

# Monterey Bay Aquarium Seafood Watch®

## Atlantic croaker

*Micropogonias undulates*

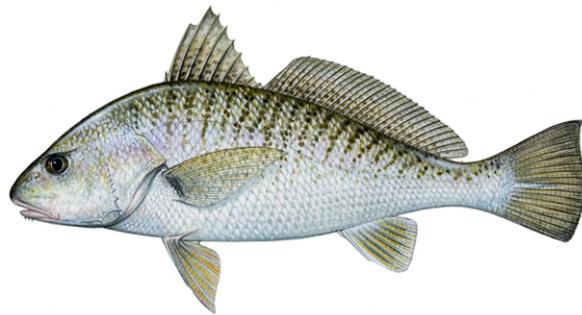


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## United States

Bottom gillnet, Drift gillnet, Hook and Line

February 13, 2014

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### Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

## Final Seafood Recommendation

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Atlantic croaker United States Atlantic - Gillnet, Bottom	Green (3.83)	Red (1.41)	Yellow (3.00)	Yellow (3.12)	<b>Good Alternative (2.669)</b>
Atlantic croaker United States Atlantic - Trawl, Bottom	Green (3.83)	Red (1.53)	Yellow (3.00)	Yellow (2.60)	<b>Good Alternative (2.598)</b>
Atlantic croaker United States Atlantic - Pound Net	Green (3.83)	Red (2.16)	Yellow (3.00)	Yellow (3.12)	<b>Good Alternative (2.967)</b>
Atlantic croaker United States Atlantic - Seine Net, Beach	Green (3.83)	Green (4.47)	Yellow (3.00)	Yellow (3.12)	<b>Best Choice (3.559)</b>

**Scoring note** – Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact. Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

▲ **Best Choice** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores

● **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores

● **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores.

## **Executive Summary**

Atlantic croaker is currently managed as a single stock from New Jersey to Florida by the Atlantic States Marine Fisheries Commission (ASMFC). The croaker population size is at a healthy level and fishing is at sustainable levels. However, a significant, but unknown number of croaker are caught in the Mid-Atlantic scrap fisheries and as bycatch in shrimp trawl fisheries, leading to some uncertainty in the assessment of the croaker stock.

The Atlantic croaker is considered a mixed fishery in which many other species are targeted. Federal observer data show that bluefish and menhaden are the species most often caught on targeted croaker trips, however observers are not mandated in the croaker fishery and so detailed information on incidental catch in the croaker fishery is not available. Atlantic menhaden, an important forage fish critical to the Mid-Atlantic ecosystem, which is caught in bottom trawl and sink gillnet gear, is experiencing overfishing, but the overfished status is unknown due to significant assessment uncertainties. However, menhaden catch in the croaker fishery is a small component of total menhaden catch. The croaker fishery overlaps with ranges of various protected species, and the scores of the gillnet, trawl and pound net fishery are limited by bycatch concerns for protected species. In particular, the gillnet fishery is known to interact with loggerhead sea turtles, Atlantic sturgeon, and bottlenose dolphins; the trawl fishery catches loggerhead turtles, and the pound net fishery interacts with some populations of bottlenose dolphin that may be experiencing cumulative fisheries bycatch rates that are higher than what the population can sustain. These interactions are the primary reason the non-seine croaker fisheries are ranked as good alternatives and not best choice fisheries. Haul seines are not known to interact with protected species, but there is some bycatch of bluefish and horseshoe crabs. From the observer data that is available, discards are not very high in the croaker fishery, but are highest when using otter trawl gear, followed by gillnet and haul seine gear. There is no observer data for the pound net fishery so the discard rate is unknown, however discard rates in stationary nets are generally less than 1%.

Croaker are managed by the Atlantic States Marine Fisheries Commission and the population is assessed annually. Specific regulations, including size limits, catch limits, or gear restrictions, are set by the states. Management has generally been successful in maintaining the abundance of croaker. Management has implemented regulations to reduce bycatch of protected species; however, observer coverage is minimal and it is unclear how effective bycatch reduction measures have been. The croaker fishery is not incorporating ecosystem-based management measures to account for the role of each species in the food web, but is not having a substantial impact on any species of exceptional importance to the ecosystem.

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## **Introduction**

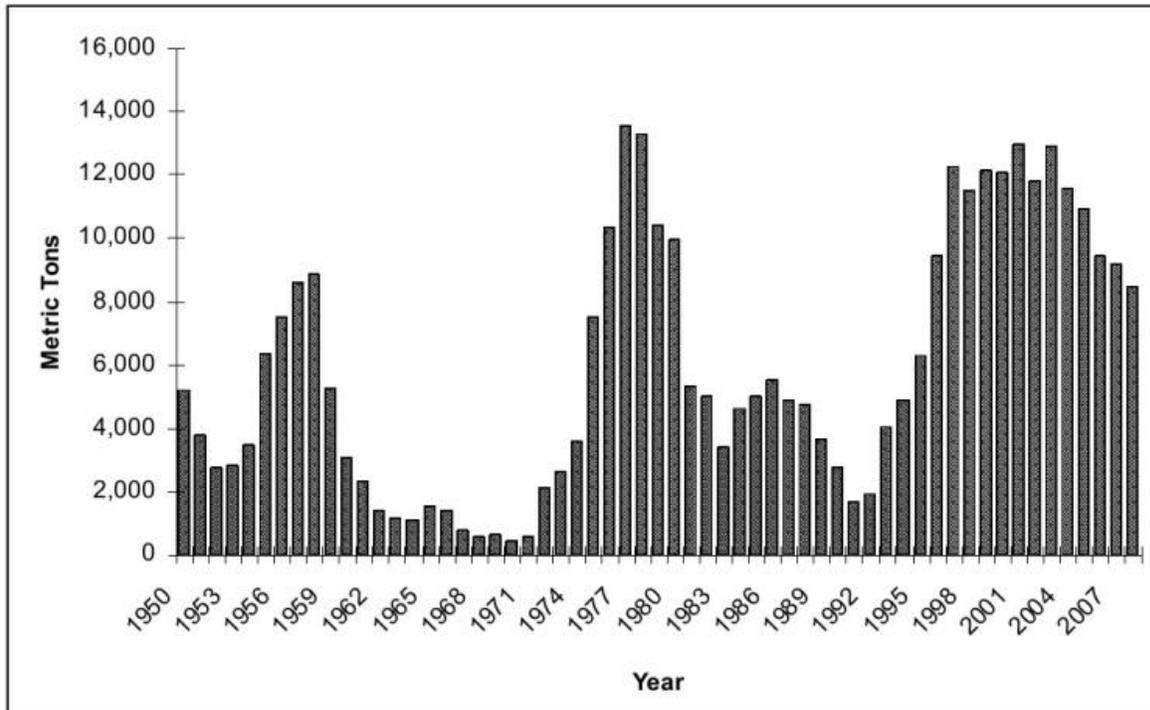
### **Scope of the analysis and ensuing recommendation**

This report provides the recommendation for the commercial Atlantic croaker (*Micropogonias undulates*) fishery, which operates in the Northwest Atlantic along the eastern coast of the United States. This report analyzes the primary gears used in the croaker fishery including gillnet, bottom trawl, haul seine, and pound net gear.

### **Overview of the species and management bodies**

Atlantic croaker are common in estuarine and coastal waters and are found from New Jersey to Florida. They are known for making a croaking sound which can be used for reproduction, or as a disturbance call ( Gannon 2007). Croaker have been observed in estuarine ecosystems as larvae and move down the estuary into the ocean as they grow. They inhabit rivers, creeks, and marshes that feed into Delaware and Chesapeake Bay as juveniles and move into the Bays in late fall and winter ( Miller et al. 2003). Juvenile croakers have been found in submerged aquatic vegetation, marshes, and sandy bottom, with no apparent bottom habitat preference ( Petrik et al. 1999). The Chesapeake Bay is a known spawning ground and important nursery for juvenile croaker ( ASMFC 2010). Croaker are predominantly age 6 and younger, but can live up to 15 years of age. They mature at an early age ( White and Chittenden 1977), and spawn in warm waters between September through April, depending on latitude ( ASMFC 2010). Croaker are bottom feeders and feed on various epifauna, such as polychaetes, mollusks, ostracods, copepods, amphipods, mysids, and decapods, depending on what is locally available ( ASMFC 1987). While croaker can inhabit eelgrass beds as juveniles, as adults, they move out into more sandy areas of the Chesapeake and Delaware Bays, which is where the majority of the commercial fishery takes place.

The Atlantic croaker fishery is a mixed species fishery using a variety of gear types such as gill nets, pound, nets, haul seines, and trawls ( ASMFC 2010). Croaker is predominantly caught recreationally and in 2011 was the third most caught fish in the Atlantic and Gulf of Mexico. The commercial croaker fishery is not as large, but croaker caught commercially is often sold as bait or scrap fish in North Carolina and Virginia, but the degree to which they are sold as bait is unknown as the species are not reported individually. The commercial croaker fishery operates primarily in bays and open ocean, where croaker are found in sandy bottom habitats; therefore, the fishery does not have any impact on sensitive eelgrass habitat.



**Figure 1:** Annual commercial landings (metric tons) of Atlantic croaker along the Atlantic coast, 1950–2008. (ASMFC 2010)

The Fishery Management Plan (FMP) was implemented by the Atlantic States Marine Fisheries Commission in 1987 and was adopted by all states from Maryland through Florida. The most recent stock assessment was conducted in 2010, which combined the two management regions into one stock due to lack of evidence for two stock components.

### Production Statistics

In the U.S., croaker landings vary by state, but overall landings and value are very low compared to other fisheries. Landings were over 20,000 mt in the 1940s, declined to less than 1,000 mt in the early 1970s, and then increased again to 13,000 mt in the late 1970s. In 1985, food landings of croaker were valued at \$3.7 million ( ASMFC 1987).

### Importance to the US/North American market

There are no data on the import or export of Atlantic croaker in the National Marine Fisheries Service foreign trade database. The original Fishery Management Plan noted that croaker was not exported outside of the U.S. ( ASMFC 1987).

**Common and market names**

Hardheads, pinheads ( Chesapeake Bay Program 2013) crocus, King Billy, corvine, roncadina, corbina, grumbler ( ASMFC 1987).

**Primary product forms**

Atlantic croaker are available as whole fish, either fresh or frozen, is processed into cat food, and crab bait, and surimi, a fish paste often used to make imitation crab meat ( ASMFC 1987). Croaker sales as a food fish have fluctuated over time, peaking in Virginia in the 1930s-50s, in Alabama in the 1970s, and in North Carolina in the 1970s and 1980s. Currently, North Carolina is the biggest producer of Atlantic croaker as food fish ( Diamond et al. 1999).

## **Analysis**

### **Scoring Guide**

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at <http://www.seafoodwatch.org>

### **Criterion 1: Stock for which you want a recommendation**

*This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown. The final Criterion 1 Score is determined by taking the geometric mean of the abundance and fishing mortality scores.*

<b>ATLANTIC CROAKER</b>				
<b>Region / Method</b>	<b>Inherent Vulnerability</b>	<b>Stock Status</b>	<b>Fishing Mortality</b>	<b>Subscore</b>
<b>United States Atlantic Gillnet, Bottom</b>	3.00:Low	4.00:Low Concern	3.67:Low Concern	<b>Green (3.831)</b>
<b>United States Atlantic Pound Net</b>	3.00:Low	4.00:Low Concern	3.67:Low Concern	<b>Green (3.831)</b>
<b>United States Atlantic Seine Net, Beach</b>	3.00:Low	4.00:Low Concern	3.67:Low Concern	<b>Green (3.831)</b>
<b>United States Atlantic Trawl, Bottom</b>	3.00:Low	4.00:Low Concern	3.67:Low Concern	<b>Green (3.831)</b>

### **Justification of Ranking**

#### **ATLANTIC CROAKER**

##### **Factor 1.1 - Inherent Vulnerability to Fishing**

- Low = FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.
- Medium = FishBase vulnerability score for species 36-55 OR life history characteristics that make it neither particularly vulnerable or resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.

- High = FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.

*Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g. schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

**United States Atlantic, Gillnet, Bottom**

**United States Atlantic, Pound Net**

**United States Atlantic, Seine Net, Beach**

**United States Atlantic, Trawl, Bottom**

**3.00**

**Low**

The FishBase vulnerability score is 34, corresponding to a low vulnerability score (Cheung et al. 2005)

### **Factor 1.2 - Abundance**

- 5 (Very Low Concern) = Strong evidence that population is above target abundance level (e.g. biomass at maximum sustainable yield, BMSY) or near virgin biomass
- 4 (Low Concern) = Population may be below target abundance level, but it is considered not overfished.
- 3 (Moderate Concern) = Abundance level is unknown and species has a low or medium inherent vulnerability to fishing
- 2 (High Concern) = Population is overfished, depleted, or a species of concern OR Abundance is unknown and species has a high inherent vulnerability to fishing.
- 1 (Very High Concern) = Population is listed as threatened or endangered.

**United States Atlantic, Gillnet, Bottom**

**United States Atlantic, Pound Net**

**United States Atlantic, Seine Net, Beach**

**United States Atlantic, Trawl, Bottom**

**4.00**

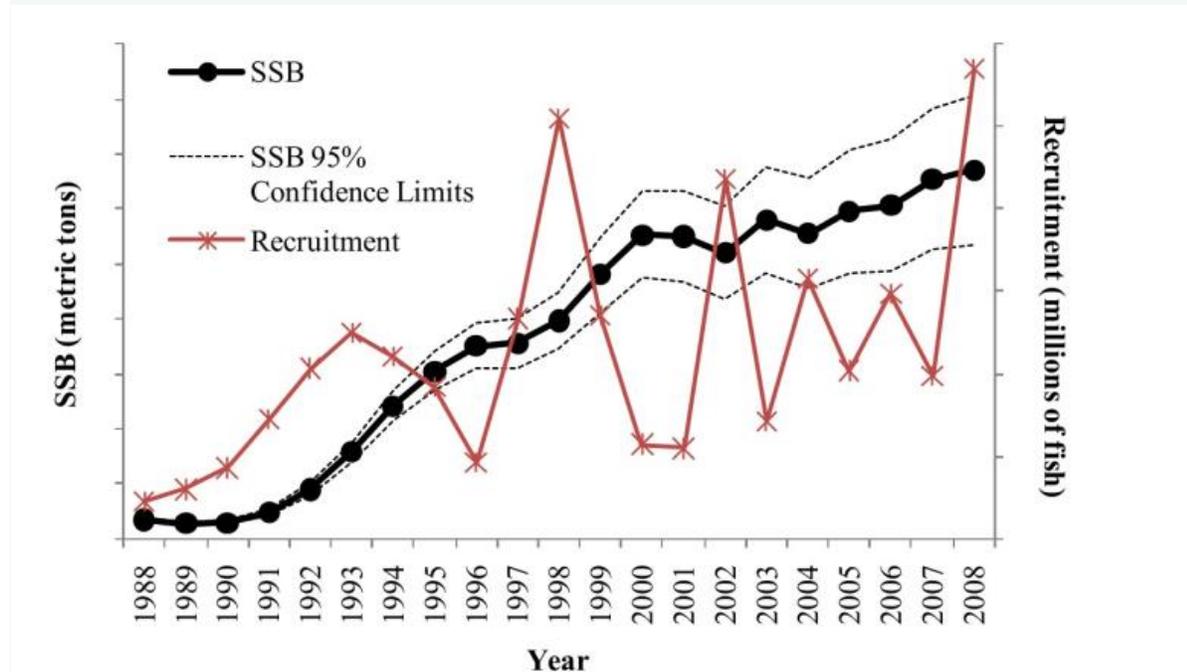
**Low Concern**

Atlantic croaker is currently managed as a single stock from New Jersey to Florida by the Atlantic States Marine Fisheries Commission (ASMFC). The most recent stock assessment found that the croaker stock is not overfished ( ASMFC 2010). However, croaker is ranked as low concern, and not very low, due to the uncertainty regarding the amount of croaker caught in the shrimp trawl fishery, and how that affects the overall population size.

**Rationale:**

Until the 2010 assessment, croaker was managed as separate stock components in the Mid-Atlantic and South Atlantic. Biological reference points were established for the Mid-Atlantic stock component in the 2004 assessment, but there was not enough data to set reference points for the South Atlantic stock. Spawning stock biomass at maximum sustainable yield ( $SSB_{MSY}$ ) was estimated for the Mid-Atlantic stock at 63.78 million lb and the threshold spawning stock biomass level was estimated at 44.65 million lb (70% of  $SSB_{MSY}$ ). As a part of the review process for the 2010 stock assessment, it was determined that there was not enough evidence to support the separation into two distinct stock components and since then, the Atlantic croaker stock has been managed as one coast wide stock ( ASMFC 2010). In 2010, the biological reference points were redefined and  $SSB_{MSY}$  was estimated at 26,268 mt, and the biomass threshold was estimated at 19,700 mt. The 2010 croaker SSB was estimated at 39,728 mt, well above the threshold biomass and  $SSB_{MSY}$ , indicating that the croaker stock is not overfished. However, there are a large number of uncertainties in the assessment which remain to be resolved. The most significant source of uncertainty is the amount of croaker caught in the Mid-Atlantic scrap fisheries, in which fish are unsorted and sold all together as bait. North Carolina has recently begun a state sampling program for its scrap fishery ( ASMFC 2010), and estimates of croaker catch in North Carolina scrap fisheries were used in the 2010 assessment, however, only a small percentage of scrap fishery landings are sampled, and only in North Carolina, leaving a significant amount of uncertainty regarding the amount of croaker in scrap landings coast wide. Furthermore, methods such as extrapolating catch composition in scrap fisheries based on sampled catch is difficult as the composition of scrap fisheries varies year to year depending on the target species caught, local abundance, gear used, as well as current fishery regulations. Croaker is also caught as bycatch in the southeastern Atlantic shrimp fishery. A few studies have provided an estimate of croaker bycatch in the shrimp trawl fishery, and some estimates of bycatch are greater than the amount of croaker landed in the North Carolina food fishery ( Diamond et al. 1999). The 2010 assessment used a fish catch to shrimp catch ratio to estimate overall bycatch in the shrimp fishery ( ASMFC 2010) and although this uses the best available science to account for croaker bycatch when estimating fishery removals in the assessment, it is highly uncertain and in all likelihood an underestimate. This uncertainty is especially concerning considering that estimated bycatch was much greater than actual reported commercial landings for most years in the assessment. In addition, bycatch of both adult and juvenile croakers in the Atlantic may have been responsible for the decreased fecundity and age at maturity that has occurred since the 1970s ( Diamond et al. 1999). Due to these unknowns, the biological reference points alone set during the assessment process were deemed to be too uncertain to be used to determine stock status. Therefore, the assessment used a ratio method of  $SSB/SSB_{MSY}$  and set the target biomass

at 1. Since the ratio was greater than 1 in the 2010 assessment, it was determined that the croaker stock was not overfished. Based on the best available information, it appears that croaker biomass has been steadily increasing and fishing mortality has been declining. In addition, if it ever appears that the stock is on the decline and headed toward being overfished or overfishing is occurring, the Atlantic croaker management board is required to implement management measures that would limit fishing mortality or implement other measures to rebuild the stock to a sustainable level.



**Figure 2:** Trends in estimated spawning stock biomass (SSB, metric tons) and age-1 recruitment (numbers of fish) of Atlantic croaker (ASMFC 2010).

### Factor 1.3 - Fishing Mortality

- 5 (Very Low Concern) = Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY) OR fishery does not target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality)
- 3.67 (Low Concern) = Probable ( $>50\%$  chance) that fishing mortality is at or below a sustainable level, but some uncertainty OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught)

- 2.33 (Moderate Concern) = Fishing mortality is fluctuating around sustainable levels OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery, and if species is depleted, reasonable management is in place.
- 1 (High Concern) = Overfishing is occurring, but management is in place to curtail overfishing OR fishing mortality is unknown, species is depleted and no management is in place
- 0 (Critical) = Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.

#### United States Atlantic, Gillnet, Bottom

#### United States Atlantic, Pound Net

#### United States Atlantic, Seine Net, Beach

#### United States Atlantic, Trawl, Bottom

3.67

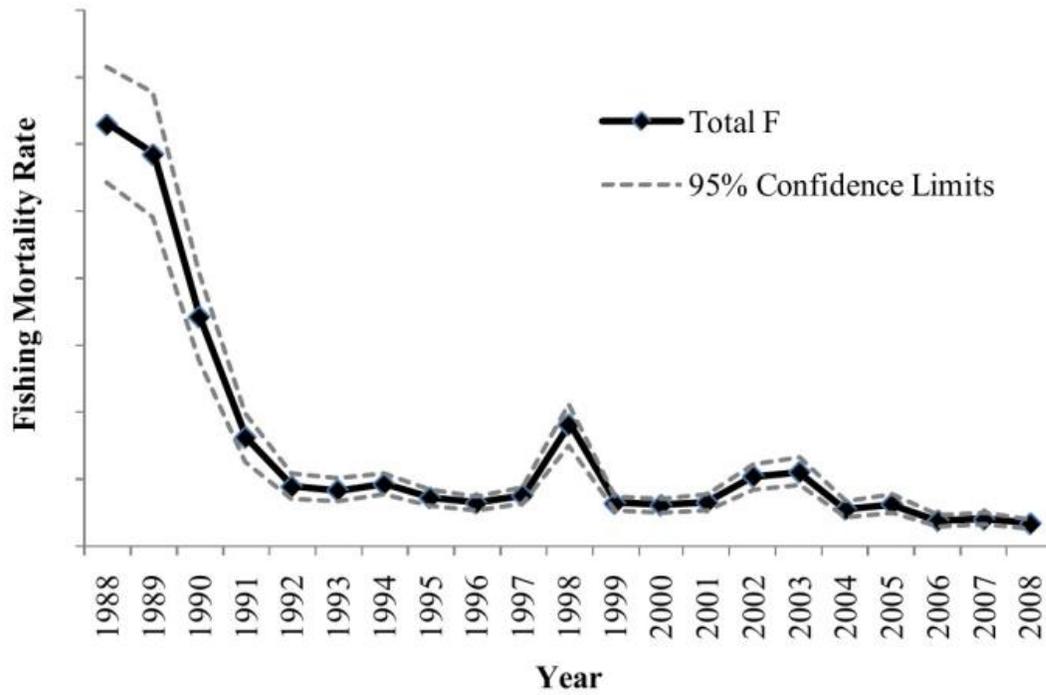
#### Low Concern

The 2010 assessment estimated fishing mortality at maximum sustainable yield ( $F_{MSY}$ ) for the coast wide stock at 0.455, and the target fishing mortality rate at 0.341 (75% of  $F_{MSY}$ ). The most recent estimated fishing mortality was from 2008, and was estimated at 0.22, well below the target rate and  $F_{MSY}$ . Therefore, overfishing is not occurring in the croaker fishery. Croaker is ranked as low concern, and not very low concern due to the uncertainties regarding how much croaker is caught in the shrimp trawl fishery and how this would affect fishing mortality rates.

#### Rationale:

Biological reference points were established for the Mid-Atlantic stock component in the 2004 assessment. In 2004, the fishing mortality rate at maximum sustainable yield ( $F_{MSY}$ ) for the Mid-Atlantic stock component was defined as 0.39 with a target fishing mortality rate of 0.29 (75% of  $F_{MSY}$ ).

Fishing mortality declined from the previous assessment, and in fact has been continuously declining since 1992. However, the same uncertainties that were a concern in estimating biomass, such as a lack of data on croaker bycatch in the shrimp trawl fishery, and croaker landings in scrap fisheries, also apply to fishing mortality estimates. While estimates of bycatch in the shrimp trawl fishery are highly uncertain because of lack of adequate observer coverage, bycatch in 2007-2008 was estimated at 5,500 mt, a decline from 13-15,000 mt from 1992-94, Commercial landings during that same period were 8,000 mt and 4,000 mt on average respectively. Because of high levels of uncertainty, the reviewers warned that the assessment results should be used cautiously when making management decisions.



**Figure 3:** Trend in estimated total fishing mortality rate (F) of Atlantic croaker (ASMFC 2010).

## **Criterion 2: Impacts on other retained and bycatch stocks**

All retained and primary bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch.

### **Atlantic croaker: United States Atlantic, Gillnet, Bottom**

**Subscore:: 1.414      Discard Rate: 1.00      C2 Rate: 1.414**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>BOTTLENOSE DOLPHIN</b>	1.00: High	2.00: High Concern	1.00: High Concern	<b>1.414</b>
<b>LOGGERHEAD TURTLE</b>	1.00: High	1.00: Very High Concern	2.33: Moderate Concern	<b>1.526</b>
<b>ATLANTIC STURGEON</b>	1.00: High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>ATLANTIC CROAKER</b>	3.00: Low	4.00: Low Concern	3.67: Low Concern	<b>3.831</b>
<b>ATLANTIC MENHADEN</b>	3.00: Low	3.00: Moderate Concern	5.00: Very Low Concern	<b>3.873</b>
<b>BLUEFISH</b>	1.00: High	4.00: Low Concern	5.00: Very Low Concern	<b>4.472</b>

### **Atlantic croaker: United States Atlantic, Pound Net**

**Subscore:: 2.159      Discard Rate: 1.00      C2 Rate: 2.159**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>BOTTLENOSE DOLPHIN</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>ATLANTIC CROAKER</b>	3.00: Low	4.00: Low Concern	3.67: Low Concern	<b>3.831</b>

**Atlantic croaker: United States Atlantic, Seine Net, Beach**

**Subscore:: 4.472      Discard Rate: 1.00      C2 Rate: 4.472**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>ATLANTIC CROAKER</b>	3.00: Low	4.00: Low Concern	3.67: Low Concern	<b>3.831</b>
<b>BLUEFISH</b>	1.00: High	4.00: Low Concern	5.00: Very Low Concern	<b>4.472</b>

**Atlantic croaker: United States Atlantic, Trawl, Bottom**

**Subscore:: 1.526      Discard Rate: 1.00      C2 Rate: 1.526**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>LOGGERHEAD TURTLE</b>	1.00: High	1.00: Very High Concern	2.33: Moderate Concern	<b>1.526</b>
<b>ATLANTIC CROAKER</b>	3.00: Low	4.00: Low Concern	3.67: Low Concern	<b>3.831</b>
<b>ATLANTIC MENHADEN</b>	3.00: Low	3.00: Moderate Concern	5.00: Very Low Concern	<b>3.873</b>

The Atlantic croaker is considered a mixed fishery in which many other species are targeted. Federal observer data show that bluefish and menhaden are the species most often caught on targeted croaker trips, however observers are not mandated in the croaker fishery and so coverage is very low. The limiting factor for the bottom gillnet fishery is the interactions with bottlenose dolphin, which is known to have high mortality in Mid-Atlantic gillnet gear; loggerhead turtle, which is listed as threatened under the Endangered Species Act; and Atlantic sturgeon, which is listed as endangered under the Endangered Species Act in the Mid-Atlantic. The limiting factor in pound net gear is the incidental take of bottlenose dolphins, and in bottom trawl gear is the interaction with loggerhead turtles. Although the beach seine fishery is listed as a Category 2 for bottlenose dolphin bycatch, most years do not have any recorded interactions and in some years there is one recorded entanglement. Since the potential biological removal of the bottlenose dolphin population that interacts with beach seines (the northern migratory stock) is 71, the cumulative fisheries mortality averages 6-8 annually, and the beach seine fishery has only occasional encounters (0-1 per year), it is reasonable to assume that the croaker fishery has no impact on bottlenose dolphin populations, and therefore no bycatch species are assessed for the beach seine fishery.

From the observer data that is available, overall discards are not very high in the croaker fishery, but are highest when using otter trawl gear, followed by gillnet and beach seine gear. There is no observer data

for the pound net fishery so the discard rate is unknown, however discard rates in stationary nets are generally less than 1% { Kelleher 2005}.

## Justification of Ranking

*See criterion 1 for scoring definitions.*

## ATLANTIC MENHADEN

### 2.1 - Inherent Vulnerability

United States Atlantic, Gillnet, Bottom

United States Atlantic, Trawl, Bottom

**3.00**     **Low**

The FishBase vulnerability score is 30, corresponding to a low vulnerability score (Cheung et al. 2005)

### 2.2 - Stock Status

United States Atlantic, Gillnet, Bottom

United States Atlantic, Trawl, Bottom

**3.00**     **Moderate Concern**

Menhaden have repeatedly been listed as one the nation's most important commercial fisheries. Menhaden are fished for a reduction fishery that processes the fish into meal and oil, and a bait fishery for a variety of other fisheries on the Eastern seaboard. The most recent assessment update in 2012 found that overfishing is occurring, and the overfished status is unknown. Spawning stock biomass (SSB) has been declining since the 1990s, but the current estimate of SSB is unknown due to uncertainties in the assessment ( ASMFC 2012a). Such uncertainties include a retrospective pattern which lead to an overestimation of SSB in 2010, but an underestimation of SSB in 2011. The confusing retrospective pattern, along with uncertainties in age composition data, an absence of spatial information on the stock, and a coast wide adult abundance index, led the menhaden Technical Committee to request a benchmark stock assessment for menhaden, which is currently scheduled for 2014. Addendum 2 defined new biological reference points using maximum spawning potential (MSP) as an interim reference point until the benchmark stock assessment is completed. The management board chose an MSP of 15% as the threshold biomass and an MSP of 30% for the target biomass. Atlantic menhaden was ranked as a moderate concern due to its low vulnerability and the current unknown stock status.

## 2.3 - Fishing Mortality

### United States Atlantic, Gillnet, Bottom

### United States Atlantic, Trawl, Bottom

5.00

**Very Low Concern**

In general fishing mortality rates for the reduction fishery have declined with the exception of the 2010-2011 fishing year, when they increased. Fishing mortality rates have increased steadily in the bait fishery. The 2012 assessment update estimated full fishing mortality at 4.5. The current overfishing definition is a fecundity-per-recruit threshold of  $F$ . Since the ratio of Full  $F$  to the overfishing benchmark ( $F_{2011}/F$ ) was greater than 1, then overfishing is occurring.

Addendum V to the Atlantic menhaden FMP established new fishing mortality threshold and target levels to increase menhaden population levels. The current fishing mortality reference points are based on menhaden's maximum spawning potential (MSP). The interim fishing mortality limit used until the next benchmark stock assessment is 15% of MSP, and the target fishing mortality rate is 30% of MSP. The most recent assessment update used a ratio method to determine whether overfishing is occurring. Since fishing mortality/ $F_{15\%}$  is greater than 1, overfishing is occurring, and has been occurring since 1955 (ASFMC 2012a). In order to constrain fishing mortality, the Board implemented a quota based management system allocated on a state by state basis based on historical landings and a mandatory biological sampling program through Amendment 2 to the Fishery Management Plan (FMP). The total allowable catch (TAC) level was set at 170,800 mt for 2013, a 20% reduction from the recent three year average of catch (2009-2011) (ASMFC 2012b).

There has not been any analysis on the impact of the croaker fishery on menhaden populations, but observer data shows an average of 1.1 mt (2,400 lb) annually between 2008-2011, which is a low estimate considering observer coverage is low in the croaker fishery. Since menhaden bycatch in the croaker fishery so low, it is not likely to substantially impact the menhaden population.

## 2.4 - Discard Rate

### United States Atlantic, Gillnet, Bottom

1.00

**< 20%**

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in gillnet gear for that time period was 11.94%

### United States Atlantic, Trawl, Bottom

1.00 < 20%

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate during that time period was 18.85%.

## ATLANTIC STURGEON

### 2.1 - Inherent Vulnerability

#### United States Atlantic, Gillnet, Bottom

1.00 High

The Fishbase score of 85 out of 100, ranks Atlantic sturgeon as High vulnerability (Cheung et al. 2005).

### 2.2 - Stock Status

#### United States Atlantic, Gillnet, Bottom

1.00 Very High Concern

Atlantic sturgeon populations have declined dramatically since their peak primarily due overfishing for the harvest of caviar ( NMFS 2013). Sturgeon are thought to have peaked prior to the caviar market at around 100,000 females for the Delaware River alone and at least 10,000 females for other spawning stocks in over 35 rivers ( NMFS 2013). Now, there are only 17 rivers that are known to support populations of spawning female sturgeon and while the true total coast wide population of sturgeon is unknown, 863 mature adults were estimated for the Hudson River, and 342 for the Altamaha River, GA. Model estimates based on these two populations show the coast wide population to be around 67,776 adults based on data collected through the Northeast Atlantic Marine Assessment Program (NEMAP) survey, a significant decline from their peak ( NMFS 2013). NMFS recently listed all of the sturgeon Distinct Population Segments (DPSs) as endangered, except the Gulf of Maine DPS, which was listed as threatened. Current threats include fisheries bycatch, vessel strikes, poor water quality, dams, dredging, and lack of regulations protecting the sturgeon ( NMFS 2013).

## 2.3 - Fishing Mortality

### United States Atlantic, Gillnet, Bottom

3.67

**Low Concern**

Atlantic sturgeon are particularly sensitive to bycatch mortality because they are long-lived, have an older age at maturity, low maximum fecundity, and egg production occurs later in life. The greatest mortality of Atlantic sturgeon is bycatch in sink gillnets ( NMFS 2013). Sturgeon bycatch in Northeast Federal fisheries from 2006-2010 was estimated to be around 1,500 interactions per year in gillnet fisheries and the mortality rate is approximately 20% ( NMFS 2013). While there are many federal and state laws prohibiting possession of Atlantic sturgeon throughout their range, such measures have not been sufficient at reducing bycatch mortality. Since Atlantic sturgeon has only recently been listed under the Endangered Species Act, further measures to limit bycatch are currently in development ( NMFS 2013). Atlantic sturgeon takes have been observed in the Atlantic croaker fishery, but a quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. Observer data indicates that, from 2006 to 2010, 60 Atlantic sturgeon (out of a total of 726 observed interactions) were captured during observed trips where the trip target was identified as croaker. This represents a minimum number of Atlantic sturgeon captured in the croaker fishery during this time period, as it only considers trips that included an observer on board, and observer coverage in the croaker fishery is minimal.

While sink gillnet gear is known to have the greatest impact on Atlantic sturgeon, the most recent biological opinion found that the continued operation of the croaker fishery will not jeopardize the Atlantic sturgeon stock, and that sturgeon interactions are more likely to occur in other gillnet fisheries in the Northeast and Mid-Atlantic ( NMFS 2013). Atlantic sturgeon is ranked as low concern due to low fishing mortality rates and increases in effort to reduce sturgeon bycatch.

## 2.4 - Discard Rate

### United States Atlantic, Gillnet, Bottom

1.00

**< 20%**

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in gillnet gear for that time period was 11.94%

## **BLUEFISH**

### **2.1 - Inherent Vulnerability**

United States Atlantic, Gillnet, Bottom

United States Atlantic, Seine Net, Beach

**1.00**     **High**

The FishBase vulnerability score is 59, corresponding to a high vulnerability score (Cheung et al. 2005)

### **2.2 - Stock Status**

United States Atlantic, Gillnet, Bottom

United States Atlantic, Seine Net, Beach

**4.00**     **Low Concern**

The bluefish stock was declared rebuilt in 2009 after the implementation of a successful rebuilding program in 2000 that limited fishing mortality. The most recent stock status update was conducted in 2013 and confirmed that bluefish is still not overfished. Survey indices were updated and the updated model using the most recent survey indices indicated a decline in bluefish abundance due to poor year classes in 2009, 2010, and 2011 (NOAA 2012). The 2011 estimate of mean total biomass was 292.972 million lb, which is below  $B_{MSY}$  (324 million lb) but well above  $\frac{1}{2} B_{MSY}$  of 162 million lb. The assessment update concluded that bluefish is still not overfished. A new bluefish assessment is expected in 2015 (NOAA 2012). Due to the uncertainties surrounding the assessment, and because biomass is below  $B_{MSY}$ , the bluefish fishery is ranked as low and not very low concern, even though the stock is not overfished.

### **2.3 - Fishing Mortality**

United States Atlantic, Gillnet, Bottom

**5.00**     **Very Low Concern**

The updated assessment model, using the most recent survey indices, estimated a fishing mortality rate of 0.114 (NOAA 2012), well below  $F_{MSY}$  (0.19) and the target  $F$  (0.17), with very little uncertainty. The assessment update concluded that overfishing is not occurring. Therefore, the bluefish fishery is ranked as very low concern.

### United States Atlantic, Seine Net, Beach

**5.00**      **Very Low Concern**

Bluefish is the most common bycatch species in the beach seine fishery, but bycatch is low and the fishery only catches about 700 lbs of bluefish a year, which likely has a negligible impact on the population. In addition, the updated assessment model for bluefish concluded with very little uncertainty that overfishing is not occurring. Therefore, the impact of the beach seine fishery for croaker on the bluefish population is ranked as a very low concern.

## 2.4 - Discard Rate

### United States Atlantic, Gillnet, Bottom

**1.00**      **< 20%**

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in gillnet gear for that time period was 11.94%

### United States Atlantic, Seine Net, Beach

**1.00**      **< 20%**

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in beach seine gear for that time period was 7.67%. There is no recorded bycatch of protected species in the croaker seine net fishery and fishery bycatch includes primarily bluefish and horseshoe crabs.

## **BOTTLENOSE DOLPHIN**

### 2.1 - Inherent Vulnerability

#### United States Atlantic, Gillnet, Bottom

#### United States Atlantic, Pound Net

**1.00**      **High**

Bottlenose dolphins are considered to have a high vulnerability to fishing according to the Seafood Watch criteria.

## 2.2 - Stock Status

### United States Atlantic, Gillnet, Bottom

2.00

**High Concern**

There are 4 coastal stocks of bottlenose dolphins that are known to interact with the Mid-Atlantic gillnet fisheries: the Northern and Southern Migratory Coastal stocks, and Northern and Southern North Carolina estuarine stocks (NOAA 2013a). The Northern and Southern Migratory Coastal populations are listed as depleted under the Marine Mammal Protection Act and the status of the estuarine stocks is unknown. Bottlenose dolphins caught in Mid-Atlantic gillnet gear are ranked as high concern due to the depleted status of the migratory stocks, and the unknown status of the estuarine stocks and high vulnerability of the species.

An Unusual Mortality Event (UME), under the Marine Mammal Protection Act (MMPA), was declared for bottlenose dolphins in the Mid-Atlantic region from early July 2013 through the present. Elevated strandings of bottlenose dolphins have occurred in New York, New Jersey, Delaware, Maryland, and Virginia. Dolphin strandings have also increased in North Carolina. Current bottlenose dolphin strandings are over nine times the historical average for the months of July and August for the Mid-Atlantic Region. All age classes of bottlenose dolphins are involved and strandings range from a few live animals to mostly dead animals with many very decomposed. Many dolphins have presented with lesions on their skin, mouth, joints, or lungs (NOAA 2013b).

### United States Atlantic, Pound Net

2.00

**High Concern**

There are 3 coastal stocks of bottlenose dolphins that are known to interact with the pound net fisheries: the Northern and Southern Migratory Coastal stocks, and the Northern North Carolina estuarine stock (NOAA 2013a). The Northern and Southern Migratory Coastal populations are listed as depleted under the Marine Mammal Protection Act and the status of the estuarine stock is unknown. Bottlenose dolphins caught in pound net gear are ranked as high concern due to the depleted status of the migratory stocks and the unknown status combined with high vulnerability of the estuarine stocks.

## 2.3 - Fishing Mortality

### United States Atlantic, Gillnet, Bottom

1.00

**High Concern**

Because the Northern Migratory Coastal, Southern Migratory Coastal, Northern North Carolina

Estuarine System and Southern North Carolina Estuarine System stocks all occur in waters off of North Carolina, it is difficult to assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, observer coverage, especially in the inshore estuarine fisheries, where the Federal observer program does not operate, is extremely limited and therefore, it is difficult to estimate total mortality specifically in gillnet gear. Although total mortality is unknown, recent mortality events have been attributed to fisheries using mid-Atlantic gillnet and pound net gear due to gear markings on the carcasses.

Potential Biological Removal (PBR) for the Northern Migratory Coastal Stock of bottlenose dolphins is 71, and gillnet fisheries are responsible for mortality between 1-10% of PBR. PBR for the Southern Migratory Coastal stock is 96, and gillnet take is between 10-50% of PBR. PBR for the Northern North Carolina Estuarine stock is 7.9 dolphins, and gillnet fisheries are responsible for mortality between 10-50% using the minimum estimate, but more than PBR using the maximum estimate of total bottlenose mortality in Mid-Atlantic gillnet gear. PBR for the Southern North Carolina Estuarine stock is 16, and gillnet mortality is less than 10% of total PBR. Because of the high estimates of gillnet take in the Northern North Carolina Estuarine stock of bottlenose dolphins relative to their PBR, the fishing mortality status is ranked as a high concern.

#### United States Atlantic, Pound Net

2.33

#### Moderate Concern

The minimum population size of the Northern Migratory Coastal stock of bottlenose dolphins is 7,147, and PBR for this stock of bottlenose dolphins is 71. Virginia pound net mortalities are between 1-10% of PBR for the Northern coastal stock. PBR for the Southern migratory stock is 96, and pound net take is between 10-50% of PBR; however, cumulative fishing mortality on this stock does not exceed PBR. PBR for the Northern North Carolina Estuarine stock is 7.9 dolphins, and pound net fisheries are responsible for at least 0-2 mortalities (which is based on confirmed reports and likely an underestimate of total mortality from this fishery). This take could exceed 10% of the PBR of the stock, and cumulative mortality may be as high as 22 dolphins per year compared to a PBR of 7.9. Because the pound net fishery is responsible for take that is likely in the range of 10-50% of the PBR of the Northern North Carolina Estuarine Stock, and PBR for the stock is being exceeded by cumulative fishing mortality, the fishing mortality status of the pound net fishery is ranked as moderate.

Historical and recent stranding network data report interactions between bottlenose dolphins and pound nets in Virginia. Stranding data for 2004-2008 indicate 17 cases where bottlenose dolphins were removed from pound net gear, and it was determined that animals were entangled pre-mortem. In each case, the bottlenose dolphin was recovered directly from the fishing gear. Of these 17 cases, 14 were documented mortalities while 3 were released alive. Five of these mortalities occurred during May and June when they could have impacted either the Northern Migratory or Southern Migratory stocks (

NOAA 2013a).

## 2.4 - Discard Rate

### United States Atlantic, Gillnet, Bottom

1.00 < 20%

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in gillnet gear for that time period was 11.94%

### United States Atlantic, Pound Net

1.00 < 20%

There is no observer data for the pound net fishery so the discard rate is unknown, however discard rates in stationary nets are generally less than 1% ( Kelleher 2005)

## LOGGERHEAD TURTLE

### 2.1 - Inherent Vulnerability

#### United States Atlantic, Gillnet, Bottom

#### United States Atlantic, Trawl, Bottom

1.00 High

Loggerhead sea turtles are highly vulnerable to fishing mortality according to Seafood Watch criteria.

### 2.2 - Stock Status

#### United States Atlantic, Gillnet, Bottom

#### United States Atlantic, Trawl, Bottom

1.00 Very High Concern

In September 2011, NMFS and U.S. Fish and Wildlife Service listed 9 distinct population segments (DPSs) of loggerhead sea turtles under the Endangered Species Act. The Northwest Atlantic DPS was listed as threatened. The majority of loggerhead sea turtle nesting occurs on beaches in the

southeastern U.S. There appeared to be an overall decline in nesting based on a few different studies in 2008 and 2009, but from 2008-2012, nesting appears to be increasing significantly. In 2009, a study estimated the female adult loggerhead population to be between 16,847 and 89,649, with a median size of 30,050 females. Another study in 2011 estimated 588,000 loggerheads on the entire U.S. Atlantic coast, but the estimates are considered preliminary and in need of further analysis ( NMFS 2013).

## 2.3 - Fishing Mortality

### United States Atlantic, Gillnet, Bottom

#### 2.33 Moderate Concern

Mortality from gillnets, longlines, and trawl fishing gear is a known to be a major issue facing loggerhead turtles in the Northwest Atlantic ( Conant et al. 2009). The shrimp trawl fishery accounts for the largest percentage of loggerhead mortality in the Northwest Atlantic, but there are also significant interactions with the scallop dredge and summer flounder trawl fisheries. While loggerhead interactions are higher in other gear types, there are still an average of 300 of interactions in Mid-Atlantic gillnet fisheries annually ( ex. Atlantic/Gulf pelagic longline averages 1400 interactions and Mid-Atlantic bottom trawl averages 600 interactions annual) ( Finkbeiner et al. 2011). Loggerhead turtles were ranked as moderate concern due to moderate, but not high levels of interactions with gillnet gear.

### United States Atlantic, Trawl, Bottom

#### 2.33 Moderate Concern

Mortality from gillnets, longlines, and trawl fishing gear is a known to be a major issue facing loggerhead turtles in the Northwest Atlantic ( Conant et al. 2009). The shrimp trawl fishery accounts for the largest percentage of loggerhead mortality in the Northwest Atlantic, but there are also significant interactions with the scallop dredge and Mid-Atlantic bottom trawl fishery, which includes the summer flounder fishery. There are currently mandatory regulations for the summer flounder fishery in the Mid-Atlantic to use turtle excluder devices (TEDs), which have been shown to decrease mortality rates of turtles caught in bottom trawl fishing gear. Even so, the Mid-Atlantic bottom trawl fishery, had an estimated average annual bycatch of 616 loggerhead turtles during 1996-2004 ( Conant et al. 2009). A more recent analysis found that bycatch of loggerhead turtles has declined due to mitigation measures such as observer coverage, TEDs, and adequate bycatch handling methods ( NMFS 2013), but 500-600 annual loggerhead turtle interactions were still documented from 1990-2007 after such regulations were put into place ( Finkbeiner et al. 2011). The number of predicted average annual loggerhead interactions for 2005-2008 was 292, with an additional 61 loggerheads interacting with trawls but, being released through a TED ( NMFS 2013). Another analysis in 2011 estimated the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used specifically in the Atlantic croaker fishery to be 70

loggerhead sea turtles ( NMFS 2013). Loggerhead turtles were ranked as moderate concern due to high levels of interactions with bottom trawl gear in the Mid-Atlantic, but relatively low estimates of interactions in the Atlantic croaker fishery specifically ( Finkbeiner et al. 2011). The fishing mortality on loggerhead turtles is considered a moderate concern because incidental takes in this fishery are relatively low compared to other fisheries, but still substantial and may be having an adverse impact in combination with bycatch from other fisheries.

## 2.4 - Discard Rate

### United States Atlantic, Gillnet, Bottom

1.00 < 20%

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate in gillnet gear for that time period was 11.94%

### United States Atlantic, Trawl, Bottom

1.00 < 20%

Discard information was compiled from data collected by the Northeast Fisheries Observer Program from 2008-2011. The discard rate during that time period was 18.85%.

### **Criterion 3: Management effectiveness**

Management is separated into management of retained species and management of non-retained species/bycatch. The final score for this criterion is the geometric mean of the two scores.

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
United States Atlantic Gillnet, Bottom	3.000	3.000	Yellow(3.000)
United States Atlantic Pound Net	3.000	3.000	Yellow(3.000)
United States Atlantic Seine Net, Beach	3.000	3.000	Yellow(3.000)
United States Atlantic Trawl, Bottom	3.000	3.000	Yellow(3.000)

Factor 3.1: Management of fishing impacts on retained species							
Region / Method	Strategy	Recovery	Research	Advice	Enforce	Track	Inclusion
United States Atlantic Gillnet, Bottom	Moderately Effective	N/A	Highly Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Pound Net	Moderately Effective	N/A	Highly Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Seine Net, Beach	Moderately Effective	N/A	Highly Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Trawl, Bottom	Moderately Effective	N/A	Highly Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective

#### **Justification of Ranking**

##### **Factor 3.1: Management of Fishing Impacts on Retained Species**

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'.

- 5 (Very Low Concern) = Rated as 'highly effective' for all seven subfactors considered
- 4 (Low Concern) = Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rated at least 'moderately effective'.

- 2 (High Concern) = At minimum meets standards for ‘moderately effective’ for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated ‘ineffective’.
- 1 (Very High Concern) = Management exists, but Management Strategy and/or Recovery of Species of Concern rated ‘ineffective’
- 0 (Critical) = No management exists when a clear need for management exists (i.e., fishery catches threatened, endangered, or high concern species) OR there is a high level of Illegal, Unregulated, and Unreported Fishing occurring.

### 3.1.0 - Critical?

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

0.00

No

Atlantic croaker is successfully managed by the Atlantic States Marine Fisheries Commission and according to the most recent assessment, is not overfished, or experiencing overfishing. Therefore, the fishery is not assessed as critical.

### Subfactor 3.1.1 - Management Strategy and Implementation

*Considerations: What type of management measures are in place, are there appropriate management goals, and is there evidence that management goals are being met. To achieve a highly effective rating, there must be appropriate management goals and evidence that the measures in place have been successful at maintaining/rebuilding species.*

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

2.00

Moderately Effective

Atlantic croaker is managed by the Atlantic States Marine Fisheries Commission (ASMFC) under Addendum 1 of Amendment 1 to the Interstate Fishery Management Plan (FMP) for Atlantic Croaker. Stock assessments are conducted by the ASMFC and reviewed on an annual basis to determine if any further management measures are necessary. The FMP currently does not include any mandatory

management measures, such as catch limits, quotas, size limits, or gear restrictions. Instead, the FMP relies on management measures set by individual states. Management measures implemented by the states and the Potomac River Fisheries Commission (PRFC) include size limits and gear restrictions (see Table 1). State by state management of the croaker fishery appears to be working well as the stock is not overfished, overfishing is not occurring, and biomass is generally increasing. If the stock assessment update were to find biomass declining or fishing mortality increasing to unsustainable levels, the ASMFC is required to implement a rebuilding plan (ASMFC 2012). In addition, Addendum 1 provides flexibility for managers to accept new biological reference points that have been adequately peer reviewed without going through a lengthy process. This allows the Commission to make adaptive changes to the management plan quickly if necessary.

**Rationale:**

**Table 1:** State regulations specific to Atlantic croaker (ASMFC 2013).

State	Recreational	Commercial
NJ	none	otter/beam trawl mesh restriction for directed croaker harvest (>100 lbs in possession)
DE	8" minimum; recreational gill nets (up to 200 ft.) with license	8" minimum
MD	9" min, 25 fish/day, charter boat logbooks	9" minimum; open 3/16 to 12/31
PRFC	25 fish/day	pound net season: 2/25 to 12/15
VA	none	none
NC	recreational use of commercial gears with license and gear restrictions	
SC	mandatory for-hire logbooks	
GA	8" min, 25 fish/day	8" minimum; 25 fish/day limit except for shrimp trawls (no limit)
FL	none	none

\* A commercial fishing license is required to sell croaker in all states with fisheries. For all states, general gear restrictions affect commercial croaker harvest.

**Subfactor 3.1.2 - Recovery of Species of Concern**

*Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success. To achieve a rating of highly effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.*

**United States Atlantic, Pound Net****United States Atlantic, Seine Net, Beach****United States Atlantic, Trawl, Bottom****-1.00****N/A**

The Atlantic croaker stock is not overfished and overfishing is not occurring ( ASMFC 2012). While croaker is not a quota based fishery, size limits and gear restrictions implemented by individual states appear to be controlling mortality of the croaker stock. According to the most recent stock assessment update, Atlantic menhaden, which is retained in the croaker fishery, is experiencing overfishing and the overfished status is unknown. In response to the assessment, the ASMFC recently implemented state specific quotas for the first time in the menhaden fishery to control fishing mortality until the next benchmark stock assessment is completed in 2014 ( ASMFC 2012b). While there are no controls on menhaden catch in the croaker fishery, the fishery is not likely a substantial contributor to menhaden mortality. Recovery of stocks of concern is ranked n/a as there are no stocks of concern in the fishery (bycatch stocks of concern are considered separately in criterion 3.2).

**Subfactor 3.1.3 - Scientific Research and Monitoring**

*Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species. To receive a highly effective score, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

**United States Atlantic, Gillnet, Bottom****United States Atlantic, Pound Net****United States Atlantic, Seine Net, Beach****United States Atlantic, Trawl, Bottom****3.00****Highly Effective**

The Atlantic croaker assessment is updated annually, with data from the previous year ( ASMFC 2012). The assessment update includes updates to both fisheries dependent and independent data sources. The most recent benchmark stock assessment was completed in 2010 and includes commercial landings collected via vessel logbooks and dealer reports or combined trip tickets from Delaware to Florida (New Jersey does not have specific reporting requirements). In addition, many states have their own monitoring and biological sampling programs. New Jersey samples trawl and gillnet fisheries from August through October; Maryland samples pound net caught croaker from June to September; Virginia samples commercial landings from seafood dealers and buyers; North Carolina samples croaker caught

in various gears from dealers and as well random sampling of scrap fish catch in which croaker are often found; and South Carolina and Florida both collect biological samples as a part of their state sampling programs (ASMFC 2010). Length and age samples are also collected on an annual basis as a part of the NMFS monitoring program and an aging workshop held by the Atlantic States Marine Fisheries Commission in 2008 identified the most accurate aging technique for croaker (ASMFC 2010). Recreational landings are sampled for length as part of the NMFS Marine Recreational Information Program (MRIP). Fisheries independent data considered in the 2010 assessment included the NMFS bottom trawl, the Southeast Area Monitoring and Assessment Program (SEAMAP) trawl survey, the Virginia Institute of Marine Sciences juvenile fish and blue crab trawl survey, North Carolina Pamlico sound survey (Program 195), and MRIP (ASMFC 2012).

#### **Subfactor 3.1.4 - Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels). A highly effective rating is given if managers nearly always follow scientific advice.*

**United States Atlantic, Gillnet, Bottom**

**United States Atlantic, Pound Net**

**United States Atlantic, Seine Net, Beach**

**United States Atlantic, Trawl, Bottom**

**3.00**

**Highly Effective**

The stock assessments use the best available scientific information and are conducted and reviewed by a stock assessment subcommittee. The most recent stock assessment was approved unanimously (ASMFC 2010). Although there is uncertainty in the croaker assessment regarding catch in shrimp trawls and scrap fisheries, the Technical Committee members are in general agreement on the management strategy for the croaker fishery moving forward (McDonough 2013).

#### **Subfactor 3.1.5 - Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.*

**United States Atlantic, Gillnet, Bottom**

**United States Atlantic, Pound Net**

**United States Atlantic, Seine Net, Beach****United States Atlantic, Trawl, Bottom****2.00****Moderately Effective**

Since regulations for the croaker fishery are set on a state by state basis, it is up to the states to enforce them. Individual states from Delaware to Florida have their own reporting requirements and reporting systems for state specific landings. In addition, the ASMFC has a Law Enforcement Committee works in conjunction with the Federal NOAA Fisheries Law Enforcement department and meets biannually to issue on the status of fisheries enforcement along the Atlantic coast. The Committee consists of law enforcement representatives from each state and each meeting discusses any law enforcement issues for fisheries in general or specific species within their state waters. Reports from late 2011 and 2012 do not discuss any enforcement issues for the Atlantic croaker fishery ( ASMFC 2013a). There are no mandatory vessel monitoring system (VMS) requirement for the Atlantic croaker fishery. This does not allow the states to adequately monitor whether vessels comply with spatial explicit management measures, for example, the prohibition on trawling from 0-2 miles from shore in New Jersey. Some vessels in the croaker fishery may have VMS units on board as a requirement for a Federal permit for another fishery, but state agencies must cooperate with the NOAA Federal law enforcement program in order to gain access to VMS data and information.

**Subfactor 3.1.6 – Management Track Record**

*Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels. A highly effective rating will be given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*

**United States Atlantic, Gillnet, Bottom****United States Atlantic, Pound Net****United States Atlantic, Seine Net, Beach****United States Atlantic, Trawl, Bottom****2.00****Moderately Effective**

The croaker fishery does not operate under a quota based system, but state specific management measures appear to have been successful at ensuring the croaker stock is not overfished and preventing overfishing from occurring thus far. Because of the uncertainties surrounding stock biomass estimates due to catch in scrap fisheries and bycatch in shrimp trawl fisheries, it is difficult to estimate whether the current management measures will ensure the long term maintenance of the croaker stock.

### Subfactor 3.1.7 - Stakeholder Inclusion

*Considerations: Are stakeholders involved/included in the decision-making process. Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g. fishermen, conservation groups, etc.). A highly effective will be given if the management process is transparent and includes stakeholder input.*

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

3.00

**Highly Effective**

Atlantic croaker is managed by the Atlantic States Marine Fisheries Commission (ASMFC) under the Atlantic Coastal Fisheries Cooperative Management Act, which mandates the inclusion of stakeholders in the management process by holding at least four public meetings and providing guidelines for the public on submitting comments on the development of new management measures. The ASMFC develops new management measure through two committees, a technical committee, which provide expert scientific advice to the management boards, and advisory panels that are made up of representatives from the commercial, charter boat, and recreational fishing industries, as well as conservation interests, that are considered experts in that particular species. Advisory panel members have the opportunity to provide input and submit comments throughout the entire management process. In addition, public comments are encouraged, accepted, and considered at all ASMFC meetings, as well as in writing via mail, fax, or email at any time ( ASMFC 2013b).

### Factor 3.2: Management of fishing impacts on bycatch species

Factor 3.2: Management of fishing impacts on bycatch species				
Region / Method	Strategy	Research	Advice	Enforce
United States Atlantic Gillnet, Bottom	No	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Pound Net	No	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Seine Net, Beach	No	Moderately Effective	Moderately Effective	Highly Effective
United States Atlantic Trawl, Bottom	No	Moderately Effective	Moderately Effective	Highly Effective

## Justification of Ranking

### Factor 3.2: Management of Fishing Impacts on Bycatch Species

*Four subfactors are evaluated: Management Strategy, Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'. Unless reason exists to rank Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations differently, these ranks are the same as in 3.1.*

- 5 (Very Low Concern) = Rated as 'highly effective' for all four subfactors considered
- 4 (Low Concern) = Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rates at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy rated 'ineffective'
- 0 (Critical) = No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substantially impacted by the fishery.

### 3.2.0 - All Species Retained?

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

0.00

No

### 3.2.0 - Critical?

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

**United States Atlantic, Trawl, Bottom****0.00****No****Subfactor 3.2.1 - Management Strategy and Implementation**

*Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures. To achieve a highly effective rating the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g. catch limits, use of proven mitigation measures, etc.).*

**United States Atlantic, Gillnet, Bottom****2.00****Moderately Effective**

The croaker fishery operates using a variety of gillnet mesh sizes to target different life stages of the fish. The inshore gillnet fishery uses smaller mesh (3 inches) while the offshore fishery uses large mesh (5.5-12 inch mesh depending on the target species) ( Steve et al. 2001). In a study of observed gillnet catch and bycatch from January – December, 2010, from North Carolina to the Florida Keys, trips targeting a variety of species including Atlantic croaker using sink gillnets caught 93.6% teleost fish such as southern kingfish, Atlantic menhaden, butterfish, and Spanish mackerel, 6.2% sharks, and other invertebrates and elasmobranchs. Sharks consisted of spiny dogfish (45.9%), smooth dogfish (28.9%), and Atlantic sharpnose shark (15.5%). Other species caught, but discarded, included spinner shark, king mackerel, sailfish, moonfish, scalloped hammerhead shark, and cobia ( Passerotti et al. 2011). The 2013 List of Fisheries lists the Mid-Atlantic gillnet fishery as Category 1 ( 78 FR 23708), which means that there is frequent incidental mortality or serious injury of marine mammals and annual mortality has been estimated at greater than or equal to 50 percent of the potential biological removal level ( NOAA 2013a). This fishery has the potential to interact with bottlenose, common, and white-sided dolphins; gray, harbor, and harp seals; humpback, short and long-finned pilot, and minke whales. NMFS recommended reasonable and prudent measures (RPMs) to minimize these interactions and reduce any injury and mortality that may occur. Such measures included good handling practices, adequate observer coverage, accurate reporting of interactions with sea turtles and/or marine mammals, conducting research on gear modifications, and investigating if there are areas where interactions with the croaker fishery are more or less likely to occur (NMFS 2010). While the majority of these measures have been addressed by NMFS, since there are no mandatory observer coverage requirements, it is unclear whether observer coverage is adequate in the croaker fishery to monitor sea turtle or marine mammal interactions. The Chesapeake Bay inshore gillnet fishery where Atlantic croaker is targeted, is listed separately as a Category 2 fishery because there have been no documented incidents of marine mammal bycatch in that particular fishery in the last 5 years ( 78 FR 23708). The South Atlantic gillnet fishery is also listed separately as a Category 2 fishery, and has been found to interact with bottlenose

dolphins. A recent study on the bycatch of loggerhead sea turtles in gillnet fishing gear estimated that 11 loggerhead turtles were caught in gillnet gear in the croaker fishery from 2002-2006. Loggerhead turtles are the only protected species bycatch observed from 2008-2011 on trips targeting Atlantic croaker, but only 3 were dead and the others were released alive. Atlantic sturgeon, which were recently listed under the Endangered Species Act, as threatened or endangered depending on the distinct population segment (DPS), are also known to be captured in gillnet gear, with sink gillnet gear posing the greatest known risk of mortality. From 2006-2010, 60 Atlantic sturgeon were captured on observed trips that were targeting Atlantic croaker. 60 is considered the minimum number of sturgeon interactions in the croaker fishery, as observer coverage is generally very low ( NMFS 2013). Even so, NMFS found that the croaker fishery is not expected to have a significant impact on or jeopardize the survival of Atlantic sturgeon.

While the offshore fishery contributes to protected species bycatch as discussed above, the inshore croaker fisheries are not expected to substantially contribute to overall mortality of any of the protected species listed in this section.

General measures, which are reasonably expected to be effective, are in place to reduce marine mammal bycatch under the take reduction plans for the Mid-Atlantic gillnet fishery, of which the offshore croaker fishery is a part. However, there are no specific bycatch mitigation measures in place to reduce marine mammal bycatch through the Atlantic States Marine Fisheries Commission (ASMFC).

## United States Atlantic, Pound Net

2.00

### Moderately Effective

Pound net interactions with marine mammals and sea turtles are known to be significant in the croaker and other pound net fisheries. Dolphins stranded in the Chesapeake Bay have had entanglement markings on them that were indicative of pound net gear. Pound nets are made up of three sections: the leader, which is a mesh wall that extends from the seafloor to the surface, the heart that funnels fish to the back of the net, and the pound, where the fish are finally trapped and removed ( Silva et al. 2011). Pound net interactions with marine mammals and sea turtles tend to occur in the pound net leader, and so, in 2004, NOAA prohibited the use of pound net leaders offshore from May 6 through July 15. They also required the use of pound net leaders with mesh size less than 12 inches stretched and prohibited the use of stringers in an inshore area in Virginia waters of the Chesapeake Bay. A study by Silva et al. ( Silva et al. 2011) in 2004-2005 found that changing pound net leader configurations lead to lower interactions with sea turtles while maintaining fish catch rates. Based on the results of that study, NOAA required the use of the modified pound net leader offshore to reduce sea turtle mortality in 2006. In 2008, NOAA implemented a pound net inspection program to enforce the pound net regulations ( 73 FR 68348).

While pound net leader modifications have reduced sea turtle interactions, their effect on bottlenose

dolphin interactions is less clear. In a North Carolina Sea Grant funded study, changing the leader design did reduce the number of bottlenose dolphin interactions with pound nets while maintaining commercial landings ( NC Sea Grant 2009). In 2009, the Bottlenose Dolphin Take Reduction Team provided NOAA with a consensus statement recommending that such pound net leader modifications be mandatory to reduce bottlenose dolphin incidental takes ( NMFS 2012). NOAA is currently working on regulations that would implement the pound net leader modifications in order to reduce bottlenose dolphin interactions. A proposed rule is expected in the spring of 2014 ( Horstman 2013).

#### United States Atlantic, Seine Net, Beach

##### 2.00 Moderately Effective

The Mid-Atlantic haul/beach seine fisheries is listed as a Category 2 fishery in the 2013 NMFS List of fisheries and has known interactions with the Northern Migratory Stock of bottlenose dolphins in coastal and estuarine ecosystems, where Atlantic croaker is also targeted ( 78 FR 23708). However, data show that there is no bottlenose dolphin bycatch in most years and at most 1-2 entanglements in recent years, which is believed to have a negligible impact on that particular stock. Haul/beach seines are used to target croaker, spot, and weakfish, but also catch many other species that are of lesser commercial value, such as menhaden, hogfish, bluefish, and spotted seatrout ( Steve et al. 2001). While there are no specific management measures in place in the croaker fishery to minimize interactions with protected species, the operation of the fishery is not expected to be a substantial contributor to mortality of such species.

#### United States Atlantic, Trawl, Bottom

##### 2.00 Moderately Effective

Bycatch of other fish species on trips targeting croaker has been found to be by more than half of total croaker catch by weight ( Gearhart 2010). Since croaker is often a mixed species fishery where multiple species are targeted, this isn't surprising. Bycatch on croaker trips consisted primarily of spiny dogfish, clearnose rays, Atlantic sturgeon, and loggerhead sea turtles. The Atlantic croaker fishery in the Mid-Atlantic uses a flynet bottom trawl that is known to have high levels of sea turtle interactions. Flynet bottom trawls have large mesh in the wings and mouth of the net, which taper to smaller mesh at the codend and do not allow sea turtles to escape. Sea turtle interactions in flynets tend to be more prevalent where sea turtle migrations and the croaker fishery overlap along temperature gradients in North Carolina ( Gearhart 2010). Although there are no regulations mandating the use of turtle excluder devices (TEDs) specifically in the croaker fishery, TEDs are required in the summer flounder bottom trawl fishery. Croaker is often targeted in mixed species fisheries, which often includes the summer flounder fishery. Therefore, TEDs are likely used on some percentage of croaker trips in the Mid-Atlantic, although how many trips is unknown. One study examined the effectiveness of a turtle excluder device

specifically on croaker trips and found it effective at reducing loggerhead sea turtle, spiny dogfish, clearnose ray, and sturgeon mortality while maintaining catch rates of Atlantic croaker ( Gearhart 2010). The 2013 List of Fisheries lists the Mid-Atlantic bottom trawl fishery as Category 2 ( 78 FR 23708), which means that there is occasional incidental mortality or serious injury of marine mammals annual mortality has been estimated between 1 and 50% of the potential biological removal level ( NOAA 2013a). The Mid-Atlantic bottom trawl fishery has the potential to interact with bottlenose, common, and white-sided dolphins; short- and long-finned pilot whales. However, since bottom trawls are used to target a variety of fisheries in the Mid-Atlantic, it is difficult to attribute any interactions directly to the Atlantic croaker fishery.

### **Subfactor 3.2.2 - Scientific Research and Monitoring**

*Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species. To achieve a highly effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met.*

**United States Atlantic, Gillnet, Bottom**

**United States Atlantic, Pound Net**

**United States Atlantic, Seine Net, Beach**

**United States Atlantic, Trawl, Bottom**

**2.00**

**Moderately Effective**

Observer coverage in the croaker fishery has not been estimated, but is assumed to be extremely low. There are no specific requirements for observers on vessels targeting croaker. There is some observer coverage on vessels targeting croaker, as all vessels with a Federal fishing permit are required to carry an observer on board if randomly selected by NMFS, but since croaker is not managed Federally, observers are only on board if the vessel has a Federal permit for another fishery. Therefore, although trips targeting croaker are occasionally randomly selected by NMFS for observer coverage, coverage is minimal. Since observer coverage is so infrequent, it is difficult to adequately quantify bycatch in the croaker fishery.

### **Subfactor 3.2.3 - Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels). A highly effective rating is given if managers nearly always follow scientific advice.*

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

3.00

Highly Effective

Refer to Section 3.1.

#### **Subfactor 3.2.4 - Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.*

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

3.00

Highly Effective

Refer to Section 3.1

## **Criterion 4: Impacts on the habitat and ecosystem**

*This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of Ecosystem Based Fisheries Management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the EBFM score.*

<b>Region / Method</b>	<b>Gear Type and Substrate</b>	<b>Mitigation of Gear Impacts</b>	<b>EBFM</b>	<b>Overall Recomm.</b>
<b>United States Atlantic Gillnet, Bottom</b>	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Yellow (3.123)</b>
<b>United States Atlantic Pound Net</b>	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Yellow (3.123)</b>
<b>United States Atlantic Seine Net, Beach</b>	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Yellow (3.123)</b>
<b>United States Atlantic Trawl, Bottom</b>	2.00:Moderate Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Yellow (2.598)</b>

### **Justification of Ranking**

#### **Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate**

- 5 (None) = Fishing gear does not contact the bottom
- 4 (Very Low) = Vertical Line Gear
- 3 (Low) = Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom *occasionally* (<25% of the time) or purse seine known to commonly contact bottom
- 2 (Moderate) = Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand;
- 1 (High) = Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g. cobble or boulder).
- 0 (Very High) = Dredge or trawl fished on biogenic habitat, e.g. deep-sea corals, eelgrass and maerl.

*Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive plausible habitat type.*

### United States Atlantic, Gillnet, Bottom

3.00

**Low Concern**

The North Carolina gillnet fishery operates using set net, drift, and run around gillnets, with the primary gillnet being the set net that is fished without anchors. Over 99% of total landings in the commercial gillnet fishery in NC are made using sinking set gillnets that have lead lines on the bottom and float submerged beneath the surface ( Steve et al. 2001). Sink gillnets have very little contact with the bottom and therefore, have little impact on habitat. Anchors used to sink the nets, as well as the weights on the bottom of the nets, are the only part of the fishing gear that touches the bottom ( Stevenson et al. 2004). While Grizzle et al. ( Grizzle et al. 2009) found that gillnets had a significant impact on bottom fauna in the Gulf of Maine, the bottom in the Gulf of Maine is primarily rocky gravel and gillnet gear can easily get hung up on bottom structure, while the croaker fishery operates in the Mid- and South Atlantic where the bottom is sandy. The inshore fishery uses a higher percentage of float gillnet gear where float lines keep the nets off the seafloor and there is even less contact with the bottom. A small percentage of the croaker fishery operates using runaround nets that have a very small weight on one end so that the net stays in place as it's wrapped around a croaker school ( Steve et al. 2001).

### United States Atlantic, Pound Net

3.00

**Low Concern**

Pound nets are stationary nets anchored on stationary poles. Pound nets in the Chesapeake Bay are usually set and fished between April and November in 12-20 feet of water ( Silva et al. 2011). The nets do not have a significant amount of bottom contact and are stationary, so the impact on bottom habitat is assumed to be minimal. However, there has not been any research on how pound nets affect bottom habitat or infauna.

### United States Atlantic, Seine Net, Beach

3.00

**Low Concern**

Haul/beach seines are anchored at one end at the beach to keep the net open and the net is set using a dory launched from the beach ( Steve et al. 2001). Since this is the only part of the gear that has significant contact with the bottom, habitat impacts are minimal. Long haul seines are also used to target Atlantic croaker in estuaries. The long haul seine hangs in the water column and is pulled in without contacting the bottom, so therefore has negligible impact with bottom habitat.

### United States Atlantic, Trawl, Bottom

2.00

#### Moderate Concern

The impacts of bottom otter trawls on habitat are dependent on the configuration of the gear and the type of habitat in which the gear is used. The least impact occurs in muddy/sandy habitats, while the highest impacts would occur on a gravel/hard bottom with plentiful structures such as clay outcroppings. Croaker are fished primarily in the Mid-Atlantic Bight and South Atlantic; they are found further north and more inshore during warm months, and south and further offshore during late fall and into winter. ( Norcross and Austin 1988), ( ASMFC 1987). The Mid-Atlantic Bight, where croaker landings predominate, is made up of mostly sand with some areas of sand-shell and sand-gravel ( Stevenson et al. 2004). The sand forms into ripples due to wave action which are reshaped after any storm event. As croaker tend to feed on infauna, they prefer soft, muddy, or sandy bottoms without a lot of bottom structure ( Diaz and Onuf 1985). In a review of 14 studies on otter trawl effects on sandy habitats, Stevenson et al. found that trawl doors have temporary impacts on sand that are not usually lasting as the sand is able to resettle. Collie et al ( Collie et al. 2000) found that the effects of bottom trawls on sandy habitats only lasted about 100 days before the ecosystem began to recover. Out of all bottom dragged fishing gear, otter trawls have the least impact ( Kaiser et al. 2006). Of course, bottom otter trawls can impact biological communities located in sandy habitats, but such impacts are not well documented. In a study of a sandy bottom closed area in New England, epifauna concentrations in the closed area were significantly higher and more diverse in the closed area than outside it where bottom trawling still occurred ( Grizzle et al. 2009).

### Factor 4.2 - Mitigation of Gear Impacts

- +1 (Strong Mitigation) = Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.
- +0.5 (Moderate Mitigation) = 20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.
- +0.25 (Low Mitigation) = A few measures in place, e.g., vulnerable habitats protected but other habitats not protected; some limits on fishing effort/intensity, but not actively being reduced.
- 0 (No Mitigation) = No effective measures are in place to limit gear impacts on habitats.

### United States Atlantic, Gillnet, Bottom

### United States Atlantic, Pound Net

**United States Atlantic, Seine Net, Beach****United States Atlantic, Trawl, Bottom****0.25****Minimal Mitigation**

The Atlantic croaker fishery is not managed using a quota based system. Croaker is managed on a state by state basis and management measures include size limits and gear restricted areas. The only effort or catch control is in Georgia, where commercial catch is limited to 25 fish per day ( ASMFC 2013). The FMP describes Habitat Areas of Particular Concern (HAPCs) as all estuarine ecosystems in the Mid-Atlantic, but there are no specific estuarine protections in place to protect the croaker fishery ( ASMFC 1987).

**Factor 4.3 – Ecosystem-Based Fisheries Management**

- 5 (Very Low Concern) = Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g. large proportion of fishery area protected with marine reserves, abundance is maintained at sufficient levels to provide food to predators).
- 4 (Low Concern) = Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. If hatchery supplementation or fish aggregating devices (FADs) are used, measures are in place to minimize potential negative ecological effects.
- 3 (Moderate Concern) = Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species. OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts.
- 2 (High Concern) = The fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.
- 1 (Very High Concern) = The use of hatchery supplementation or Fish Aggregating Devices (FADs) in the fishery is having serious negative ecological or genetic consequences. OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.

United States Atlantic, Gillnet, Bottom

United States Atlantic, Pound Net

United States Atlantic, Seine Net, Beach

United States Atlantic, Trawl, Bottom

3.00

**Moderate Concern**

Predators of Atlantic croaker include striped bass, southern flounder, bluefish, weakfish, and spotted sea trout ( ASMFC 1987). In a study by Rudershausen et al ( Rudershausen et al. 2005), croaker was lumped in with other fishes that made up approximately 20% of striped bass diet. Croaker are also known to be part of the bottlenose dolphin diet in the Mid-Atlantic in the summer and fall ( Pate and McFee 2012). They make up the majority of bottlenose dolphin prey in oceanic waters, and are consumed in greater number by males than females ( Gannon and Waples 2004). Atlantic croaker are bottom feeders and will feed on any benthic epifauna and infauna that is locally available. Croaker feed primarily at the bottom of the food chain, preying on a variety of invertebrates such as polychaetes, mollusks, ostracods, copepods, amphipods, mysids, decapods, and only rarely fish (ASMFC 1987). There are no Federal regulations for croaker, and regulations set by the states include only size and area restrictions and the designation of estuarine ecosystems as Habitat Areas of Particular Concern. Therefore, there are no management measures in place to protect the ecosystem role of croaker in the Mid-Atlantic. Atlantic menhaden, however, are known to occupy a very important link in the coastal marine food chain, and are therefore considered species of exceptional importance. They are considered a forage fish species and are relied upon as prey by a host of other fish species. Menhaden feed on small phytoplankton and zooplankton, which cannot be filtered by larger fish species, and therefore, larger fish are dependent on this contribution of menhaden to the Atlantic coastal ecosystem. Menhaden have been shown to be critical food sources for predators such as striped bass, bluefish, weakfish, and piscivorous birds ( ASMFC 2012b). There are currently no management measures in the croaker fishery to protect the ecological role of menhaden in the Mid-Atlantic ecosystem. Since the croaker fishery is not managed under a quota or area based system, it would be difficult to integrate bycatch mitigation measures for menhaden into the croaker management plan. While menhaden catch levels were reduced as a result of the most recent assessment, which found the fishery is experiencing overfishing, no measures have yet been taken to reduce bycatch of menhaden in the croaker fishery (ASMFC 2012)(ASMFC 2012a). However, menhaden bycatch is a very small percentage of all bycatch in the croaker fishery, so it is unlikely that incidental take in the croaker fishery is substantially impacting the menhaden population.

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*Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.*

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## **About Seafood Watch®**

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the North American marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public on [www.seafoodwatch.org](http://www.seafoodwatch.org). The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives," or "Avoid." The detailed evaluation methodology is available on our website. In producing the Seafood Reports, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch and Seafood Reports, please contact the Seafood Watch program at Monterey Bay Aquarium by calling 1-877-229-9990.

### Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

## **Guiding Principles**

Seafood Watch® defines sustainable seafood as originating from sources, whether fished<sup>1</sup> or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

**Best Choices/Green:** Are well managed and caught or farmed in environmentally friendly ways.

**Good Alternatives/Yellow:** Buy, but be aware there are concerns with how they're caught or farmed.

**Avoid/Red:** Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.

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<sup>1</sup> "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.