This document contains the regional discussion of the Gulf of Mexico estuaries, from the National Estuary Program Coastal Condition Report. The entire report can be downloaded from
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National Estuary Program Coastal Condition Report

Chapter 5: Gulf of Mexico National Estuary Program Coastal Condition, Part A

June 2007

CHAPTER 5

GULF COAST NATIONAL ESTUARY PROGRAM COASTAL CONDITION

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Background

The Gulf Coast region extends from the lush tropical southern tip of Florida, including the Florida Keys, westward to the saline lagoons of South Texas at the Mexican border. The Gulf of Mexico receives runoff from almost two-thirds of the continental United States, primarily funneled through the Mississippi River drainage basin (NOAA, 1985). Within the Gulf Coast region, there are seven NEP estuaries—Charlotte Harbor, Sarasota Bay, Tampa Bay, Mobile Bay, the Barataria-Terrebonne Estuarine Complex, Galveston Bay, and the Coastal Bend Bays (Figure 5-1).

The entire Gulf Coast region is characterized by flat coastal plains and high levels of sediment deposition. Some of the estuaries in this region have large deltas at their river mouths (e.g., Mobile-Tensaw River Delta in Mobile Bay), where suspended sediment carried by runoff is deposited in shallow coastal waters. In other areas, sediment deposited by ocean currents has formed offshore sand bars that enclose shallow saline lagoons known as bar-built estuaries (e.g., Laguna Madre of the Coastal Bend Bays), which are most common along the Texas coast. The inlets to these estuaries are often narrow, and the exchange of water with the ocean is highly restricted; as a result, the circulation patterns in these waterbodies are driven primarily by wind (NOAA, 1985). In general, the shallow coastal plain estuaries characteristic of the Gulf Coast region receive little tidal influence, and tidal range in the region is small, with a minimum of 1 foot in Louisiana and Texas and a maximum of 3.6 feet in Florida (NOAA, 1985). Hurricanes and their accompanying heavy rains, an ever-present risk during the June-to-late-November hurricane season, have a dramatic effect on the Gulf Coast NEP estuaries by increasing freshwater inflow from storm precipitation and saltwater intrusion from wind-driven storm surge. Annual rainfall averages 48 inches in western Florida; increases to 56 inches in Alabama, Mississippi, and Louisiana; and then dramatically decreases to 24 inches in south Texas (NOAA, 1985).

The Gulf Coast NEP estuaries provide critical feeding, spawning, and nursery habitats for a rich assemblage of fish, wildlife, and plant species, including endangered species such as sea turtles, the Gulf

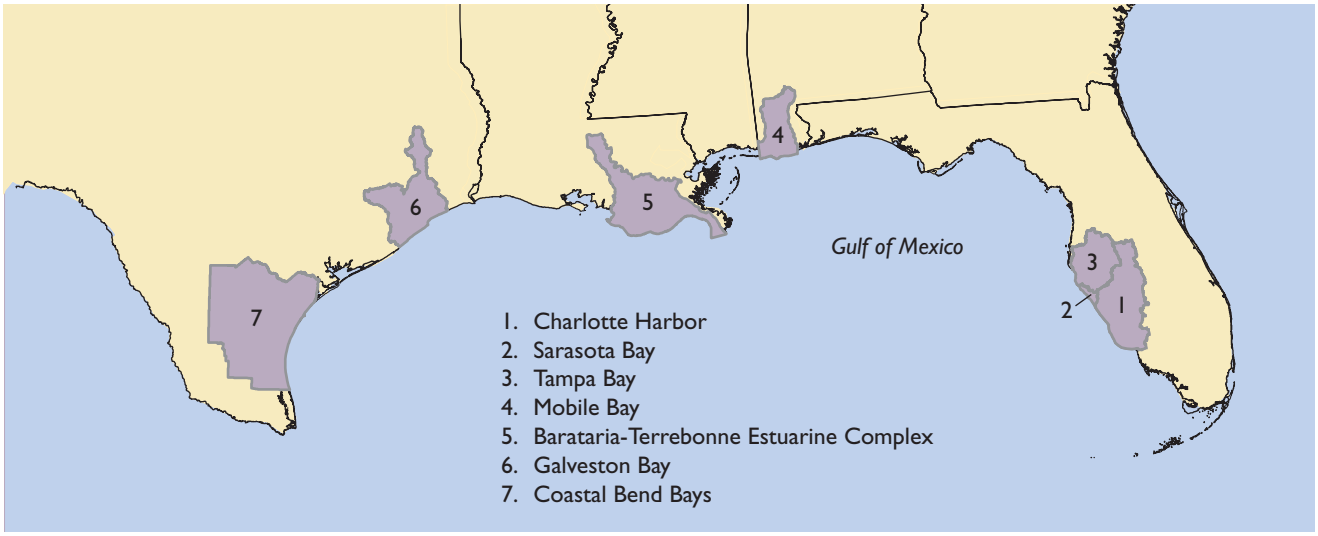

Figure 5-1. The Gulf Coast region is home to seven NEP estuaries.

sturgeon, the Perdido Key beach mouse, the manatee, the white-topped pitcher plant, and the red-cockaded woodpecker. These estuaries also support SAV communities that stabilize shorelines from erosion, reduce non-point source loadings, improve water clarity, and provide wildlife habitat. Increasingly, the varied estuarine habitats found along the Gulf Coast region are under pressure from human development.

Population Pressures

The population of the 48 NOAA-designated coastal counties coincident with the study areas of the Gulf Coast NEP estuaries increased by more than 133% during a 40-year period, from 4.9 million people in 1960 to 11.3 million people in 2000 (Figure 5-2) (U.S. Census Bureau, 1991; 2001). Population density for these coastal counties was 287 persons/mi^2 in 2000; however, the population densities of the individual NEP study areas varied considerably, from a high of 651 persons/mi^2 in Galveston Bay to 53 persons/mi^2 in the Coastal Bend Bays (U.S. Census Bureau, 2001). Development and population pressures are especially strong in these 48 Gulf Coast counties because the coincident NEP study areas serve as centers of commerce, contain substantial commercial and recreational fisheries, and provide recreational areas for coastal communities.

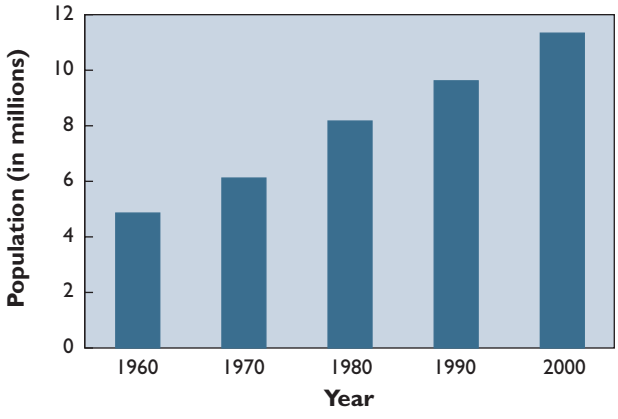

Figure 5-2. Population of the 48 NOAA-designated coastal counties of the Gulf Coast NEP study areas, 1960–2000 (U.S. Census Bureau, 1991; 2001).

The following sections of this report discuss two different approaches for characterizing estuarine condition.

Approach 1 – The NCA provides unbiased, quality-assured data that can be used to make consistent "snapshot" comparisons among the nation's estuaries. These comparisons are expressed in terms of the percent of estuarine area in good, fair, or poor condition.

Approach 2 – Each individual NEP collects site-specific estuarine data in support of local problem-solving efforts. These data are difficult to compare among NEPs, within regions or nationally, because the sampling and evaluation procedures used by the NEPs are often unique to their individual estuaries. However, these assessments are important because NEP-collected data can evaluate spatial and temporal changes in estuarine condition on a more in-depth scale than can be achieved by the NCA snapshot approach.

Atmospheric deposition is often monitored in NEP study areas because it can contribute to estuarine nitrogen loadings (Mobile Bay NEP).

NCA Indices of Estuarine Condition—Gulf Coast Region

The overall condition of the collective NEP estuaries of the Gulf Coast region is rated fair based on the four indices of estuarine condition used by the NCA (Figure 5-3). The region's water quality index is rated fair, the sediment quality and benthic indices are rated fair to poor, and the fish tissue contaminants index is rated good to fair. Figure 5-4 provides a summary of the percentage of estuarine area rated good, fair, poor, or missing for each parameter considered. This assessment is based on data collected by the NCA and its state partners from 221 sites sampled in the Gulf Coast region's NEP estuaries in 2000, 2001, and 2002. Samples were collected during the summer, the most stressful period of the year, and neither environmental stressors (e.g., nutrients, TOC) nor aquatic life communities showed any major evidence of degradation. Please refer to Tables 1-24, 1-25, and 1-26 (Chapter 1) for a summary of the criteria used to develop the rating for each index and component indicator.

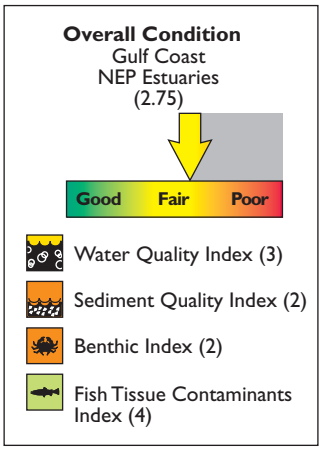

Figure 5-3. The overall condition of the Gulf Coast region's NEP estuarine areas is fair (U.S. EPA/NCA).

The sampling conducted by EPA's NCA has been designed to estimate the percent of estuarine area (nationally or in a region or state) in varying conditions, which are displayed as pie diagrams. Many of the figures in this report illustrate environmental measurements made at specific locations (colored dots on maps); however, these dots (color) represent the value of the indicator specifically at the time of sampling. Additional sampling may be required to define variability and confirm impairment or the lack of impairment at specific locations.

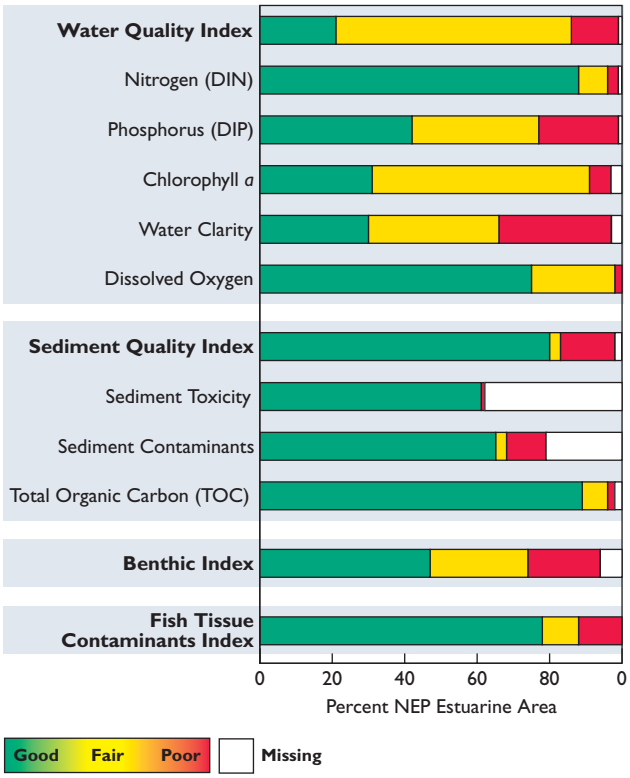

Figure 5-4. Percentage of NEP estuarine area achieving each rating for all indices and component indicators — Gulf Coast region (U.S. EPA/NCA).

Gulf Coast NEP estuaries provide breeding and wintering habitat for royal terns (*Sterna maxima*) (Mobile Bay NEP).

Water Quality Index

Based on NCA results, the water quality index for the collective NEP estuaries of the Gulf Coast region is rated fair (Figure 5-5). This index was developed using NCA data on five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. The NCA survey data indicates that 21% of the Gulf Coast region's NEP estuarine area was rated good for water quality, 65% of the area was rated fair, and 13% of the area was rated poor. In NOAA's Estuarine Eutrophication Survey (NOAA, 1997), the Gulf of Mexico as a whole was ranked poor for eutrophic condition, with an estimated 38% of the estuarine area having a high expression of eutrophication.

Dissolved Nitrogen and Phosphorus | The Gulf Coast region is rated good for DIN concentrations, with 88% of the region's NEP estuarine area rated good for this component indicator, 8% rated fair, and 3% rated poor. Elevated DIN concentrations are not expected to occur during the summer in Gulf Coast waters because freshwater input is generally lower and dissolved nutrients are more rapidly utilized by phytoplankton during this season. The Gulf Coast region is rated fair for DIP concentrations because 22% of the NEP estuarine area was rated poor for this component indicator.

Chlorophyll a | The Gulf Coast region is rated fair for chlorophyll *a* concentrations. Although poor chlorophyll *a* conditions occurred rarely in this region (6% of the NEP estuarine area), 60% of the area was rated fair for this component indicator, and 31% of the area was rated good. NCA data on chlorophyll *a* concentrations were unavailable for 3% of the Gulf Coast NEP estuarine area.

Water Clarity | Water clarity in the Gulf Coast NEP estuarine area is rated poor. Thirty-one percent of the Gulf Coast region's NEP estuarine area was rated poor, 30% was rated good, and 36% was rated fair. NCA data on water clarity were unavailable for 3% of the Gulf Coast NEP estuarine area.

Dissolved Oxygen | The Gulf Coast region is rated good for dissolved oxygen conditions in its NEP estuaries. The NCA results for these estuaries show that only 2% of the estuarine area was rated poor for dissolved oxygen concentrations, 23% of the estuarine area was rated fair, and 75% of the area was rated good.

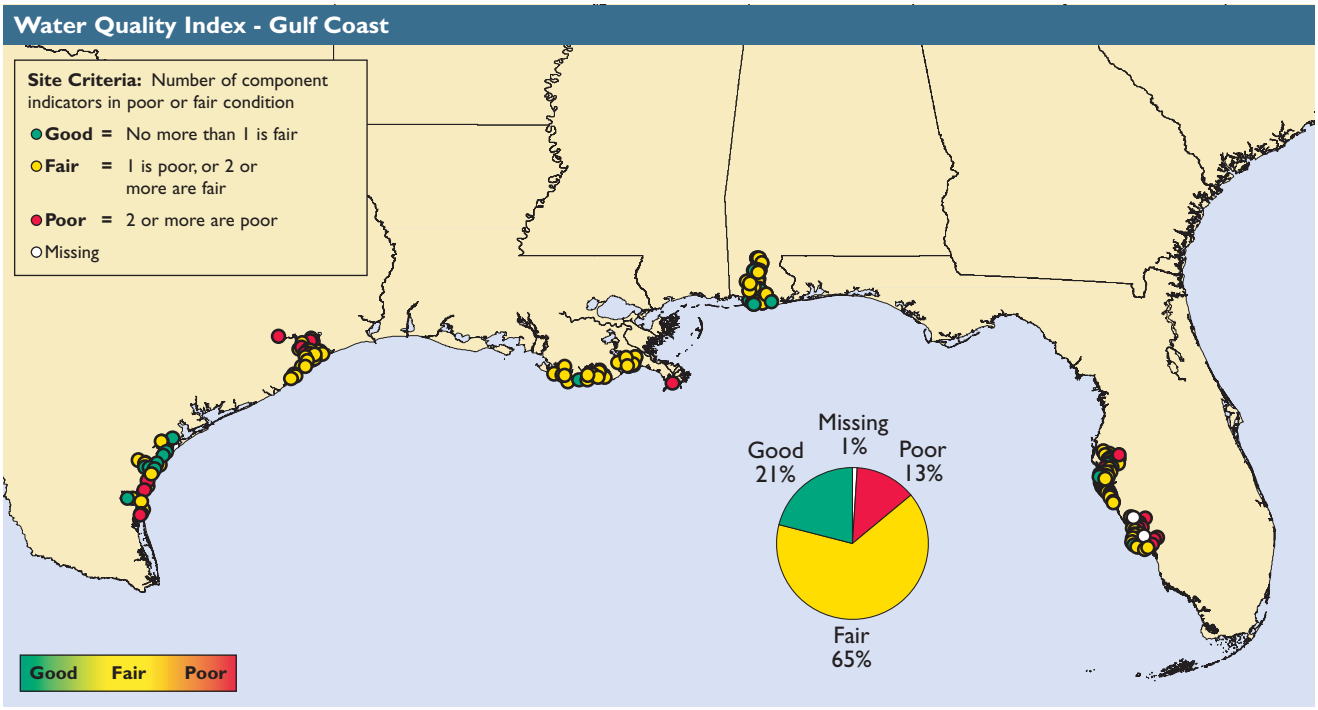

Figure 5-5. Water quality index data for the Gulf Coast NEP estuarine area, 2000–2002 (U.S. EPA/NCA).

Sediment Quality Index

The sediment quality index for the collective NEP estuaries of the Gulf Coast region is rated fair to poor because 18% of the region's NEP estuarine area was rated either fair or poor for sediment quality (Figure 5-6). This index was developed using NCA data on three component indicators: sediment toxicity, sediment contaminants, and sediment TOC.

Sediment Toxicity | Sediment toxicity in the Gulf Coast region is rated good because only 1% of the region's NEP estuarine area was rated poor for this component indicator. It should be noted that data on sediment toxicity were unavailable for 38% of the Gulf Coast NEP estuarine area, including the region's three Florida estuaries (Charlotte Harbor, Sarasota Bay, and Tampa Bay).

Sediment Contaminants | The Gulf Coast region is rated fair for sediment contaminant concentrations, with 11% of the region's NEP estuarine area rated poor for this component indicator. It should be noted that NCA data on sediment contaminant concentrations were unavailable for 21% of the Gulf Coast NEP estuarine area, including the region's three Florida estuaries (Charlotte Harbor, Sarasota Bay, and Tampa Bay).

Total Organic Carbon | The Gulf Coast region is rated good for sediment TOC. Eighty-nine percent of the estuarine area was rated good for TOC concentrations, and 2% of the area was rated poor.

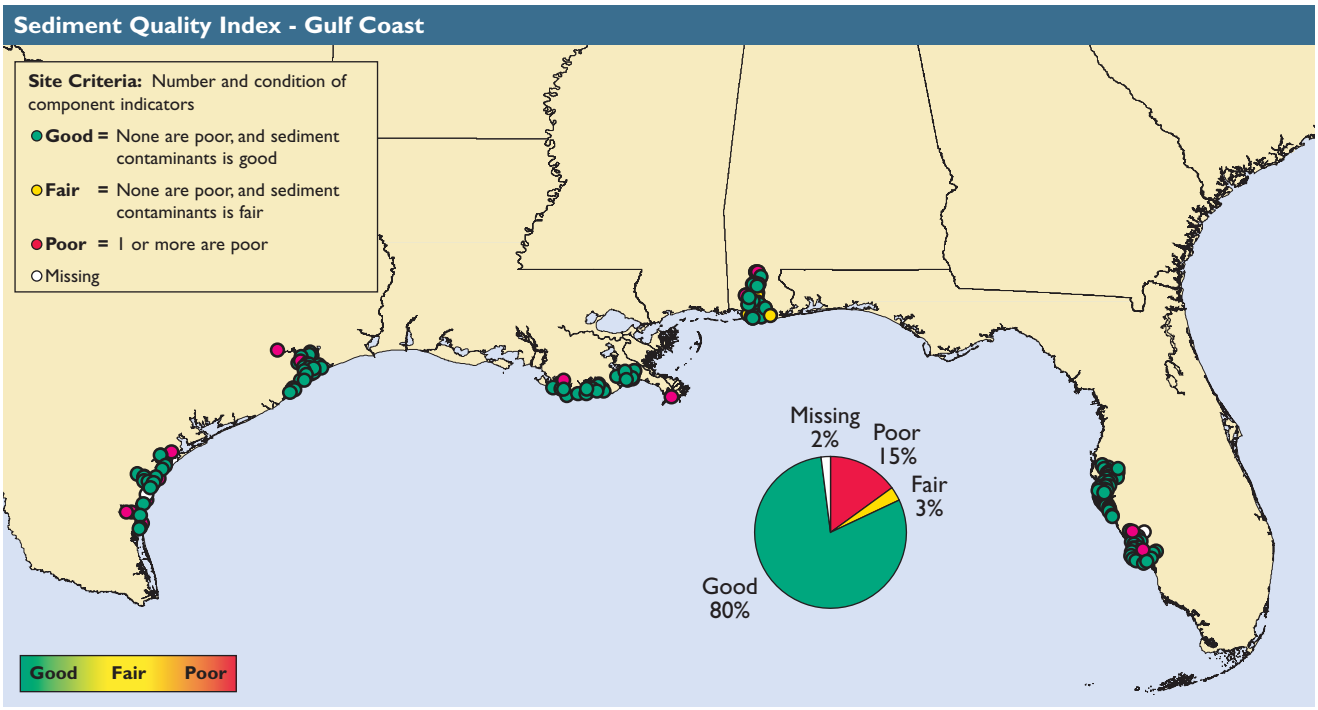

Figure 5-6. Sediment quality index data for the Gulf Coast NEP estuarine area, 2000–2002 (U.S. EPA/NCA).

Benthic Index

The condition of benthic invertebrate communities in the collective Gulf Coast NEP estuaries is rated fair to poor. The composition of benthic invertebrate communities reflects long-term exposure to sediment quality in estuaries, and short-term changes in benthic communities occur in response to hypoxic events and disturbance. Indices of biotic integrity have been developed for aquatic systems to describe the condition of biotic communities. Engle and Summers (1999) developed a Gulf Coast Benthic Index that integrates measures of diversity and populations of indicator species to distinguish between degraded and reference benthic communities. Based on NCA survey data and the Gulf Coast Benthic Index, 20% of the Gulf Coast region's NEP estuarine area showed degraded benthic resources (Figure 5-7).

Field trips can be used to teach students about Gulf Coast NEP estuaries (CHNEP).

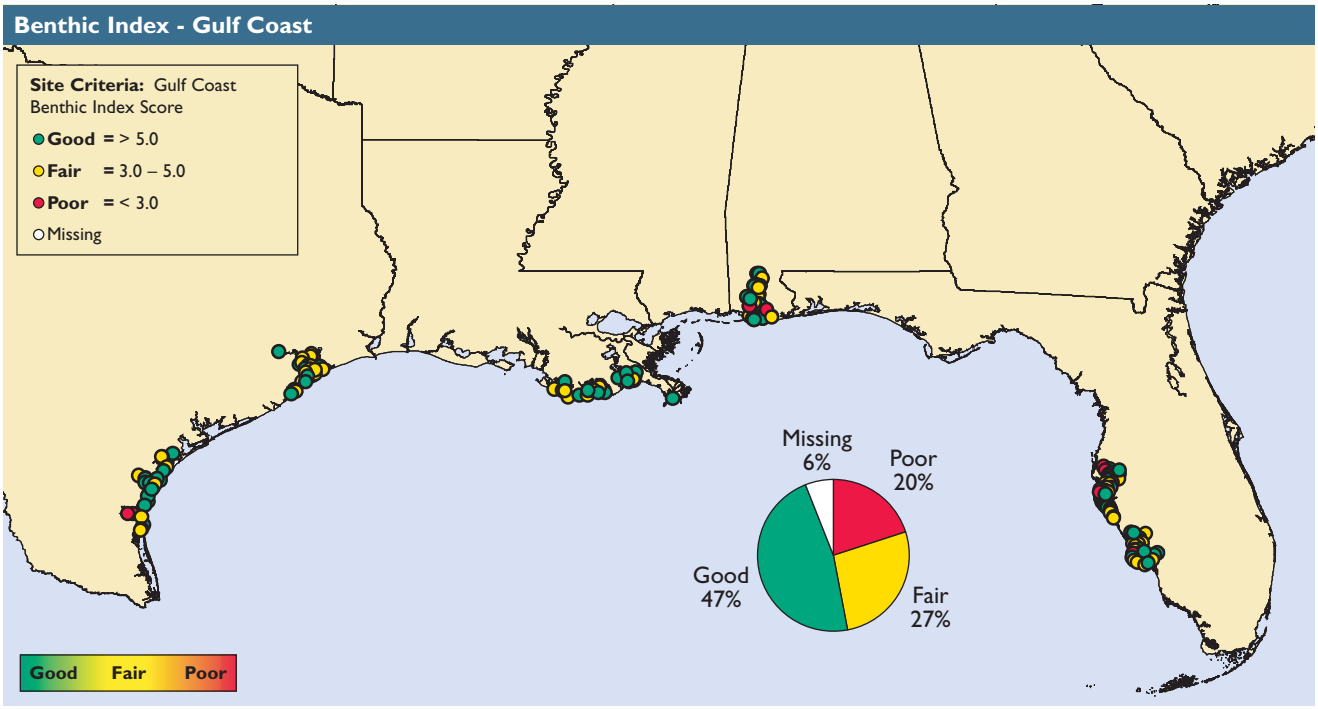

Figure 5-7. Benthic index data for the Gulf Coast NEP estuarine area, 2000–2002 (U.S. EPA/NCA).

A great blue heron looking for its next meal (CBBEP).

Fish Tissue Contaminants Index

The fish tissue contaminants index for the Gulf Coast NEP estuarine area is rated good to fair. It should be noted that fish tissue contaminants were measured in only four of the seven Gulf Coast NEP estuaries, and NCA fish tissue data were not collected for the three Florida estuaries (Charlotte Harbor, Sarasota Bay, and Tampa Bay). Figure 5-8 shows that 12% of all stations sampled where fish were caught exceeded the EPA Advisory Guidance values used in this assessment and were rated poor. The whole-fish contaminant concentrations measured in this survey can be higher or lower than the concentrations associated with fillets only; only those contaminants that have an affinity for muscle tissue (e.g., mercury) are likely to have higher fillet concentrations. Fillet contaminant concentrations for most other contaminants will likely be lower; however, for some populations that consume whole fish, these risk calculations are appropriate.

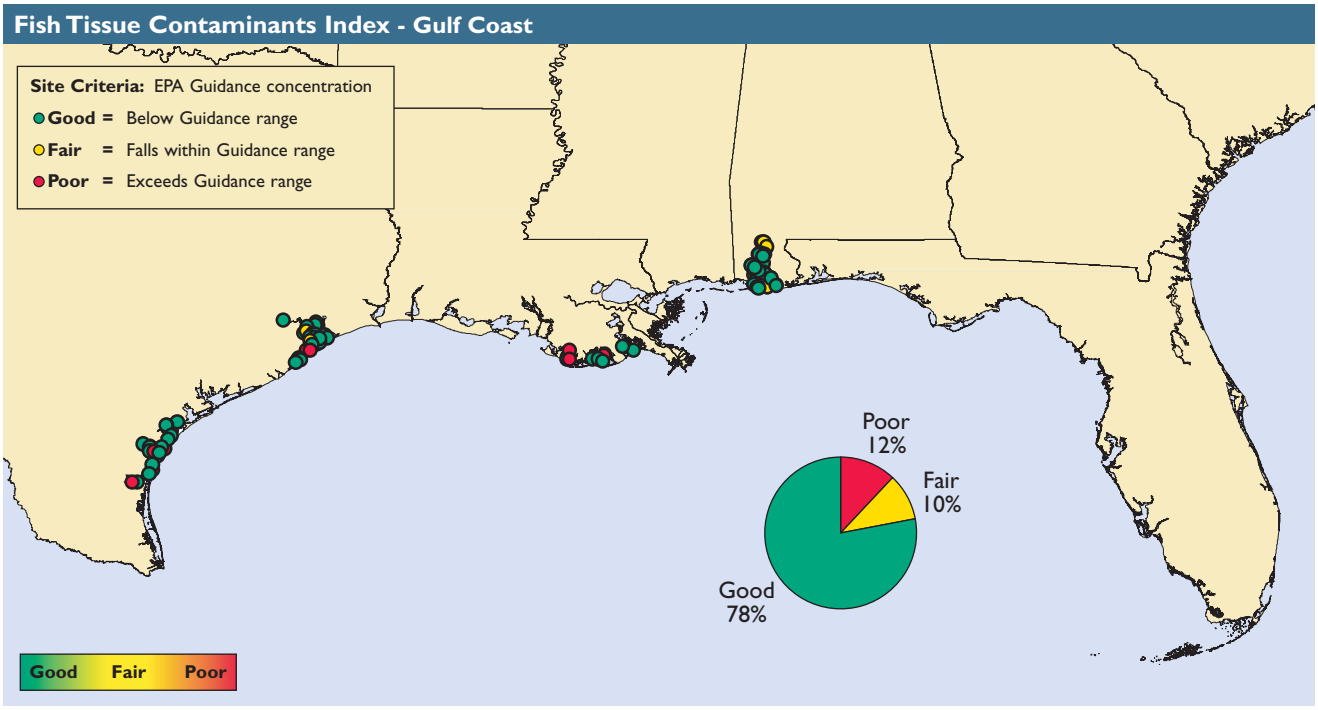

Figure 5-8. Fish tissue contaminants index data for the Gulf Coast NEP estuarine area, 2000–2002 (U.S. EPA/NCA).

NEP Estuaries and the Condition of the Gulf Coast Region

The purpose of the NEP is to identify, restore, and protect the nationally significant estuaries of the United States. Most of the seven NEP estuaries located in the Gulf Coast region need this extra protection, in part because their size and societal significance have led to intense human development; a diversity of uses, including municipal drinking water sources, industrial and agricultural production, and international commerce and shipping; and the associated environmental concerns throughout their watersheds. Does the condition of the Gulf Coast NEP estuaries accurately reflect the condition of all Gulf Coast estuaries (both NEP and non-NEP)? Based on the NCA survey results, the collective Gulf Coast NEP estuaries and all Gulf Coast estuaries combined are both rated fair for overall condition, with both groups receiving an overall condition score of 2.75 (Figure 5-9). Although the overall condition scores for the two groups of estuaries are the same, and both groups received similar ratings for the NCA estuarine indices, a comparison of NCA data reveals that the NEP estuaries had a greater percentage of area rated poor for almost every index than the non-NEP estuaries of the Gulf Coast region (Engle, 2004).

A comparison of NCA data for both groups of estuaries shows that the collective Gulf Coast NEP estuaries are rated fair for the water quality index; fair to poor for the sediment quality and benthic indices; and good to fair for the fish tissue contaminants index. In contrast, the group of all Gulf Coast estuaries combined are rated fair for the water quality, sediment quality, and fish tissue contaminants indices and fair to poor for the benthic index. In addition, the two groups of estuaries are rated comparably for most of the water quality and sediment quality component indicators, with both groups of estuaries rated good for DIN and dissolved oxygen concentrations, sediment toxicity, and sediment TOC and fair for DIP and sediment contaminant

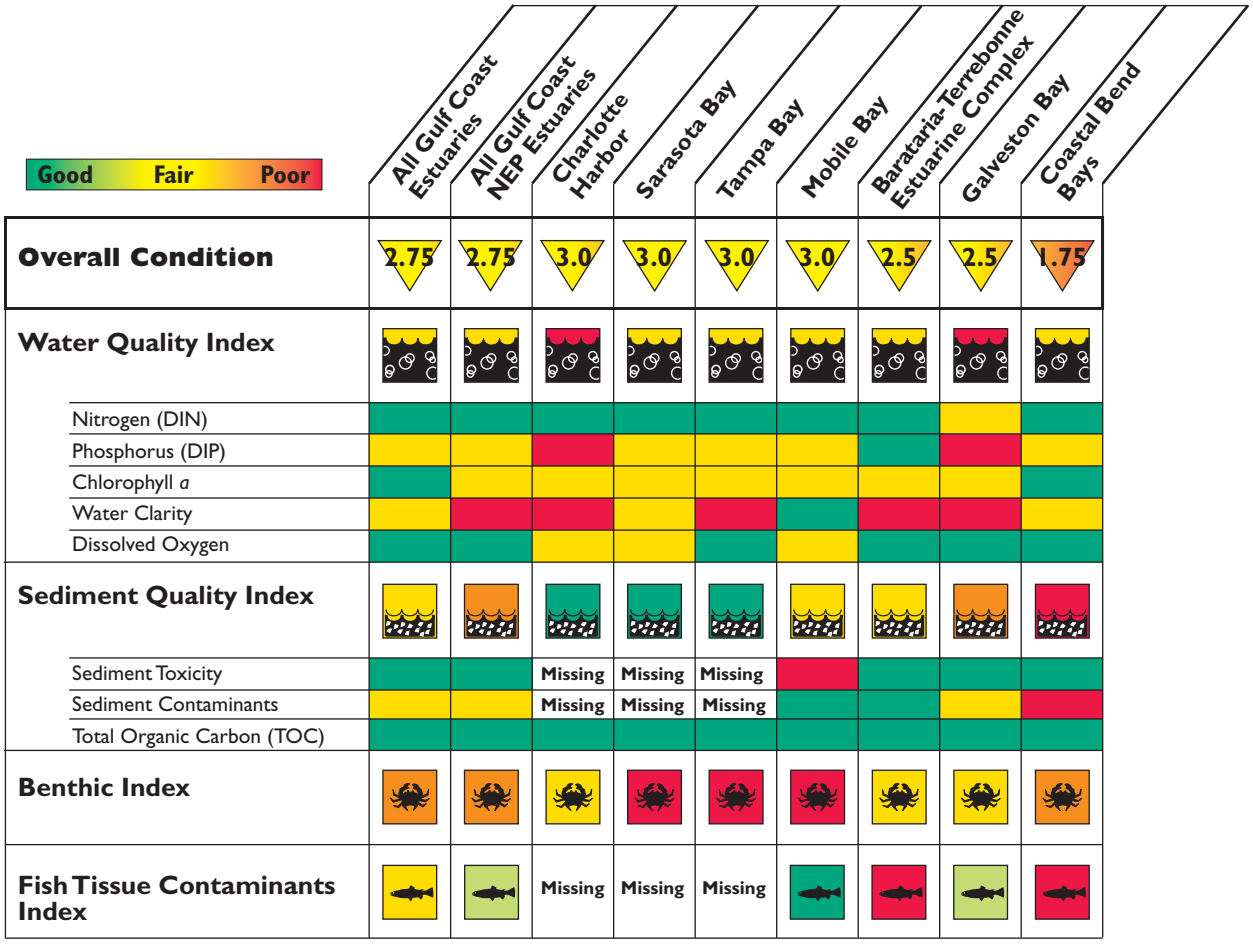

Figure 5-9. Comparison of NCA results for Gulf Coast NEP estuaries and all Gulf Coast estuaries (U.S. EPA/NCA).

concentrations. For the remaining two component indicators, the collective Gulf Coast NEP estuaries are rated fair for chlorophyll *a* concentrations and poor for water clarity, whereas the Gulf Coast estuaries combined are rated good and fair for these indicators, respectively.

With respect to the individual NEP estuaries, four of the seven estuaries received higher overall condition scores than the overall condition score for the collective Gulf Coast NEP estuaries (2.75, rated fair). These four estuaries are Charlotte Harbor (3.0), Sarasota Bay (3.0), Tampa Bay (3.0), and Mobile Bay (3.0) which are all rated fair. Galveston Bay (2.5, rated fair), the Barataria-Terrebonne Estuarine Complex (2.5, rated fair), and the Coastal Bend Bays (1.75, rated poor) received lower overall condition scores than the score for the collective Gulf Coast NEP estuaries.

A review of the NCA data for the water quality index and component indicators shows that the ratings vary between the individual Gulf Coast NEP estuaries. None of the NEP estuaries are rated good for the water quality index; Sarasota Bay, Mobile Bay, the Barataria-Terrebonne Estuarine Complex, and the Coastal Bend Bays are rated fair; Tampa Bay is rated fair to poor, largely driven by poor water clarity and fair concentrations of chlorophyll *a* and DIP; and Charlotte Harbor and Galveston Bay are rated poor, primarily due to poor DIP concentrations and poor water clarity ratings. All Gulf Coast NEP estuaries are rated good for DIN concentrations, except for Galveston Bay, which is rated fair. The Barataria-Terrebonne Estuarine Complex is rated good for DIP concentrations; Sarasota Bay, Tampa Bay, Mobile Bay, and the Coastal Bend Bays are rated fair; and Charlotte Harbor and Galveston Bay are rated poor. All the Gulf Coast NEP estuaries are rated fair for chlorophyll *a* concentrations, except for the Coastal Bend Bays, which are rated good for this component indicator. Although most Gulf Coast NEP estuaries (Charlotte Harbor, Tampa Bay, the Barataria-Terrebonne Estuarine Complex, and Galveston Bay) are rated poor for water clarity, Sarasota Bay and the Coastal Bend Bays are rated fair for this component indicator, and Mobile Bay is rated good. Four Gulf Coast NEP estuaries (Tampa Bay, the Barataria-Terrebonne Estuarine Complex, Galveston Bay, and the Coastal Bend Bays) are rated good for dissolved oxygen concentrations, but the three remaining NEP estuaries (Charlotte Harbor, Sarasota Bay, and Mobile Bay) are rated fair.

Kayaking is a popular pastime in Gulf Coast NEP estuaries (CBBEP).

The sediment quality index scores for the individual Gulf Coast NEP estuaries range from good to poor. For the three Florida NEP estuaries (Charlotte Harbor, Sarasota Bay, and Tampa Bay), the sediment quality index is rated good; however, it should be noted that NCA data on the sediment toxicity and sediment contaminants component indicators were not collected for these estuaries. For the remaining NEP estuaries, sediment quality index ratings decrease from east to west, with Mobile Bay and the Barataria-Terrebonne Estuarine Complex rated fair for sediment quality; Galveston Bay rated fair to poor; and the Coastal Bend Bays rated poor. Sediment toxicity is rated good for the Barataria-Terrebonne Estuarine Complex, Galveston Bay, and the Coastal Bend Bays and poor for Mobile Bay. Sediment contaminant concentrations are rated good for Mobile Bay and the Barataria-Terrebonne

Estuarine Complex, fair for Galveston Bay, and poor for the Coastal Bend Bays. Sediment TOC content is rated good for all Gulf Coast NEP estuaries, both collectively and individually, as well as for all Gulf Coast estuaries combined.

The benthic index scores for the individual NEP estuaries range from poor to fair. The benthic index is rated fair for Charlotte Harbor, the Barataria-Terrebonne Estuarine Complex, and Galveston Bay; fair to poor for the Coastal Bend Bays; and poor for Sarasota Bay, Tampa Bay, and Mobile Bay. The fish tissue contaminants index is rated good for Mobile Bay, good to fair for Galveston Bay, and poor for the Barataria-Terrebonne Estuarine Complex and the Coastal Bend Bays. NCA survey data on fish tissue contaminants were unavailable to evaluate any of the Gulf Coast NEP estuaries in Florida (Charlotte Harbor, Sarasota Bay, and Tampa Bay).

Nationally, the overall condition score for the collective NEP estuaries of the Gulf Coast region (2.75) is lower than the overall condition score for the collective NEP estuaries of the Southeast Coast region (4.0), comparable to the score for the West Coast region (2.5), and higher than the scores for the Northeast Coast (1.5) and Puerto Rico (1.5) regions. Population pressures, measured as population density (number of persons/mi^2), did not correlate well with the overall condition ratings for the individual Gulf Coast NEP estuaries. For example, the Coastal Bend Bays had the lowest population density of 53 persons/mi^2 in 2000, yet this estuary is rated poor for overall condition, with an overall condition score of 1.75. The two estuaries with the highest population densities in 2000, Galveston Bay (651 persons/mi^2) and Tampa Bay (640 persons/mi^2), are both rated fair for overall condition and received overall condition scores of 2.5 and 2.66, respectively. Mobile Bay (191 persons/mi^2), Charlotte Harbor (306 persons/mi^2), and Sarasota Bay (364 persons/mi^2), which had more intermediate population densities in 2000, each received an overall condition score of 3.0 and are rated fair for overall condition.