regulations that may apply within MPAs/protected areas within each jurisdiction (NMFS, 2012).

Although adult harvest is better documented than juvenile harvest, many of the gear types discussed previously may be used to harvest both adults and large juveniles. As such, regulatory mechanisms for harvest methods are not separated into methods specific to adult harvest and juvenile harvest, unless specifically noted. Thus, all types of fisheries regulations that may apply to bumphead parrotfish were researched and compiled both inside and outside protected areas, with particular emphasis on spearfishing, the primary gear type for directed fishing (NMFS, 2012).

Loss and degradation of juvenile habitat may be caused by a wide variety of activities because juveniles inhabit mangrove swamps, seagrass beds, coral reef lagoons, and likely other coastal habitats. Although adults typically occur in coral reefs, many of the impacts that exist for juvenile habitat also apply in adult habitat areas. Regulations related to the two primary habitats used by the species, mangrove swamps and coral reefs, were also researched and compiled both inside and outside of protected areas. Pollution as a threat is relevant to habitat loss and degradation for both juveniles and adults and is assessed within existing regulations for specific habitat types. Because seagrass beds are found in or near mangroves and coral reefs, they are not considered separately (NMFS, 2012).

*Overall Patterns and Summary for Existing Regulatory Mechanisms*

Several overall patterns emerged from the compilation and evaluation of existing regulatory mechanisms addressing Harvest and Habitat Loss/Degradation threats to bumphead parrotfish.

A wide array of regulatory mechanisms exists within the 46 areas in bumphead parrotfish range that are intended to address the threats of habitat loss/degradation and harvest for the species. Australia, Fiji, Maldives, Micronesia, Palau, and Samoa all have fisheries regulations pertaining specifically to parrotfish species, in some cases specifically bumphead parrotfish. These range from prohibition of take for all parrotfish, to size and bag limits, to seasonal restrictions, to listing as an Endangered Species (Fiji). These six countries together represent 26 percent of total coral reef habitat and 13.1 percent of mangrove habitat in the 46 areas within bumphead parrotfish range.

Twenty-four out of the 46 areas have some sort of regulations pertaining to spearfishing. These include prohibiting spearfishing altogether, prohibiting fishing with SCUBA, prohibiting fishing with lights (limiting night spearfishing), area closures, permit requirements, or various combinations of those. Some regulations may only apply in some areas within a country or jurisdiction and some only within marine protected areas (MPAs). Those 24 areas combined represent 63.6 percent of total coral reef habitat within the 46 areas in bumphead parrotfish range, although in some cases regulations do not apply throughout the entire area of coral reef habitat.

A different set of 24 out of the 46 areas within the species range have some sort of regulatory mechanisms in place that offer some protection to mangrove habitat. These regulations include prohibition on mangrove harvest and/or sale, inclusion of mangroves in protected areas, and sustainable harvest and/or restoration requirements. Combined, these 24 areas account for 94.8 percent of mangrove habitat in the 46 areas within the range of bumphead parrotfish.

Spearfishing regulations exist in a majority (17 out of 24) of the areas within the area defined by the BRT as the significant portion of the species range (SPOIR). Regulations providing some level of protection for mangrove habitat exist in an even larger majority (19 out of 24) of areas within SPOIR.

Customary governance and management remain important in many areas throughout bumphead parrotfish range and may confer conservation benefits to the species. After intensive efforts by governments in the past to centrally manage coastal fisheries, there has been a shift in government policies from a centralized or ''top-down'' approach to restore resources to a ''bottom-up'' or community-based approach. This community-based management approach is more widespread in Oceania today than any other tropical region in the world (Johannes, 2002). We found documentation that at least 16 of the 46 areas within bumphead parrotfish range employ traditional governance systems based on customary and traditional resource management practices throughout all or part of the country, most of which are explicitly recognized and supported by their national governments. Notably, the national government in Indonesia recognizes that customary law and/or traditional management is adapted to local areas and therefore more effective than a homogeneous national law. As such, coral reef fisheries management is decentralized and delegated to the 503 Districts where District laws and regulations are based on customary law and/or traditional management. Indonesia accounts for 40 percent of mangrove habitat and 18.5 percent of coral reef habitat in the 46 areas within bumphead parrotfish range. Fenner (2012) asserts that customary marine tenure, or traditional resource management by indigenous cultures, has high social acceptance and compliance and may work fairly well for fisheries management and conservation where it is still strong.

Marine protected areas simplify management and reduce enforcement costs for fish populations where little biological information is available (Bohnsack, 1998), which makes them an attractive and viable option for reef fishery management and conservation, especially in developing countries (Russ, 2002). There has been recent rapid growth in coral reef and coastal MPAs. In 2000, there were 660 protected areas world-wide that included coral reefs (Spalding *et al.,* 2001). Mora *et al.* (2006) compiled a database in 2006 with 908 MPAs covering 18.7 percent of the world's coral reefs. The Reefs at Risk Revisited report (Burke *et al.,* 2011) indicates that now 2,679 MPAs exist (a four-fold increase in one decade),covering 27 percent of coral reefs worldwide, over 1,800 of which occur within the range of bumphead parrotfish (NMFS 2012, Appendix A–1). An estimated 25 percent of coral reef area within bumphead parrotfish range is within MPAs. Additionally, over 650 protected areas have been established throughout the range that include mangrove habitat (Spalding *et al.,* 2010; NMFS, 2012).

MPA is a broad term that can include a wide range of regulatory structures. According to Mora *et al.* (2006), 5.3 percent of global reefs were in extractive MPAs that allowed take, 12 percent were inside multi-use MPAs that were defined as zoned areas including take and no-take grounds, and 1.4 percent were in no-take MPAs, although this information is now outdated. MPAs that occur within the range of the bumphead parrotfish certainly represent different levels of protection from no-take zones to limited restrictions on fishing and other activities. There is evidence that no-take marine reserves can be successful fisheries management tools and many have been shown to increase fish populations relative to areas outside of the reserves or the same area before the reserve was established (Mosquera *et al.,* 2000; Gell and Roberts, 2003). Mosquera *et al.* (2000) note in particular that parrotfishes responded positively to protection, and species with large body size and those that are the target of fisheries (both of which describe bumphead parrotfish) respond particularly well. It is noted, however, that a very small proportion of global MPAs are no-take reserves that allow no fishing while the majority allow for some level of extraction (IUCN, 2010). Within bumphead parrotfish range, 20 percent of coral reef areas are in Australia, most of which are within the Great Barrier Reef Marine Park (GBRMP); more than 33 percent of the GBRMP areas are known as ''green zones'' within which fishing is entirely prohibited (GBRMPA, not dated). Additionally, Fiji (3.1 percent of coral reef area in bumphead range) and the Maldives (2.5 percent of coral reef in bumphead range) prohibit take of parrotfish, so coral reef areas within those jurisdictions are essentially no-take areas for bumpheads. When combined, a minimum estimate of coral reef habitat that can be considered no-take within bumphead parrotfish range is 12.2 percent (minimum because there may be additional no-take marine reserves among the rest of the 1,874 MPAs within bumphead range but Mora *et al.* (2006) were unable to systematically identify and calculate those areas). Of note here is a recently proposed network of MPAs including a large percentage of no-take areas throughout Australia's EEZ, in addition to the GBRMP. Known as the Commonwealth Marine Reserves Network, if finalized, this action would greatly increase the area of marine protected zones and maintain about ⅓ of all marine protected areas as no-take zones throughout the MPA network in Australia's EEZ (Commonwealth of Australia, 2012). No-take marine reserves simplify management and reduce enforcement costs for fish populations where little biological information is available (Bohnsack, 1998) which makes them an attractive and viable option for reef fishery management and conservation, especially in developing countries (Russ, 2002).

On a global scale, Selig and Bruno (2010) found that MPAs can be a useful tool for maintaining coral cover and that benefits resulting from MPA establishment increase over time. The Reefs at Risk Revisited report from 2011 offers effectiveness ratings for 30 percent of the 2,679 MPAs compiled therein. Within bumphead parrotfish range, 25 percent of total reef area within rated MPAs are in MPAs rated as ''effective'', defined as managed sufficiently well that local threats are not undermining natural ecosystem function; 44 percent of reef area within rated MPAs are in MPAs rated as ''partially effective'', defined as managed such that local threats were significantly lower than adjacent non-managed sites, but there still may be some detrimental effects on ecosystem function; 30.6 percent of total reef area within rated MPAs are in MPAs rated as ''not effective'', defined as unmanaged or where management was insufficient to reduce local threats in any meaningful way. Sixty-nine percent of reef areas within MPAs are in MPAs that are unrated.

Effectiveness of protected areas depends not only on implementation and enforcement of regulations, but also on reserve design; reserves are not always created or designed with an understanding of how they will affect biological factors or how they can be designed to meet biological goals more effectively (Halpern, 2003). Even results from the same regulatory scheme can differ between species within the protected ecosystem. As such, global assessments are only moderately informative and do not reflect important considerations in MPA effectiveness on a regional or local scale. The results of one study on Guam demonstrate that a reduction in fishing pressure had a positive effect on the demography of *Lethrinus harak* through the significant accumulation of older individuals in certain areas (Taylor and McIlwain, 2010). *Lethrinus harak* is a reef fish that, similar to bumphead parrotfish, constitutes an important part of many inshore artisanal, commercial, and recreational fisheries (Carpenter and Allen, 1989). This species is easily targeted by fishers and heavily exploited. On Saipan, the abundance of *L. harak* increased 4-fold (on average) from 2000 to 2005 (Starmer *et al.,* 2008); Taylor and McIlwain (2010) attribute this increase not only to the recent ban on certain fishing methods (SCUBA spearfishing and gill, drag, and surround nets) but also the presence of well enforced MPAs. In Western Australia, contrasting effects of MPAs were observed on the abundance of two exploited reef fishes; a species of wrasse did not appear to respond to protection, while the coral trout (a sea bass) showed a significant increase in abundance after eight years of protection at two MPA sites (Nardi *et al.,* 2004). The authors note that, while MPAs are clearly an effective tool for increasing the local abundance of some reef fishes, the spatial and temporal scales required for their success may vary among species. McClanahan *et al.* (2007) studied the recovery of coral reef fishes through 37 years of protection at four marine parks in Kenya and found that parrotfish biomass initially recovered rapidly, but then exhibited some decline, primarily due to competition with more steadily increasing taxonomic groups and a decline in smaller individuals.

While a body of literature exists on MPA effectiveness, reserve size, and design, Ban *et al.* (2011) found that the majority of these studies originate from developed countries and/or present theoretical models; as such, generally accepted recommendations on MPA reserve design and management need to be adapted to the needs of developing countries. Sixty-six percent of coral reef habitat in bumphead parrotfish range is in fact in developing countries (as defined by the Human Development Index; *http://hdr.undp.org/en/countries/*). Despite the demonstrated effectiveness of no-take zones, the broader definition of MPA to include other management regimes (time/area closures, gear restrictions, zoning for controlled use and limitations) better incorporates essential social aspects of communities in developing coral reef countries (Ban et al., 2011).

MPA critics often point to problems with compliance and enforcement. MPA size can affect both its effectiveness at conserving the necessary space/resources for species to recover and compliance rates. Kritzer (2003) found that noncompliance is more prevalent around the boundaries of an MPA, and a single large MPA provides much greater stability in both protected population size and yield at high fishing mortality rates as noncompliance increases. As discussed previously, customary governance systems exist in many countries where bumpheads are found. The nature of a customary governance system would likely result in many smaller MPAs as individual villages would manage their local marine areas; however, customary governance is likely to have high compliance (Fenner, 2012). Integrating local scale management into larger regional planning schemes can further add to the effectiveness of MPAs. Examples of where this combination of traditional institution of marine protected or marine managed areas and integration of local approaches into regional or national regulation has occurred within the range of bumphead parrotfish include Fiji (Tawake *et al.,* 2001; Gell and Roberts, 2003; Ban *et al.,* 2011; Mills *et al.,* 2011;), Philippines (Eisma-Osorio *et al.,* 2009; Ban *et al.,* 2011), Solomon Islands (Game *et al.,* 2010; Ban *et al.,* 2011) American Samoa (Tuimavave, 2012) and Yap State in the Federated States of Micronesia (Gorong, 2012).

A detailed evaluation of the 1,874 MPAs within the range of bumphead parrotfish was beyond the scope of the management report. Population monitoring data are so scarce for this species across most of its range that even if these MPAs are positively affecting the species, there is no documentation to reflect these changes. The combination of local MPA establishment and customary governance and enforcement, along with the trend toward integrating local management regimes into regional scale planning in developing countries, is encouraging for conservation. Based on these factors, along with the existence of regulatory mechanisms and marine protected areas in developed countries with more capacity for enforcement, we believe that regulatory mechanisms throughout bumphead parrotfish range may confer some conservation benefit to the species, although unquantifiable, and the inadequacy of regulatory mechanisms is not a contributing factor to increased extinction risk for the species.

*Assessment of Existing Regulatory Mechanisms Relevant to Climate Change Threats*

In terms of coral reef protection, even if countries participating in the current international agreements to reduce greenhouse gases were able to reduce emissions enough and at a quick enough rate to meet the goal of capping increasing average global temperature at 2°C above pre-industrial levels, there would still be moderate to severe consequences for coral reef ecosystems (Hoegh-Guldberg, 1999; Bernstein *et al.,* 2007; Eakin, 2009; Leadley *et al.,* 2010). Existing regulatory mechanisms and conservation efforts targeting reduction in greenhouse gases are therefore inadequate. However, the BRT Report concludes, and we agree, that climate change threats are not thought to be primary drivers of bumphead parrotfish population dynamics, either now or over a 40–100 year future time horizon (Kobayashi *et al.,* 2011; NMFS, 2012).

*Overall Conclusions Regarding Inadequacy of Existing Regulatory Mechanisms*

Overall, existing regulatory mechanisms throughout the species' global range vary in effectiveness in addressing the most serious threats to the bumphead parrotfish. In many regions, a broad array of national regulatory mechanisms, increase in MPAs, and resurgence of customary management may be effective by addressing the two greatest threats to the species, including adult harvest, as described above under factor B, and loss and degradation of juvenile habitat, as described above under factor A. We note, however, that because many of these regulatory mechanisms are relatively new, their effectiveness remains to be demonstrated. Moreover, regulatory mechanisms are not deemed effective in addressing the threat of climate change, although this threat is less important to bumphead parrotfish, as described below under factor E. In conclusion, we find that existing regulatory mechanisms are likely to have a positive, if undetermined, effect on the conservation of species, and are not a contributing factor to increased extinction risk for bumphead parrotfish.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Climate Change threats to bumphead parrotfish include global warming and ocean acidification. The BRT Report states that overall, climate change threats ''are not thought to be plausible drivers of bumphead parrotfish population dynamics, either now or in the foreseeable future''.

The BRT rated the severity of global warming as ''low'' historically, ''medium'' currently, and ''medium +'' over a 40–100 year future time horizon. The BRT assigned a medium + ranking for global warming threat severity in the future, because of the potential impact of warmer seawater temperatures on pelagic life history stages. Seawater temperature increases may affect fertilized eggs and larvae in the pelagic environment by exceeding biological tolerances, and/or indirect ecological effects, e.g., increasing oligotrophic areas (Kobayashi *et al.,* 2011).

The BRT rated the severity of ocean acidification as ''nil'' historically, ''nil +'' currently, and ''low −'' over a 40–100 year future time horizon. The impacts of ocean acidification on coral abundance and coral reefs are increasingly recognized (Hoegh-Guldberg *et al.,* 2007). However, since the bumphead parrotfish is not an obligate corallivore, it may not be directly affected by ocean acidification. This is because adult bumphead parrotfish do not appear to be food-limited or space-limited in any portion of its range. The species also appears to be adaptable to a variety of biotic and abiotic conditions, given its wide geographic range. The existing nearshore variability and the nearshore acid buffering capability both serve to reduce the effects of climate change and ocean acidification on bumphead parrotfish. Short- or long-term changes in ocean acidification are unlikely to have a strong impact on bumphead parrotfish populations unless it is via some unknown direct or indirect effect on three dimensional refuge sites or egg/larval survival and subsequent recruitment dynamics, as noted above for global warming (Kobayashi *et al.,* 2011).

The other threat considered under Factor E for which the BRT had enough information to rank severity was recruitment limitation or variability. The BRT Report evaluated the severity of this threat as ''low'' historically, ''medium'' currently, and ''medium +'' over a 40–100 year future time horizon. Areas of the Great Barrier Reef, for example, appear to be lacking juveniles. Both local retention and incoming propagules may be demographically important, although their relative importance is unknown. It remains unclear whether any shortages of juveniles reflect shortages of egg/larval supply, or instead are indicative of bottlenecks in older life history stages. Since recruitment limitation is commonly documented in other reef fish species, this is a plausible limiting factor for population growth of this species (Kobayashi *et al.,* 2011).

**Synergistic Effects**

In the status review, we evaluated the five factors individually and in combination to determine the risk to the species. The BRT determined that, with respect to factors A, B, C, and E, there are no data to draw conclusions or even speculate on synergistic effects among the factors. Given the lack of such data, it would be precautionary to assume that any combination of hazards will work together with a net effect greater than the sum of their separate effects. The BRT recognizes that this species is extremely data poor and should be the focus of continued study.

Existing regulatory mechanisms under Factor D can have impacts that interact with existing threats under the other four factors by potentially reducing the impacts of those threats and conferring some conservation benefit to the species by regulating the human activities posing the threat. Harvest is a threat that may be alleviated by existing regulatory mechanisms like fisheries regulations and protected areas. Harvest of adults was considered in the BRT Report to be one of the two most important threats to the short- and long-term status of bumphead parrotfish, but the BRT did not fully consider implications of existing regulatory mechanisms in the 46 areas within the current range of bumphead parrotfish addressing historical, current, or future harvest-related threats to the species. These regulatory mechanisms may provide important conservation benefits when considering the significance of the current and future impact of harvest-related threats to bumphead parrotfish, although they are unquantifiable. Similarly, habitat degradation may be alleviated or mitigated by regulatory mechanisms. A variety of regulatory mechanisms including a recent increase in protected areas (as described above) are in place throughout the range of bumphead parrotfish that may confer conservation benefit to the species by addressing this threat.

*Conservation Efforts*

As described above, Section 4(a)(1) of the ESA requires the Secretary to consider factors A through E above in a listing decision. In addition, Section 4(b)(1)(A) requires the Secretary to consider these five factors based upon the best available data ''after taking into account those efforts, if any, being made by any State or foreign nation * * * to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices.'' Section 4(b)(1)(A) authorizes us to more broadly take into account conservation efforts of States and foreign nations including laws and regulations, management plans, conservation agreements, and similar documents, to determine if these efforts may improve the status of the species being considered for ESA listing. The PECE policy (described above) applies to conservation efforts that have yet to be fully implemented or have yet to demonstrate effectiveness.

One purpose of the Management Report (NMFS, 2012) was to describe and assess conservation efforts for the bumphead parrotfish throughout its range. For the purposes of the status review, conservation efforts are defined as non-regulatory or voluntary conservation actions undertaken by both governmental and non-governmental organizations (NGOs, e.g., conservation groups, private companies, academia, etc.) that are intended to abate threats described in the BRT Report or are incidentally doing so. Conservation efforts with the potential to address threats to bumphead parrotfish include, but are not limited to: fisheries management plans, coral reef monitoring, coral reef resilience research, coral reef education and/or outreach, marine debris removal projects, coral reef restoration, and others. These conservation efforts may be conducted by countries, states, local governments, individuals, NGOs, academic institutions, private companies, individuals, or other entities. They also include global conservation organizations that conduct coral reef and/or marine environment conservation projects, global coral reef monitoring networks and research projects, regional or global conventions, and education and outreach projects throughout the range of bumphead parrotfish. After taking into account these conservation efforts, as more fully discussed in the management report (NMFS, 2012), our evaluation of the Section 4(a)(1) factors is that the conservation efforts identified may confer some conservation benefit to the species, although the amount of benefit is undetermined. The conservation efforts do not at this time positively or negatively affect our evaluation of the Section 4(a)(1) factors or our determination regarding the status of the bumphead parrotfish. The Management Report also considered conservation efforts that have yet to be fully implemented or have yet to demonstrate effectiveness (under the PECE policy) and found that these conservation efforts do not at this time positively or negatively affect the species status.

**Extinction Risk Analysis**

The Extinction Risk Analysis is the third step in the process of making an ESA listing determination for bumphead parrotfish. For this step, we completed an extinction risk analysis to determine the status of the species. We asked the BRT to develop an extinction risk analysis approach based on the best available information for bumphead parrotfish. The extinction risk results in the BRT Report (Kobayashi *et al.,* 2011) are based on statutory factors A, B, C, and E listed under section 4(a)(1) of the ESA. Factor D (''inadequacy of existing regulatory mechanisms'') was assessed in the Management Report (NMFS, 2012) and this finding (above), and not considered by the BRT in its extinction risk analysis for the species. Thus, a final extinction risk analysis was done by determining whether the results of the BRT's extinction risk analysis would be affected by the incorporation of Factor D, thereby addressing the five 4(a)(1) factors. Following are results of the BRT's extinction risk analysis based on factors A, B, C, and E (Kobayashi *et al.,* 2011), our determination with regard to extinction risk based on factor D (NMFS 2011a), and a final extinction risk determination for bumphead parrotfish based on all five factors.

*Definitions*

There are two situations in which NMFS determines that a species is eligible for listing under ESA: (1) Where the species is in danger of extinction, or is likely to become in danger of extinction in the foreseeable future, throughout all its range; or (2) where the species is in danger of extinction, or is likely to become in danger of extinction in the foreseeable future, throughout a significant portion of its range (SPOIR). Accordingly, as long as the species is in danger of going extinct throughout a significant portion of its range, the entire species is subject to listing and must be protected everywhere.

The first step the BRT took in developing an approach for bumphead parrotfish extinction risk analysis was to define these spatial (SPOIR) and temporal scales for application to the analysis. Next the BRT defined a Critical Risk Threshold against which the status of the species would be compared over these spatial and temporal scales (Kobayashi *et al.,* 2011). These three key definitions are described below.

The ESA does not define the terms SPOIR or ''foreseeable future.'' In application, a portion of a species' range is generally considered ''significant'' if its contribution to the viability of the species is so important that, without that portion, the species would be in danger of extinction. Or put another way, we would not consider the portion of the range at issue to be ''significant'' if there is sufficient resiliency, redundancy, and representation elsewhere in the species' range that the species would not be in danger of extinction throughout its range if the population in that portion of the range in question disappeared. When analyzing portions of a species' range, we consider the importance of the individuals in that portion to the viability of the species in determining whether a portion is significant, and we consider the status of the species in that portion.

For purposes of the bumphead parrotfish, the BRT analyzed SPOIR based on an ecological index consisting of five criteria, summarized as: (1) Distance from the center of Indo-Pacific marine shore fish biodiversity to account for the underlying biogeographic pattern; (2) adult habitat area to account for adult habitat availability importance; (3) juvenile habitat area to account for juvenile habitat availability importance; (4) a connectivity measurement of outgoing contributions to all other geographic strata to account for demographic importance; and (5) a connectivity measurement of incoming contributions from all other geographic strata to further account for demographic importance (Kobayashi *et al.,* 2011). Analyzing the significance of the portion of the species' range in terms of its biological importance to the conservation of the species is consistent with NMFS' past practices as well as the Draft Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' (76 FR 76987; December 9, 2011).

These 5 important ecological components were used in an additive fashion to construct a composite SPOIR index, the median value of which was 0.4506 over all geographic strata. Of 63 strata used by the BRT for the current range of bumphead parrotfish, 32 strata had a SPOIR index greater than the median value. These 32 strata were defined as SPOIR by the BRT, and include American Samoa, Andaman and Nicobar, Australia, Papua New Guinea, Cambodia, China, Christmas Island, Comoro Islands, East Timor, India, Indonesia, Kenya, Madagascar, Malaysia, Maldives, Mayotte, Micronesia, Mozambique, Myanmar, Timor Leste, Palau, Papua New Guinea, Paracel Islands, Philippines, Seychelles, Solomon Islands, Spratly Islands, Sri Lanka, Taiwan, Tanzania, Thailand, and Vietnam (Kobayashi *et al.,* 2011).

Following the completion of the BRT report, USFWS and NMFS published a Draft Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of Endangered Species and Threatened Species (76 FR 76987; December 9, 2011). The Draft Policy has not yet been finalized as the Services continue to evaluate comments and information received during the public comment period. While the policy remains in draft form, the Services are to consider the interpretations and principles contained in the Draft Policy as non-binding guidance in making individual listing determinations, while taking into account the unique circumstances of the species under consideration. Accordingly, we have analyzed the BRT's findings in light of the Draft Policy to determine whether this affects the SPOIR determination.

We apply the following principles from the Draft Policy to this status review. First, if a species is found to be endangered or threatened in only a significant portion of its range, the entire species is listed as endangered or threatened, as appropriate, and the Act's protections apply across the species' entire range. Second, the range of a species is considered to be the general geographical area within which that species can be found at the time of the particular status determination. While lost historical range is relevant to the analysis of the status of the species, it does not constitute a significant portion of a species' range. Third, if the species is not endangered or threatened throughout all of its range, but it is endangered or threatened within a significant portion of its range, and the population in that significant portion is a valid DPS, we will list the DPS rather than the entire taxonomic species or subspecies. Finally, a portion of the species' range is significant if its contribution to the viability of the species is so important that without that portion, its abundance, spatial distribution, productivity, and diversity would be so impaired that the species would be in danger of extinction, either currently or in the foreseeable future.

Under the Draft Policy, the determination of a portion's ''significance'' emphasizes its biological importance and contribution to the conservation of the species. When determining a portion's biological or conservation importance, we consider the species' resiliency, or those characteristics that allow it to recover from periodic disturbances. We also consider the species' redundancy (having multiple aggregations distributed across the landscape, abundance, spatial distribution) as a measure of its margin of safety to withstand catastrophic events. Finally, we consider its representation (the range of variation found in a species; spatial distribution, and diversity) as a measure of its adaptive capability.

We have reconsidered the BRT's conclusions in light of the non-binding guidance of the Draft Policy. As indicated above, the BRT determined SPOIR first by identifying and qualitatively scoring five ecologically significant components, and then by identifying the SPOIR from those strata that scored higher than the median value. We believe that the BRT's five ecologically significant components are consistent with the Draft Policy's emphasis on identifying those biological factors that are necessary to contribute to species viability—that is, abundance, spatial distribution, productivity, and diversity. For example, the identified SPOIR considered spatial structure that, if removed, would result in isolated and fragmented remaining bumphead populations. It also considered biologically important microhabitat characteristics and connectivity of subareas to adjacent portions of range, which are necessary to ensure continued productivity and diversity to respond to future environmental changes.

We note that the BRT's additive approach may not capture all possible combinations of demographic and population changes and concentrations of threats that occur currently and might occur in the future. The BRT in fact acknowledged that a combinational approach may be more useful to determine SPOIR, but that it was not possible with the limited information currently available.

Our next step in this evaluation under the Draft Policy was to review all of the available information used in completing this status review to identify any portions of the range of the species that warrant further consideration (76 FR 77002; December 9, 2011). We evaluated whether substantial information indicated ''that (i) the portions may be significant [within the meaning of the Draft Policy] and (ii) the species [occupying those portions] may be in danger of extinction or likely to become so within the foreseeable future'' (76 FR 77002; December 9, 2011). Under the Draft Policy, both considerations must apply to warrant listing a species as endangered or threatened throughout its range based upon threats within a portion of the range. In other words, if either consideration does not apply, we would not list a species based solely upon its status within a significant portion of its range.

Thus, in addition to the evaluation of ecological and biological significance of portions of the range completed by the BRT, we considered whether there are portions of the range in which threats are so concentrated or acute as to place the species in those portions in danger of extinction, and if so, whether those portions are significant. No information presented in the BRT report, management report, or that has otherwise been identified indicates a high concentration of harvest or habitat degradation threats in one or more specific portions within bumphead parrotfish range. The BRT rated the geographic scope of each threat identified; adult harvest was rated as ''Localized'', defined as ''likely to be confined in its scope and to affect the species in a limited portion of its range''. The BRT did not identify any portions of the range where this threat may be concentrated and this rating likely reflects the limited information available specific to bumphead parrotfish harvest. Data pertaining to harvest are sparse, incomplete, or lacking for a majority of regions across the range and in most cases bumpheads are not distinguished in the records from other parrotfish species. Of known fisheries assessments, harvest information specific to bumphead parrotfish is available for only five of the 63 strata evaluated by the BRT. The records that exist for these five strata do not indicate any area of exceptionally intensive harvest, and it is not possible to compare these strata with other portions of the species range that lack similar information. We found no further evidence during the status review of a concentrated threat of harvest in any portion of the species' range.

The geographic scope for juvenile habitat loss and degradation was rated by the BRT as ''Moderate'', defined as likely to be occurring at more than some to many, but not all, areas in its scope and to affect the species at a number of locations within its range. Again, specific locations or portions of the range where this threat may be concentrated were not identified by the BRT and we found no further evidence that the threat of juvenile habitat loss is acutely concentrated in any specific portions of the species' range. We acknowledge that there are likely variations in the severity of threats throughout the species' range but we have insufficient information to conclude that any specific portion of the range warrants further consideration due to acute or concentrated threats.

Finally, the BRT clarified that its qualitative method was only a preliminary delineation of SPOIR for this species, and that the tool was primarily useful as a relative reference because the ''absolute magnitude of this SPOIR is not ecologically interpretable in present form.'' We acknowledge that the BRT's approach in determining SPOIR is a predictive judgment based on the best available—albeit limited—science, and therefore must be used with caution. The BRT also acknowledges that the selection of all strata with a SPOIR index above the median value for inclusion in SPOIR was a conservative approach; the species is able to persist in most, if not all, of the geographic strata presented, therefore concerns of underestimating the actual minimum threshold would appear unlikely; i.e., there is no compelling evidence to suggest that the SPOIR index threshold should be greater than the median, and is more likely lower than the median, hence it is suggested that SPOIR was conservatively delineated in this exercise.

With respect to this relatively numerous, widely dispersed, and interconnected species, we consider the BRT's approach to be an appropriate tool for evaluating the biological importance of those range portions that, if removed, would so impair the abundance, spatial distribution, productivity, and diversity of the species that it would be in danger of extinction. Our additional evaluation of portions of the range that may warrant further consideration due to concentrated threats does not support the delineation of any additional or different portions of the species range as significant. Accordingly, our SPOIR analysis remains the same when considered in light of the non-binding guidance of the Draft Policy.

The BRT selected time frames over which identified threats are likely to impact the biological status of the species and can be reasonably predicted. The appropriate period of time corresponding to the foreseeable future depends on the particular kinds of threats, life-history characteristics, and specific habitat requirements for the species under consideration. The bumphead parrotfish BRT selected 40 years as a working time frame, which is the approximate maximum age of individuals of this species, keeping in mind the age at which most females spawn is approximately 10 years, so that this reference point spans approximately four bumphead parrotfish generations. As a means of evaluating the sensitivity of this period, an independent vote was taken examining 100 years (approximately 10 bumphead parrotfish generations; Kobayashi *et al.,* 2011).

Under the ESA, the determination of the foreseeable future is to be made on a species-by-species basis through an analysis of the time frames applicable to the threats to the particular species at issue, including the interactive effect among those threats. Each threat may have a different time frame associated with it over which we can reliably predict impacts to the species. Our conclusion regarding the future status of the species represents a synthesis of different time frames associated with different threats.

Although available data for threats related to climate change allow for reasonable projections over one hundred years, our ability to make reliable predictions over this period based on existing data for other threats affecting bumphead parrotfish, including the most serious threats to the species (loss of juvenile habitat and adult harvest) involves considerable uncertainty. We note that the BRT identified significant levels of uncertainty regarding all aspects of bumphead parrotfish biology. Although the BRT evaluated extinction risk over distinct 40- and 100-year time horizons, the BRT analyzed the severity of future impacts from identified threats and the certainty with which they could make those conclusions over a combined 40- to 100-year time horizon. Our determination of the foreseeable future necessarily involves consideration of the most appropriate way to manage known risks, and is bounded by the point where we can no longer make reliable predictions as to the likely future status of this species. Accordingly, while it was appropriate for the BRT to consider a time frame of up to one hundred years to gauge the sensitivity of its extinction analysis, for purposes of our determination, we believe that a 40-year foreseeable future is more reliable for evaluating the future conservation status of the species. Accordingly, we adopt this 40-year period as the species' foreseeable future.

The BRT used a qualitative approach that characterizes extinction risk in terms of the certainty that the species' condition will decline below a Critical Risk Threshold (CRT) within a certain time period because data allowing for a quantitative approach were not available. The CRT is defined as a threshold below which the species is of such low abundance or so spatially fragmented that it is at risk of extinction. The CRT is not defined as a single abundance number, density, spatial distribution or trend value; it is a qualitative description encompassing multiple life-history characteristics and other important ecological factors. Establishing the CRT level involves consideration of all factors affecting the risk of bumphead parrotfish extinction, including depensatory processes, environmental stochasticity, and catastrophic events. Depensatory processes include reproductive failure from low density of reproductive individuals and genetic processes such as inbreeding. Environmental stochasticity represents background environmental variation. Catastrophes result from severe, sudden, and deleterious environmental events (Kobayashi *et al.,* 2011).

*Extinction Risk Analysis Results*

The BRT used a structured decision-making process of expert elicitation to assess the extinction risk for bumphead parrotfish. To account for uncertainty in the extinction risk analysis, each of the five BRT members distributed 10 votes in three categories representing likelihood of the species falling below the CRT. The three categories were 0–33 percent, 33–66 percent, and 66–100 percent likelihood of the species falling below the CRT. The average vote distribution amongst the 3 categories for all five BRT members combined represents the BRT's opinion of extinction risk. Extinction risk was evaluated at four spatial-temporal scales (two time frames over both current range and in SPOIR): (1) Current range at 40 years in the future; (2) current range at 100 years in the future; (3) SPOIR at 40 years in the future; and (4) SPOIR at 100 years in the future (Kobayashi *et al.,* 2011).

For current range at 40 years in the future, the largest proportion (56 percent) of the BRT's total votes fell into Category 1 (0–33 percent likelihood of falling below CRT), 40 percent fell into Category 2 (33–66 percent likelihood of falling below CRT), and 4 percent fell into Category 3 (66–100 percent likelihood of falling below CRT; Kobayashi et al. 2011).

For current range at 100 years in the future, the largest proportion (48 percent) of the BRT's total votes again fell into Category 1 (0–33 percent likelihood of falling below CRT), 46 percent fell into Category 2 (33–66 percent likelihood of falling below CRT), and 6 percent fell into Category 3 (66–100 percent likelihood of falling below CRT; Kobayashi et al. 2011).

For SPOIR at 40 years in the future, the largest proportion (52 percent) of the BRT's total votes again fell into Category 1 (0–33 percent likelihood of falling below CRT), 42 percent fell into Category 2 (33–66 percent likelihood of falling below CRT), and 6 percent fell into Category 3 (66–100 percent likelihood of falling below CRT; Kobayashi et al. 2011).

For SPOIR at 100 years in the future, 46 percent of the BRT's total votes fell into Category 1 (0–33 percent likelihood of falling below CRT), 48 percent fell into Category 2 (33–66 percent likelihood of falling below CRT), and 6 percent fell into the Category 3 (66–100 percent likelihood of falling below CRT; Kobayashi et al. 2011).

To summarize the BRT's extinction risk analysis results for the four spatial-temporal scales, in three of the four scenarios examined, the largest proportion of the BRT's votes were cast into Category 1 (0–33 percent likelihood of falling below the CRT) and in one scenario (SPOIR at 100 years) the largest proportion of their votes fell into Category 2 (33–66% likelihood of falling below CRT).

The BRT's extinction risk results are based only on the statutory factors A, B, C, and E listed under section 4(a)(1) of the ESA (Kobayashi *et al.,* 2011). The most significant threats to bumphead parrotfish are adult harvest and juvenile habitat loss/degradation, while juvenile harvest, adult habitat loss/degradation, pollution, global warming, and ocean acidification were considered by the BRT to be of medium threat (Kobayashi *et al.,* 2011). Factor D (''inadequacy of existing regulatory mechanisms'') was assessed in the Management Report (NMFS 2012) and summarized in section D of the Threats Evaluation above. Based on the information presented in the Management Report, we conclude that the inadequacy of regulatory mechanisms is not a factor contributing to increased extinction risk for bumphead parrotfish. Extensive fisheries and coastal management laws and decrees in the 46 areas within the current range of the bumphead parrotfish exist. In addition, up to 25 percent of adult and juvenile habitats are within protected areas. Ideally, some proponents of marine reserve design recommend at least 20 to 30 percent or more of habitat be protected as a no-take areas (Bohnsack *et al.,* 2000; Airame *et al.,* 2003; Fernandes *et al.,* 2005; Gladstone 2007; Gaines *et al.,* 2010), although the actual area depends on the goal in mind. Considering the entire range of bumphead parrotfish as one ecosystem in order to apply this concept is not necessarily feasible; however, as discussed previously, at least 12 per cent of coral reef areas within bumphead parrotfish range are essentially no-take areas for this species. We acknowledge that this percentage is lower than the bar set for marine reserve design in the literature. We express no conclusion on whether existing regulatory mechanisms should or could provide greater protection to the bumphead parrotfish. We conclude only that the inadequacy of regulatory mechanisms is not a factor contributing to increased extinction risk of the species. The Management Report also considered current conservation efforts as well as conservation efforts that have yet to be fully implemented or have yet to demonstrate effectiveness (under the PECE policy) and found that these conservation efforts do not at this time positively or negatively affect the species status. Accordingly, we conclude that the information in the Management Report does not support an adjustment in the BRT's extinction risk results. We therefore conclude after considering all five factors that the BRT's extinction risk results described above provide the best available information on the current extinction risk faced by the bumphead parrotfish.

**Listing Determination**

As described above, we are responsible for determining whether the bumphead parrotfish (*Bolbometopon muricatum*) warrants listing under the ESA (16 U.S.C. 1531 *et seq.*). In order to make this listing determination, we conducted a comprehensive status review, consisting of a Biological Review, a Threats Evaluation, and an Extinction Risk Analysis, as summarized above. Key conclusions are described below, which provide the basis for our listing determination.

**Key Conclusions From Biological Review**

*The species is made up of a single population over its entire geographic range.* As indicated above, the ESA requires us to determine whether any species warrants listing as endangered or threatened. A species includes any species, subspecies, ''and any distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature.'' Under the joint USFWS–NOAA ''Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act'' (61 FR 4722; February 7, 1996) two elements are considered when evaluating whether a population segment qualifies as a distinct population segment (DPS) under the ESA: (1) The discreteness of the population segment in relation to the remainder of the species or subspecies to which it belongs; and (2) the significance of the population segment to the species or subspecies to which it belongs. If a population segment is discrete and significant (i.e., it is a DPS), its evaluation for endangered or threatened status will be based on the ESA's definitions of those terms and a review of the factors enumerated in section 4(a). However, it should be noted that Congress has instructed the Secretary to exercise this authority with regard to DPS's ''sparingly and only when the biological evidence indicates that such action is warranted.'' (Senate Report 151, 96th Congress, 1st Session).

Under the DPS Policy, a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors; or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA. As discussed more fully above, prong (1) is not satisfied because the species is made up of a single population over its entire geographic range. In particular, the BRT report describes how available observations and pelagic dispersal modeling support the conclusion that the bumphead parrotfish is a single, well-described species that cannot be sub-divided into distinct population segments.

Under the DPS policy, population segments also may be considered discrete based on international political boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant. Even assuming discreteness based on significant differences in management or conservation status defined by political boundaries for bumphead parrotfish, there is insufficient information to conclude that the loss of any segment of the population defined by those boundaries would be significant to the taxon as a whole. Significance is evaluated based on a variety of factors, including whether the DPS persists in an ecological setting unusual or unique for the taxon, if there is evidence that loss of the DPS would result in a significant gap in the range of a taxon, if there is evidence that the DPS represents the only surviving natural occurrence of a taxon that may be more abundant as an introduced population outside its historic range, or if there is evidence that the DPS differs markedly from other populations of the species in its genetic characteristics. We have no evidence to conclude that any of these significance criteria apply to the bumphead parrotfish. Specifically, there is no evidence to suggest the existence of genetic differences between bumphead parrotfish in different portions of the range. There is also no evidence to suggest that the loss of any segment of the population would cause a significant gap in the range of the taxon because the best available science indicates one interconnected population throughout the species range based on estimates of connectivity and a lack of evidence indicating morphological, behavioral, or other regional differences. Accordingly, we do not find that distinct population segments of bumphead parrotfish exist.

*The species has patchy abundance, being depleted or absent in many areas while abundant in others.* This conclusion is based on the Abundance and Density section of the Biological Review, which describes how the abundance of bumphead parrotfish varies widely across its range. Patchy abundance throughout the range of a species is common and due to differences in habitat quality/quantity or exploitation levels at different locations. Pinca *et al.* (2011) examined the relative importance of habitat variability and fishing pressure in influencing reef fish communities across 17 Pacific Island countries and territories; they found that the relative impact of fishing on fish populations accounted for 20 percent of the variance while habitat accounted for 30 percent.

*The species possesses life history characteristics that increase vulnerability to harvest, including slow growth, late maturation, shallow habitat, nocturnal resting in refuge sites that are returned to daily, large size, and conspicuous coloration.* This conclusion is based on the Age and Growth, Reproductive Biology, Habitat and Distribution, and Settlement and Recruitment sections of the Biological Review. Bumphead parrotfish grow slowly and mature at a large size, thus juveniles and sub-adults can be large, attractive targets for harvest. Sub-adult and adult bumphead parrotfish possess a multitude of life history characteristics that increase vulnerability to harvest, such as nocturnal resting behavior in shallow areas, diurnal feeding behavior on shallow forereefs, large size, and conspicuous coloration. Several of these traits have also been related to slow recovery rates for severely depleted populations (*Reynolds et al., 2001; Dulvy and Reynolds, 2002; Dulvy et al., 2003; Reynolds, 2003*).

*The species possesses life history characteristics conducive to population resilience including broad pelagic dispersal, frequent spawning, and non-selective feeding.* This conclusion is based on the Movements and Dispersal, Reproductive Biology, Feeding, Ecosystem Considerations sections of the Biological Review. Resiliency (abundance, spatial distribution, productivity) describes characteristics of a species that allow it to recover from periodic disturbance, as defined in the NMFS/USFWS joint Draft SPOIR policy (76 FR 76987; 9 December 2011). The broad geographic range of bumphead parrotfish includes areas of refuge where abundance is high and harvest pressure is low. Although some unknown proportion of recruitment is likely local in nature (Jones *et al.,* 2009; Hogan *et al.,* 2012), the combination of high fecundity and broad pelagic dispersal of eggs and larvae may contribute to replenishment of depleted areas at some level. Non-selective feeding allows the species to be resilient to changes in community composition within its habitat. In combination, these life history characteristics contribute to population resilience.

*The species is broadly distributed, and its current range is similar to its historical range.* This conclusion is based on the Habitat and Distribution section of the BRT report, which concluded that available information suggests that the current range is equivalent to the historical range.

*While abundance is declining across the species' range, the contemporary population is estimated at 3.9 million adults.* This conclusion is based on the Contemporary Global Population and Global Population Trends sections of the Biological Review. Available evidence indicates a historical decline, and a continuing trend of decline, although unquantifiable, in the global population of bumphead parrotfish. The best estimate of contemporary global population abundance of bumphead parrotfish is 3.9 million adults.

## Key Conclusions From Threats Evaluation

*The two most important threats to bumphead parrotfish are adult harvest and juvenile habitat loss.* Adult harvest and juvenile habitat loss are both rated as ''high severity'' threats to the species, both currently and over the next 40–100 years. All of the other threats to the species were rated as lower severity, both currently and over the next 40–100 years.

*Existing regulatory mechanisms may provide benefits in addressing the most serious threats to bumphead parrotfish.* National and/or local laws and regulations, many relatively new marine protected areas, and a resurgence of customary management occurring across much of the range of the species, may address both adult harvest and juvenile habitat loss to an undetermined extent. The inadequacy of regulatory mechanisms is not a contributing factor to increased extinction risk for the species.

*Existing regulatory mechanisms are at least as good within SPOIR as outside of SPOIR.* Of the 46 countries and areas within the range of the bumphead parrotfish, 26 countries or parts thereof are considered to be the ''significant portion of its range'' (SPOIR). Within these 26 areas, regulatory mechanisms are at least as effective as in the other areas of the species' range.

## Key Conclusions From Extinction Risk Analysis

*Bumphead parrotfish are not likely to fall below the critical risk threshold within the foreseeable future.* In three of the four spatio-temporal scenarios examined by the BRT, the largest proportion of the BRT's votes indicate that bumphead parrotfish are 0–33 per cent likely to fall below the CRT. Within SPOIR 100 years into the future, the largest proportion (by a small margin) of the BRTs votes were that bumphead parrotfish are 33–66% likely to fall below the CRT. Once again, the CRT is defined as a threshold below which the species is of such low abundance or so spatially fragmented that it is at risk of extinction. As stated earlier, our conclusion is based on a synthesis of multiple trends and threats over different time periods. The 40-year time frame is a point beyond which our ability to predict the status of the species when considering the best scientific and commercial information available becomes more uncertain, including future impacts from the primary threats of juvenile habitat loss and adult harvest. Accordingly, so as to avoid basing our findings on speculation, we adopt a 40-year time frame as the species' foreseeable future.

*The BRT's extinction risk results are unchanged by the Management Report.* The BRT's extinction risk analysis was based on Factors A, B, C, and E (Kobayashi *et al.,* 2011). After also considering Factor D and conservation efforts, based on information in the Management Report (NMFS 2012), an adjustment in the BRT's extinction risk results is not supported. We therefore conclude after considering all five factors that the BRT's extinction risk results described above provide the best available information on the current extinction risk faced by the bumphead parrotfish.

## Conclusion

Based on the key conclusions from the Biological Review, the Threats Evaluation, and the Extinction Risk Analysis, we summarize the results of our comprehensive status review as follows: (1) The species is made up of a single population over a broad geographic range, and its current range is indistinguishable from its historical range; (2) while the species possesses life history characteristics that increase vulnerability to harvest, it also possesses characteristics conducive to population resilience; (3) although abundance is declining and patchy across the species' range, the contemporary population size is sufficient to maintain population viability into the foreseeable future, based on the BRT's assessment of extinction risk; (4) existing regulatory mechanisms throughout the species' range may be effective in addressing the most important threats to the species (adult harvest and juvenile habitat loss), but the extent of those conservation benefits cannot be determined; and (5) while the global population is likely to further decline, the combination of life history characteristics, large contemporary population, and, to a lesser extent, existing regulatory mechanisms indicate that the species is not currently in danger of extinction, nor is it likely to become in danger of extinction in the foreseeable future.

These overall results of our status review portray a species that still occupies its historical range, although at lower and declining abundance, but with both biological characteristics and, potentially, management measures that help maintain the population above the viability threshold. Our information does not indicate that this status is likely to change within the foreseeable future.

Based on these results, we conclude that the bumphead parrotfish is not currently in danger of extinction throughout its range or throughout SPOIR, and is not likely to become in danger of extinction within the foreseeable future. Accordingly, the species does not meet the definition of threatened or endangered. Based on these findings, our listing determination is that the bumphead parrotfish does not warrant listing as threatened or endangered at this time.

### References

A complete list of all references cited herein is available upon request (see **FOR FURTHER INFORMATION CONTACT**).

### Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: November 2, 2012.

**Alan D. Risenhoover,**

*Director, Office of Sustainable Fisheries, performing the functions and duties of the Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.*

[FR Doc. 2012–27244 Filed 11–6–12; 8:45 am]

**BILLING CODE 3510–22–P**

## DEPARTMENT OF COMMERCE

### National Oceanic and Atmospheric Administration

**RIN 0648–XC328**

### Fisheries of the Gulf of Mexico; Southeast Data, Assessment, and Review (SEDAR); Assessment Process Webinar for Gulf of Mexico Spanish Mackerel and Cobia

**AGENCY:** National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

**ACTION:** Notice of SEDAR 28 Gulf of Mexico Spanish mackerel and cobia assessment webinar.

**SUMMARY:** The SEDAR 28 assessment of the Gulf of Mexico Spanish mackerel and cobia fisheries will consist of a series of workshops and supplemental webinars. This notice is for a webinar associated with the Assessment portion of the SEDAR process.

**DATES:** The SEDAR 28 Assessment Workshop Webinar will be held on November 26, 2012, from 1 p.m. until 5 p.m. EDT. The established time may be adjusted as necessary to accommodate the timely completion of discussion relevant to the assessment process. Such adjustments may result in the meeting being extended from, or completed prior to, the times established by this notice.

**ADDRESSES:** The webinar will be held via a GoToMeeting Webinar Conference. The webinar is open to members of the public. Those interested in participating should contact Ryan Rindone at SEDAR (see **FOR FURTHER INFORMATION CONTACT**) to request an invitation providing webinar access information. Please request meeting information at least 24 hours in advance.

**FOR FURTHER INFORMATION CONTACT:** Ryan Rindone, SEDAR Coordinator, 2203 N Lois Ave, Suite 1100, Tampa FL 33607; telephone: (813) 348–1630; email: *ryan.rindone@gulfcouncil.org*

**SUPPLEMENTARY INFORMATION:** The Gulf of Mexico Fishery Management Council (GMFMC), in conjunction with NOAA Fisheries, has implemented the Southeast Data, Assessment and Review (SEDAR) process, a multi-step method for determining the status of fish stocks in the Southeast Region. SEDAR is a three-step process including: (1) Data Workshop; (2) Assessment Process, including a workshop and webinars; and (3) Review Workshop. The product of the Data Workshop is a data report which compiles and evaluates potential datasets and recommends which datasets are appropriate for assessment analyses. The product of the Assessment Process is a stock assessment report which describes the fisheries, evaluates the status of the stock, estimates biological benchmarks, projects future population conditions, and recommends research and monitoring needs. The assessment is independently peer reviewed at the Review Workshop. The product of the Review Workshop is a summary documenting panel opinions regarding the strengths and weaknesses of the stock assessment and input data. Participants for SEDAR Workshops are appointed by the GMFMC, NOAA Fisheries Southeast Regional Office, and the NOAA Southeast Fisheries Science Center. Participants include: Data collectors and database managers; stock assessment scientists, biologists, and researchers; constituency representatives including fishermen, environmentalists, and non-governmental organizations (NGOs); international experts; and staff of Councils, Commissions, and state and federal agencies.

### SEDAR 28 Assessment Workshop Webinar

Panelists will continue deliberations and discussions regarding modeling methodologies for the Gulf of Mexico Spanish mackerel and cobia fisheries.

### Special Accommodations

This meeting is accessible to people with disabilities. Requests for auxiliary aids should be directed to the Council office (see **FOR FURTHER INFORMATION CONTACT**) at least 10 business days prior to the meeting.

Dated: November 1, 2012.

**Tracey L. Thompson,**

*Acting Deputy Director, Office of Sustainable Fisheries, National Marine Fisheries Service.*

[FR Doc. 2012–27087 Filed 11–6–12; 8:45 am]

**BILLING CODE 3510–22–P**

## DEPARTMENT OF COMMERCE

### United States Patent and Trademark Office

### Submission for OMB Review; Comment Request

The United States Patent and Trademark Office (USPTO) will submit to the Office of Management and Budget (OMB) for clearance the following proposal for collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35).

Agency: United States Patent and Trademark Office (USPTO).

*Title:* Invention Promoters/Promotion Firms Complaints.

*Form Number(s):* PTO/SB/2048.

*Agency Approval Number:* 0651–0044.

*Type of Request:* Revision of a currently approved collection.

*Burden:* 18 hours annually.

*Number of Respondents:* 50 responses per year.

*Avg. Hours per Response:* The USPTO estimates that it will take the public approximately 15 minutes (0.25 hours) to gather the necessary information, prepare the form, and submit a complaint to the USPTO and approximately 30 minutes (0.5 hours) for an invention promoter or promotion firm to prepare and submit a response to a complaint.

*Needs and Uses:* The Inventors' Rights Act of 1999 requires the USPTO to provide a forum for the publication of complaints concerning invention