

# FISHERIES SNAPSHOTS

On Trade and Conservation Issues

## LITTLE FISH IN BIG DEMAND

Menhaden have been an important high-volume, relatively low-value staple of U.S. fishery landings for centuries. In the last 20 years pollock displaced menhaden as the top-ranking fish, in terms of landings by weight in the United States, but menhaden have consistently retained the number two spot and the Gulf menhaden is among the top 20 species worldwide for landings by weight. Since 1980, the average landings per year for Gulf menhaden have been 666,397 metric tons (1.5 billion pounds).

Menhaden, a type of herring found in both the Atlantic Ocean and the Gulf of Mexico, are small fish used primarily for fish meal and oil. Because fish meal and oil compete in the marketplace with vegetable meal and oil, price has determined whether it has been profitable to pursue the fishery. The United States sends fish meal and menhaden oil all over the world, but mostly to Japan, China, and the Netherlands.

The overall population of Atlantic menhaden has generally increased in recent years, but some parts of the population are decreasing for reasons that are not yet understood. Managers in the region are focused on better understanding the population and ecosystem dynamics. In contrast, Gulf menhaden have fluctuated without a consistent trend. The main

# Menhaden

Atlantic menhaden (*Brevoortia tyrannus*)  
Gulf menhaden (*Brevoortia patronus*)



Atlantic menhaden © Roz Davis

As consumer demand for healthful foods grows worldwide, more and more producers look to the sea for ingredients. Once used only for industrial oils and animal feeds, the fish oil from menhaden is now a component of major brands of yogurt, breakfast cereal, margarine, and shortening.

focus of fishery management in the Gulf of Mexico has been on addressing the economic consequences of the consolidation of the industry, which involves many fewer vessels and reduction plants now than were operating in years past.

Although both Atlantic menhaden and Gulf menhaden seem to be at healthy levels overall, TRAFFIC is concerned about the recent decline in the number of juvenile Atlantic menhaden. It will be important to ensure that fishing mortality does not push the population beyond the bounds of resilience during natural

fluctuations, and does not threaten the health of species that feed on menhaden. It will also be important to improve our understanding of menhaden population dynamics and the role menhaden play in the ecosystem.

## BIOLOGY AND ECOLOGY

Menhaden, also known as alewives, pogey, or bunker, are small coastal fish that migrate in large schools along both the Atlantic and Gulf coasts of North America. The Atlantic menhaden is one of the most abundant species of finfish in estuarine and coastal Atlantic waters. The species is found primarily in nearshore waters from Nova Scotia to central Florida, but can be found in deeper water in winter. Gulf menhaden range from the Yucatan Peninsula in Mexico across the western and northern Gulf of Mexico to Tampa Bay, Florida. They, too, are estuarine-dependent, moving offshore to spawn, and maturing in rivers, bays, bayous, and other nearshore habitats.

Atlantic and Gulf menhaden both grow rapidly. Atlantic menhaden mature at 3 years, when they are about 25 centimeters (10 inches) long and weigh about .2 kilograms (.5 pounds). They have been found as old as 12 years, as long as 50 centimeters (20 inches), and weighing as much as 1.4 kilograms (3 pounds), but not commonly since the 1960s. In contrast to the Atlantic species, Gulf menhaden reach sexual maturity in their second year and are shorter-lived. Animals older than 4 years are rare, though they have been found up to 6 years old. They reach lengths of 20 to 23 centimeters (8 to 9 inches).

Both Atlantic and Gulf menhaden are herbivorous, filtering plankton and straining plant detritus, and providing a very important link in the food web between primary production and higher organisms. After their first year or two of fast growth, menhaden are referred to as fatbacks or bunkers, and are fed upon by species such as striped bass, bluefish, weakfish, red drum, gars, sea trout, king mackerel, bluefin tuna, and sharks. Seabirds including brown pelicans,

ospreys, common loons, and terns prey on menhaden, as do marine mammals such as whales and porpoises. A large crustacean parasite commonly feeds off the menhaden, attaching to the fish's mouth and earning menhaden the nickname "bugfish."

Their dependence on estuaries at important stages of development makes menhaden susceptible to changes in environmental conditions, such as increases or decreases in salinity caused by weather, the effects of polluted runoff from the land, the filling in of wetlands, and other habitat modifications.

## CONSERVATION STATUS

Data on Atlantic menhaden have been collected for many years. The stock was first formally assessed in the late 1970s, with multiyear assessments thereafter, until annual assessments began in 1990 (fig. 1). In recent decades, the overall population has generally increased. The biomass of the spawning stock (sexually mature individuals) has increased, but the recruitment (number of young menhaden in the population) has been alarmingly low in recent years for reasons that are not yet understood (fig. 2).

Fishery managers do not consider Atlantic menhaden to be overfished, but there is significant concern

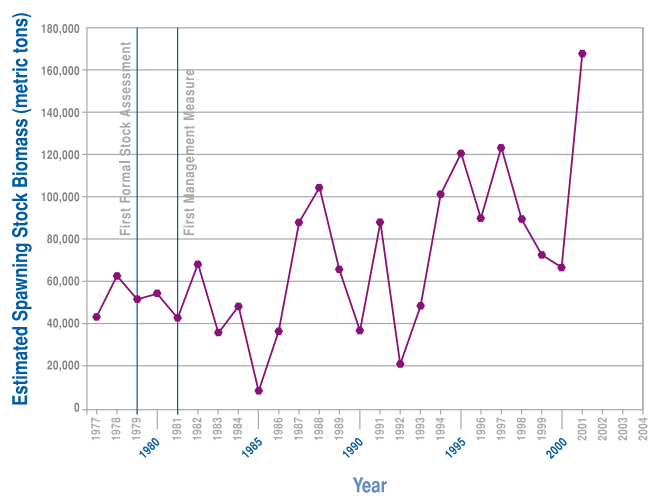
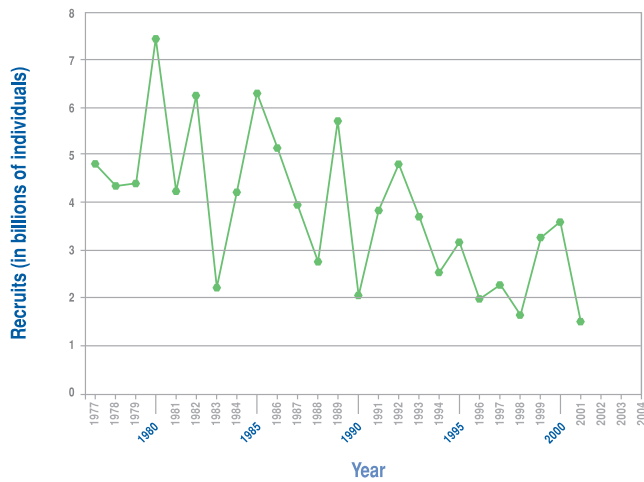


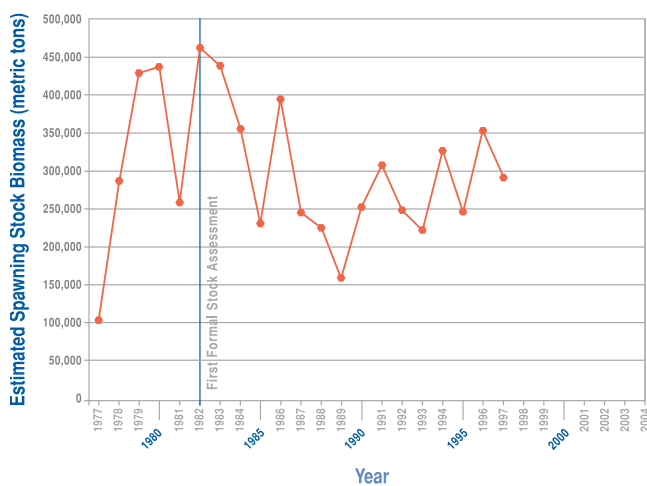
Figure 1. Spawning Biomass of Atlantic Menhaden. Data Source: NOAA Fisheries, United States



**Figure 2. Recruitment of Atlantic Menhaden.** Data Source: NOAA Fisheries, United States

about the role that menhaden play in the ecosystem, and especially what the low recruitment might mean for species that depend upon menhaden for prey, particularly in the Chesapeake Bay. Preliminary analysis of size and age composition of the catch in 2001 indicates the fishery is taking larger, older fish.

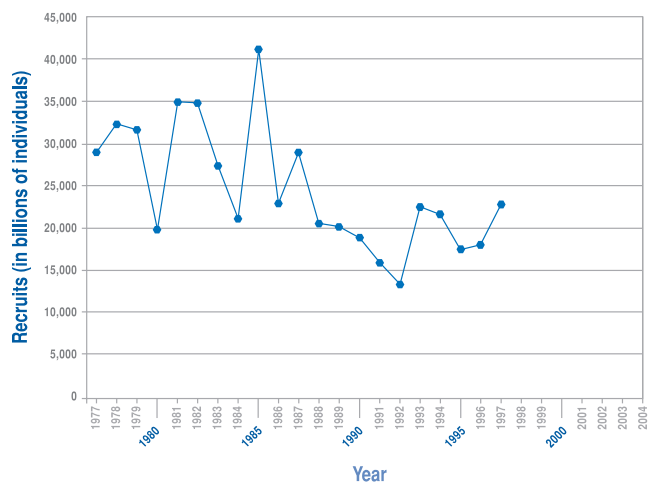
Some conservationists and recreational fishing groups are so concerned about what recent low recruitment could mean for the forage base of the Chesapeake that they have called for a closure of the purse seine



**Figure 3. Spawning Biomass of Gulf Menhaden.** Note: Management measures were first implemented in the mid-1960s, on a state-by-state basis. Data Source: NOAA Fisheries, United States

fishery there. The links between fishing, environmental conditions, predators, and prey have not been clearly drawn and certainly will be the emphasis of management investigations in coming years.

Data on Gulf menhaden have also been collected for many years; the stock was first formally assessed in 1982, and updated every five years thereafter (fig. 3). Fishery managers do not consider Gulf menhaden to be overfished. The most recent stock assessment found Gulf menhaden to be healthy and stable with good recruitment (fig. 4). Gulf menhaden population



**Figure 4. Recruitment of Gulf Menhaden.** Data Sources: NOAA Fisheries, United States

dynamics are driven primarily by recruitment and show the cyclical ups and downs typical of short-lived species like herrings.

## PRODUCTS AND MARKETING

With the exception of a local tradition of eating menhaden roe in Beaufort, North Carolina, the products of the menhaden fisheries in the Atlantic and Gulf are not for human consumption—until you take a closer look. When consumers eat chicken, shrimp, pork, or a host of prepared foods containing shortening, they are often eating products made with derivatives of menhaden, such as fish meal or fish oil.

Menhaden is primarily reduced into fish meal, fish oil, and fish solubles and used for livestock feed and human consumption. A smaller amount of menhaden is used as bait. In the Gulf, 98 percent of the catch goes to reduction and 2 percent to bait; in the Atlantic, the percentage used for bait is higher—10 to 17 percent since 1998.

Fish meal is a valuable ingredient in poultry and livestock feeds because of its high protein content. The broiler chicken industry has been one of the largest users of menhaden meal, along with the turkey, swine, pet food, and ruminant industries. Use of fish meal as feed in aquaculture operations, particularly in shrimp food, has increased in recent years. In the United States, approximately 80 percent of fish meal production comes from menhaden.

Menhaden oil has been marketed as edible oil for many years in Europe, and was approved for human consumption in the United States in 1997. The main uses of the oil are in shortening and margarine, but applications in prepared foods are expanding. Another expanding use of fish oil is in nutritional supplements such as fish oil capsules. Fish oil is high in omega-3 type fatty acids, which have been linked to positive health effects in humans. A small portion of fish oil is also used in the United States in pet food, cosmetics, leather tanning, and paints.

Fish solubles are high-protein, liquid by-products used directly in animal feed or dried onto fish meal. The use of menhaden for solubles is small relative to use for meal and oil, but a significant market for menhaden solubles exists in the agricultural Midwest, where solubles are used as a feed ingredient in the poultry and swine industries to complement or replace fish meal.

Menhaden are caught for use as bait in small, local bait fisheries. In both the Gulf and Atlantic, menhaden are used by sport fishermen as chum (cut up or ground fish) or live bait for sport fishes such as bluefish, striped bass, weakfish, king mackerel, red drum, shark, and tuna. In commercial fisheries, they

are used to bait blue crab, lobster, stone crab, spiny lobster, crayfish, and eel. Compared to meal and oil use, use as bait is insignificant in quantity and value. There is only one company in the Gulf that takes menhaden for bait, and it sometimes buys fish from the reduction fishery. The bait fishery has been closely monitored for decades, and data collected have provided important information that is helping stock assessment scientists to better understand menhaden recruitment.

## THE FISHERY

The majority of Atlantic menhaden catch comes from the Chesapeake Bay; the remainder is caught within a mile of shore, from New York to North Carolina. Gulf menhaden are taken near the coastlines of Alabama through eastern Texas, with the majority of landings off Louisiana. Catches occur from less than a mile to more than 10 miles offshore in the Gulf. There are no recorded landings for menhaden in Mexico or Canada.

The Atlantic menhaden fishery began in New England during the 1600s with the object of obtaining fish for fertilizer. The fishery for oil originated in the early 1800s and spread south after the Civil War (1861-65). The purse seine was introduced after the



Although the menhaden fishery has existed since colonial times, the fish's ecological role in the mid-Atlantic has not been adequately studied. *Courtesy of NOAA Fisheries, United States*





The Atlantic menhaden fishery extends from New York to North Carolina, with the majority of landings in the Chesapeake Bay. The Gulf menhaden fishery extends from Alabama to Texas, with the majority of landings off Louisiana. Map by WWF-US Conservation Science

Civil War, replacing the hand-thrown haul seine and allowing the fishery to expand until the reduction plants were located from Maine to North Carolina. The technological advances brought about by World War II contributed much to the efficiency of the fishery: spotter aircraft, radio communications, nylon nets, hydraulic power blocks, aluminum purse boats, fish pumps, and large carrier vessels.

Today, both the Atlantic and Gulf menhaden are generally caught with large purse seine nets, although there is some use of gill and trammel nets, and hand-cast nets are used in inshore waters for the bait fishery. Many commercial menhaden purse seine fishing operations use spotter aircraft to locate schools of menhaden and direct vessels to the fish. All menhaden in trade are caught in the wild; there is currently no aquaculture of the species.

In the Atlantic, the number of vessels fishing for menhaden declined from 150 in 1955 to 31 in 1993, while the number of reduction plants declined from 23 in 1955, to 7 (excluding two factory ships) in 1993. During the period 1994 to 1997, three plants operated with about 20 vessels. This decline in vessels and plants was offset by increased catching and

processing efficiency. In 2002, only two shore-side reduction plants operated on the U.S. Atlantic coast: one in Beaufort, North Carolina, with two vessels, and one in Reedville, Virginia, with about 10 vessels. The fishery is now much more concentrated in the Chesapeake Bay than in previous years.

In the Gulf of Mexico, only six menhaden vessels were reported operating in 1940, but the fleet grew to 81 vessels by 1956. Fleet size expanded and contracted over the decades, peaking at 92 vessels in 1966 and shrinking to 58 in 1991. Since 1995, the fleet size has been fewer than 50 vessels, but they are more efficient than their predecessors. Historically, up to 13 menhaden processing plants existed in the northern Gulf of Mexico, from Apalachicola, Florida, to Sabine Pass, Texas. Over time, the economics of the fishery and corporate consolidation have brought the number of plants down to four. Since 2000, active processing plants have been located at Moss Point, in Mississippi, and at Empire, Abbeville, and Cameron, in Louisiana.

Consolidation of processing companies linked to the reduction fishery has been a trend in recent years, so that there are now many fewer menhaden fishing vessels and reduction plants than in past years (fig. 5). In 1997, Zapata Corporation launched the subsidiary Omega Protein, Inc. in a bid to capture the new

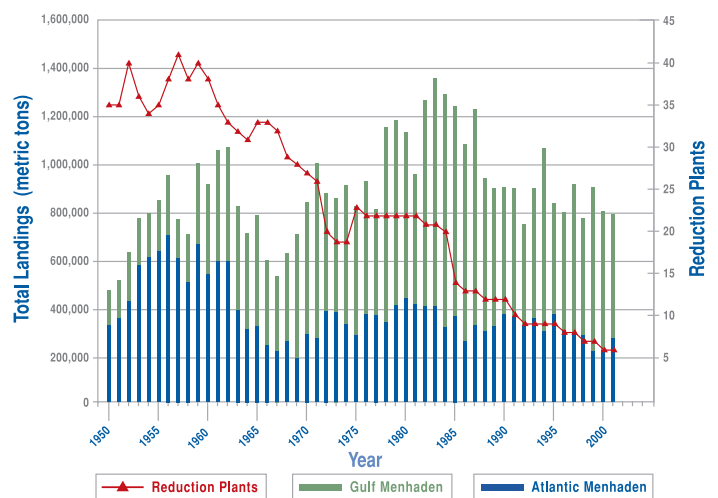


Figure 5. Landings and Reduction Plants. Data Source: NOAA Fisheries, United States

domestic market for fish oil. Later in 1997, Omega Protein, Inc. took over American Protein of Virginia and Gulf Protein of Louisiana and has since been described as a “monopoly” for menhaden fishing. The company uses 11 fishing vessels based in Virginia and 30 in the Gulf of Mexico. This leaves only three companies operating in the U.S. reduction fishery: Omega Protein, Inc. and Daybrook Fisheries, Inc. in the Gulf and Omega Protein, Inc. and Beaufort Fisheries, Inc. on the Atlantic coast.

## FISHERY MANAGEMENT

Menhaden migrate along both the Gulf and Atlantic coasts, crossing multiple state jurisdictions. Nearly 90 percent of the total menhaden catch comes from inside state waters where the individual states manage both reduction and bait fisheries. The Atlantic States Marine Fisheries Commission and the Gulf States Marine Fisheries Commission, which provide interjurisdictional mechanisms to coordinate and manage state fisheries, have both developed fishery management plans (FMPs) for menhaden.

The Atlantic States commission developed an FMP for Atlantic menhaden in 1981; it was revised in 1992 and again in 2002. Although a quota-based management system with annual total allowable catch (TAC) was recommended, the commission instead adopted a framework for future management, including a new overfishing definition and a requirement for full accounting of catches and landings.

The new overfishing definition employs a target and threshold approach for assessing the status of the population, and calls for future management measures to be developed to ensure that fishing mortality remains at or below the target rate, and that the spawning stock is maintained at or above the biomass target level. The framework in the revised plan enables a TAC to be set if fishing mortality exceeds the threshold; there was no TAC in place for 2002. Experts have also recommended research of the ecological role of menhaden as both filter feeders and prey species, in an effort to understand ecosystem dynamics and recent poor recruitment.

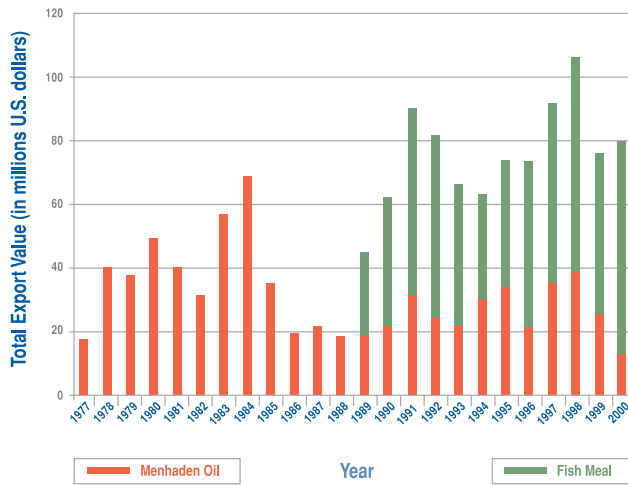
Individual states have managed menhaden in the Gulf since the mid-1960s. The Gulf States commission developed its first Gulf-wide management plan in 1978 and has followed it with four revisions. Current management measures vary by state but generally include seasonal and gear regulations. Alabama and Louisiana have established quotas for the menhaden bait fishery; none of the Gulf States have established quotas for the reduction fishery. The most recent Gulf-wide menhaden management plan concluded that state measures in place to manage the fishery were sufficient to prevent overfishing.

Experts have called for research into the habitat, ecological relationships, and population dynamics of the Gulf menhaden, particularly relating to growth and recruitment. They also recommend the exploration of ways to improve the economic efficiency and profitability of the fishery. In the Gulf, menhaden fishing companies report catches directly to NOAA Fisheries daily. NOAA Fisheries also oversees port sampling efforts. Catch records and effort data are computerized and compiled on a monthly basis.

## LANDINGS AND TRADE

Atlantic menhaden landings have fluctuated significantly over the last 50 years. Fishery managers attribute the recent declines in landings to a combination of environmental factors and reduced fishing effort. Even with the recent declines, however, the United States has exported more than \$60 million worth of fish meal (made mostly from menhaden) and menhaden oil annually throughout the 1990s (fig. 6).

In the Gulf of Mexico, the Gulf menhaden fishery dates landings as far back as the late 1800s. Data for the fishery are incomplete prior to World War II; thereafter, however, landings generally increased through the mid-1980s, as the industry grew. Technological advances in the Gulf mirrored those in the Atlantic. Although there were considerable annual fluctuations, Gulf menhaden landings increased to a record level in 1984 and declined to a 20-year low in 1992. Fishery managers attribute the decline in



**Figure 6. U.S. Total Export Value for Fish Meal and Menhaden Oil.** Note: Fish meal data not available 1977-1988. Data Source: NOAA Fisheries, United States

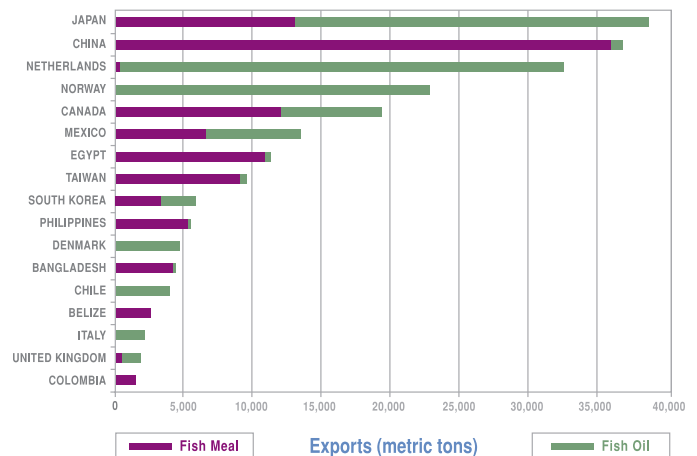
landings to decreases in effort, vessels, and plants operating in the Gulf of Mexico.

In 2000, Atlantic and Gulf menhaden comprised 26 percent and 74 percent, respectively, of total U.S. menhaden landings. Atlantic menhaden landings made up nearly half, by weight, of total U.S. Atlantic coast commercial fisheries landings, and Gulf menhaden landings constituted more than 70 percent by weight of total Gulf landings of fish and shellfish.

Although the Gulf menhaden fishery is one of the world’s largest in terms of total weight of catch, the contribution of American menhaden to worldwide fish meal and oil production is relatively small. About a fifth of total world fish catch—about 26.5 million metric tons—is converted to fish meal, oil, and solubles. Relative to this, the U.S. menhaden catch of less than 1 million metric tons is small. However, the United States does export significant amounts of menhaden oil and meal around the globe. Data for exports of menhaden meal are not readily available. However, menhaden meal makes up approximately 80 percent of the total U.S. fish meal exported by the United States, so exports of fish meal provide a helpful reference.

The value of menhaden has fluctuated historically more as a response to the market for fish meal and oil than

to the availability of menhaden to catch. The value of U.S. exports of fish meal (approximately 80 percent of which is from menhaden) has ranged from approximately \$20 to \$70 million since the early 1990s, and the export unit value has ranged between \$500 and \$750 per metric ton. The value of U.S. exports of menhaden oil reached a high of nearly \$70 million in the mid-1980s and has ranged between \$10 and \$40 million since that time. The export unit value has ranged between \$200 and \$650 per metric ton, with a notable decline in the export unit value between 1998 and 1999. In 2001, Japan, China, the Netherlands, Norway, Mexico, Denmark, and Chile were the top importers of U.S. fish oil and China, Japan, and Canada were the top importers of U.S. fish meal (fig. 7).



**Figure 7. U.S. Export Destinations (2001).** Note: The United States also exported less than 800 metric tons to more than 30 other countries. Data Source: NOAA Fisheries, United States

## CONCLUSIONS

- The menhaden fishery has been one of the largest U.S. fisheries since colonial times, and the Gulf menhaden is among the top 20 species landed worldwide. Although the U.S. menhaden fishery contributes only a small fraction of the fish meal and oil in world trade, the U.S. exports menhaden all over the globe.

- Exploitation of menhaden is closely linked to price and world markets, and landings have fluctuated historically more as a response to the market for fish meal and oil than in response to the availability of menhaden.
- In recent years, the U.S. menhaden industry has experienced significant consolidation in terms of the number and ownership of fishing vessels, and the number of processing facilities.
- Though they are closely related species and serve the same markets, Gulf menhaden are much shorter-lived than Atlantic menhaden, and so may be more resilient to overfishing than Atlantic menhaden. While fishery managers currently consider neither species to be overfished, recent poor recruitment of juvenile Atlantic menhaden is cause for serious concern.
- Fishery managers should ensure that fishing mortality for menhaden remains at safe levels to guard the future health of menhaden populations and the species that prey on them—and the fisheries that depend upon all those species. Managers should recognize that, although population variability and poor recruitment are likely to be the result of factors besides fishing, such as climatic change and habitat degradation, fishing mortality is a key factor that can be controlled.
- Managers should modify management targets and thresholds if the results of ecological research indicate that this is necessary. Research priorities should include
  - study of the links between variations in menhaden populations and changes in environmental conditions
  - assessment of the risk of menhaden populations being fished beyond the bounds of resilience to natural fluctuations
  - examination of the role of menhaden as prey for other species.



Fishery management plans are in place for both Atlantic and Gulf menhaden. Nevertheless, more research on menhaden population dynamics, habitat, and ecological relationships is needed.  
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