# Hogfish

Lachnolaimus maximus

## United States: Western Central Atlantic

## Hand implements, Handlines and hand-operated pole-and-lines

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**Disclaimer**

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Seafood Watch Standard used in this assessment: Fisheries Standard v2

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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 United States 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 in the form of regional pocket guides that can be downloaded from 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 on the regional pocket guides is supported by a Seafood Watch Assessment. Each assessment 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." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, 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 assessments 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 Watch assessments in any way they find useful.

## Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] 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 fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

**Best Choice/Green:** Are well managed and caught in ways that cause little harm to habitats or other wildlife.

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

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

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

## Summary

Hogfish is found in tropical, subtropical, and temperate reefs in the western Atlantic and Caribbean Sea. This assessment covers the U.S. Atlantic, Gulf of Mexico, and Puerto Rico hogfish fisheries.

Hogfish is vulnerable to fishing pressure because is it slow-growing, relatively long-lived, and changes sex from female to male as it ages. In the U.S. Atlantic/Gulf of Mexico, scientists have identified three separate hogfish stocks: West Florida, Florida Keys/East Florida, and Georgia to North Carolina. The West Florida hogfish stock appears relatively healthy, but the hogfish stock in the Florida Keys/East Florida is overfished, and fishing levels in this region are fluctuating around sustainable levels. The status of the Georgia to North Carolina hogfish stock could not be determined. There has been no formal assessment of hogfish in the Caribbean, but a data-limited assessment of Puerto Rico reef fishes suggests that hogfish is likely overexploited.

Handline and spear are the primary gears used to catch hogfish. Hogfish is often targeted along with other species, most of which are abundant in the Southeast Atlantic and Gulf of Mexico, but some are less abundant and experiencing overfishing in Puerto Rico. But in the Gulf of Mexico handline fishery, there is high concern over the abundance of hogfish.

Hogfish and other co-landed species are managed under general reef-fish management plans by several federal and state organizations; typical management measures include catch limits, minimum size limits, gear restrictions, and closed areas.

The handline and spear fisheries have limited contact with bottom habitats. Managers are working toward the development of ecosystem-based management policies, and these fisheries are not expected to have large negative effects on the Gulf and Southeast ecosystems.

Hogfish caught in the Gulf of Mexico (Florida) by spear is rated **Green/Best Choice**, while handline fisheries in the Gulf of Mexico is rated **Yellow/Good Alternative**. All other hogfish caught in the Western Central Atlantic by spear and handline and hogfish landed in Puerto Rico by spear are rated as **Red/Avoid**.

## Final Seafood Recommendations

| SPECIES \| FISHERY | CRITERION 1 TARGET SPECIES | CRITERION 2 OTHER SPECIES | CRITERION 3 MANAGEMENT | CRITERION 4 HABITAT | OVERALL RECOMMENDATION |
|---|---|---|---|---|---|
| Hogfish \| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 3.831 | 1.343 | 3.000 | 3.571 | **Good Alternative (2.724)** |
| Hogfish \| Western Central Atlantic \| Hand implements \| United States \| Florida | 2.159 | 1.414 | 3.000 | 3.571 | **Avoid (2.391)** |
| Hogfish \| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | 2.159 | 1.343 | 3.000 | 3.571 | **Avoid (2.360)** |
| Hogfish \| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | 2.159 | 1.343 | 3.000 | 3.571 | **Avoid (2.360)** |
| Hogfish \| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | 2.159 | 1.414 | 1.000 | 3.571 | **Avoid (1.817)** |
| Hogfish \| Western Central Atlantic \| Hand implements \| United States \| North Carolina | 2.159 | 1.414 | 3.000 | 3.571 | **Avoid (2.391)** |
| Hogfish \| Western Central Atlantic \| Hand implements \| United States \| South Carolina | 2.159 | 1.732 | 3.000 | 3.571 | **Avoid (2.515)** |
| Hogfish \| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | 3.831 | 3.053 | 3.000 | 3.571 | **Best Choice (3.345)** |
| Hogfish \| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 2.159 | 1.343 | 3.000 | 3.571 | **Avoid (2.360)** |

**Scoring Guide**

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/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores

**Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores

**Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

# Introduction

**Scope of the analysis and ensuing recommendation**

This report evaluates the U.S. fisheries for hogfish *(Lachnolaimus maximus)* in the Gulf of Mexico, East Florida, the Carolinas, and Puerto Rico. Most hogfish are caught by divers using spears, followed by handlines.

**Species Overview**

Hogfish is part of the wrasse family of fishes (Labridae). It is found in the western Atlantic from North Carolina to northern South America, including throughout the Gulf of Mexico and Caribbean seas. Juvenile hogfish live in nearshore habitats such as estuaries, seagrass beds, or shallow reef habitats (Ault et al. 2003). As hogfish grows and begins to sexually mature, it migrates from these nursery areas to offshore areas (McBride and Johnson 2007). Adult hogfish live in hard-bottom habitats or coral reefs, and have been observed as deep as 65 meters (Collins and McBride 2011)(Munoz et al. 2010). Adults seem to have limited home ranges and show high site fidelity (Colin 1982) (Lindholm et al. 2006) (Munoz et al. 2010). Hogfish is a sequential hermaphrodite, which means it first sexually matures as female and later change sex to male (McBride and Johnson 2007).

Recent genetic research of hogfish indicates that there are at least three distinct stocks: Eastern Gulf of Mexico (Florida Panhandle to the Florida Keys), Florida Keys and East Florida, and Georgia to North Carolina (Seyoum et al. 2014). There is a lack of information on the stock structure in the western Gulf of Mexico and the Caribbean. The U.S. hogfish fisheries are managed by the South Atlantic Fishery Management Council, the Gulf of Mexico Fishery Management Council, and the Caribbean Fishery Management Council, as well as by state governments in state waters.

**Production Statistics**

In the U.S. mainland, commercial catches of hogfish peaked in the early 1990s at around 160,000 lbs (75 metric tons [MT]). Since then, catches have declined, ranging from 50,000 to 90,000 lbs (20 to 40 MT) from 2010 to 2014 (NMFS 2016a). About half the catch is taken off the West Coast of Florida, 30%–40% of the catch is taken off the coasts of North and South Carolina, and around 15% of the catch is taken off East Florida. The majority of hogfish (60%–80%) are caught by divers using spears, followed by handlines (20%–35% of the catch). Other gears (e.g., pots and traps) account for only a small percentage of the catch (Cooper et al. 2014) (NMFS 2016a).

There is a large recreational fishery for hogfish in Florida, which accounts for approximately 80% of total hogfish catches (commercial plus recreational) each year. From 2001 to 2014, annual recreational catches are estimated to have ranged from 150,000 to 500,000 lbs (70 to 230 MT) (NMFS 2016b).

In the U.S. Caribbean, hogfish is part of the "wrasse unit" that includes puddingwife and Spanish hogfish. But hogfish accounts for nearly all the "wrasse unit" catches (CFMC and NOAA 2011). In Puerto Rico, hogfish commercial catches ranged from 50,000 to 130,000 lbs from 2000 to 2009 and averaged 80,000 lbs (CFMC and NOAA 2011). In recent years, hogfish catches have been around 60,000 lbs (CFMC 2016). Hogfish in Puerto Rico is caught primarily by divers using spears (CFMC and NOAA 2014a) (Dolan 2015). Around 2,000 lbs of hogfish are caught in fisheries in the U.S. Virgin Islands (not covered in this assessment) (CFMC 2016). Hogfish is not directly targeted in the U.S. Virgin Islands but is an incidental catch in fisheries for other reef fish (CFMC and NOAA 2014a).

**Importance to the US/North American market.**

Hogfish is caught and sold by commercial fishers in the United States, the Caribbean, and Mexico. The amount of hogfish imported or exported by the U.S. is unavailable (NMFS 2016a).

**Common and market names.**

Hogfish is also called hog snapper.

**Primary product forms**

Hogfish is marketed both fresh and frozen.

# Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

## Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

**Guiding Principles**

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

# Criterion 1 Summary

| HOGFISH | | | | |
|---|---|---|---|---|
| **REGION / METHOD** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Best Choice (3.831) |
| Western Central Atlantic \| Hand implements \| United States \| Florida | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Best Choice (3.831) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Avoid (2.159) |

The International Union for the Conservation of Nature (IUCN) has assessed hogfish as "Vulnerable" because of a 30% decline in the global population. A more recent assessment of the U.S. South Atlantic and Gulf of Mexico hogfish was conducted in 2014, with updates for the Gulf of Mexico stock published in 2018. The assessment divided hogfish in U.S. mainland waters into three stocks: Eastern Gulf of Mexico (Florida Panhandle to the Florida Keys), Florida Keys and East Florida, and Georgia to North Carolina. The assessment determined that the Eastern Gulf of Mexico stock is not overfished and that fishing levels on this stock are likely sustainable, while the Florida Keys/East Florida stock is

overfished/depleted and fishing levels on hogfish in this region appear to be fluctuating around sustainable levels. The status of the Georgia to North Carolina stock could not be determined, but it is possible that this population is overfished/depleted. There has been no formal assessment of U.S. Caribbean hogfish, but a data-limited assessment of Puerto Rico reef fish suggests that hogfish is likely overexploited. Additionally, hogfish catches in Puerto Rico have exceeded established catch limits in recent years.

# Criterion 1 Assessments

SCORING GUIDELINES

**Factor 1.1 - Abundance**

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

**Factor 1.2 - Fishing Mortality**

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

# Hogfish

**Factor 1.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**High**
FishBase has assigned a high vulnerability score of 67 out of 100 to hogfish {Froese and Pauly 2014} and the International Union for the Conservation of Nature (IUCN) considers it a "Vulnerable" species (Choat et al. 2010). Hogfish can live to 23 years of age and grow to around 80 cm in length. Hogfish in the Gulf of Mexico and off the Carolinas live to older ages and grow to larger sizes than those off the eastern/southern coast of Florida (McBride et al. 2001) (McBride and Richardson 2007). It is thought that the lower maximum age and size observed for hogfish off the eastern/southern coast of Florida is a consequence of intense fishing in this region and the removal of the largest individuals (Ault et al. 2003) (McBride and Richardson 2007). Hogfish is a high-level predator in the food chain, primarily eating mollusks (e.g., clams), crabs, and sea urchins {Froese and Pauly 2014}.

Hogfish is a sequential hermaphrodite, which means that it first sexually matures as female and then transitions to male later in life. Females reach sexual maturity at an average age of 1 to 1.5 years and an average length of 15–19 cm (McBride et al. 2008) (Collins and McBride 2011). Sexual transition from female to male is believed to be controlled by social dynamics. Transition from female to male can occur at 1–11 years of age and 20–70 cm in length (Collins and McBride 2011). The transition from female to male is slow and can take several months (McBride and Johnson 2007). On average, males reach sexual maturity at 6.5 to 7 years of age and 41–43 cm in length (McBride and Johnson 2007). Hogfish forms small, temporary spawning aggregations, and it is typically easy to catch by divers because of its curious nature, potentially making it particularly vulnerable to spearfishing (Choat et al. 2010) (Munoz et al. 2010). Spawning occurs over several months in the winter and spring, with females producing 1,000 to 64,000 eggs in a spawning season (McBride et al. 2008) (Collins and McBride 2011).

**Factor 1.2 - Abundance**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**High Concern**
The International Union for the Conservation of Nature (IUCN) assessed hogfish as "Vulnerable" in 2010 because of a 30% decline in the global population (Choat et al. 2010). There has been no formal population assessment of hogfish specific to the U.S. Caribbean region, so hogfish abundance in this area is unknown (NMFS 2016c). But a recent data-limited assessment of Puerto Rico reef fish suggests that hogfish is likely overexploited (Ault and Smith 2015). Limited data exist beyond this assessment. Because of the uncertain abundance of hogfish in the Caribbean, the IUCN listing, and hogfish's high vulnerability to fishing, we have scored abundance as "high" concern.

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Low Concern**
The International Union for the Conservation of Nature (IUCN) assessed hogfish as "Vulnerable" in 2010 because of a 30% decline in the global population (Choat et al. 2010). A more recent assessment of the U.S. South Atlantic and Gulf of Mexico hogfish populations was conducted in 2016, with updates in 2018 (Addis et al. 2018). The assessment indicated that hogfish abundance in the Eastern Gulf of Mexico was relatively constant from 1986 to 2005 and has increased since 2006 (Addis et al. 2018). The recent rise in abundance is due to a high number of new fish or recruits that entered the population in 2006. Additionally, it has been hypothesized that a large number of new fish entered the population in 2012 (Cooper et al. 2014). Based on the updated assessment, estimated abundance is about 50% of virgin or unfished biomass and stock is above the target reference point of $SSB/MSST_{30\%}$ (Addis et al. 2018). This population is not considered to be depleted/overfished, but there is a large amount of uncertainty in these results because of the limited data that were available for use in the assessment. Because the abundance estimates are highly uncertain but this population is unlikely to be overfished (NMFS 2020), we have awarded a "low" concern score.

**Justification:**
An addendum to the update of the SEDAR 37 benchmark assessment of the West Florida Shelf (WFL) Hogfish stock was made in 2018. This addendum uses the MSST definition has been updated by Amendment 44 to an MSST = 50% of SSB30% SPR (Addis et al. 2018).

| Parameter/Quantity | Continuity Run | Bootstrap Runs | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2.5% | 25% | 50% | 75% | 97.5% | Mean | SD |
| SSB_Virgin | 2747.58 | 2189.35 | 2407.5 | 2534.52 | 2701.12 | 3058.46 | 2556.79 | 218.54 |
| SSB_2016 | 1762.71 | 924.03 | 1135.12 | 1269.49 | 1419.32 | 1722.87 | 1282.00 | 205.67 |
| MSY | 81.31 | 58.23 | 65.17 | 70.22 | 75.37 | 86.36 | 70.76 | 7.28 |
| SPR | 0.17 | 0.053 | 0.09 | 0.13 | 0.18 | 0.29 | 0.14 | 0.07 |
| R0 | 463.025 | 368.95 | 405.71 | 427.12 | 455.20 | 515.41 | 430.87 | 36.83 |
| Steepness | 0.87 | 0.77 | 0.80 | 0.82 | 0.84 | 0.86 | 0.82 | 0.025 |
| FMSY | 0.17 | 0.11 | 0.12 | 0.13 | 0.14 | 0.16 | 0.13 | 0.014 |
| F/FMSY | 0.30 | 0.32 | 0.42 | 0.49 | 0.57 | 0.76 | 0.50 | 0.12 |
| MSSTMSY | 222.92 | 199.55 | 228.92 | 241.35 | 255.92 | 289.49 | 242.72 | 22.04 |
| SSB/MSSTMSY | 7.90 | 3.87 | 4.83 | 5.31 | 5.79 | 6.54 | 5.28 | 0.69 |
| F30% | 0.096 | 0.095 | 0.096 | 0.097 | 0.098 | 0.099 | 0.097 | 0.0009 |
| F/F30% | 0.51 | 0.46 | 0.59 | 0.68 | 0.78 | 0.96 | 0.68 | 0.13 |
| MSST30% | 373.69 | 272.38 | 308.14 | 329.60 | 352.45 | 401.62 | 331.48 | 32.4 |
| SSB/MSST30% | 4.71 | 3.08 | 3.62 | 3.85 | 4.08 | 4.59 | 3.86 | 0.38 |

Figure 1: Estimates of parameters, derived quantities, BRPs, and stock status from both the continuity run and bootstrap analyses for the WFL stock continuity model configuration. WHERE: MSST = (0.5)*SSBREFERENCE (SSBREFERENCE: SSBMSY, SSB30%). From Addis et al. 2018.

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**High Concern**
The International Union for the Conservation of Nature (IUCN) assessed hogfish as "Vulnerable" in 2010 because of a 30% decline in the global population (Choat et al. 2010). A more recent assessment of the U.S. Gulf of Mexico and South Atlantic hogfish stocks was conducted in 2014. The assessment indicated that the abundance of the Florida Keys/East Florida hogfish stock has been low since the mid-1980s. Abundance declined slightly from the mid-1980s through 2000 but has remained relatively stable since. Current abundance is estimated to be at only 7.5% of the virgin or unfished abundance level (Cooper et al. 2014). There is high uncertainty with the assessment because of limited data; however, all abundance estimates indicated that this stock is overfished (Cooper et al. 2014) (NMFS 2020). Previous evaluations of hogfish in South Florida/Florida Keys have also suggested that hogfish in this region is highly depleted (Ault et al. 2004) (Ault et al. 2005) (Smith et al. 2011). We have awarded a "high" concern score.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**High Concern**
The International Union for the Conservation of Nature (IUCN) assessed hogfish as "Vulnerable" in 2010 because of a 30% decline in the global population (Choat et al. 2010). A more recent assessment of the U.S. South Atlantic and Gulf of Mexico hogfish stocks was conducted in 2014. The assessment indicated that the abundance of the Georgia to North Carolina hogfish stock has varied over the years and has most recently declined. Some abundance estimates from the assessment suggested that the stock is overfished, while others suggested it is not. Current abundance was estimated between 20% and 30% of the virgin or unfished abundance level. There was a high degree of uncertainty in the assessment results, particularly for this stock, because of limited data (Cooper et al. 2014). Overall, NOAA Fisheries considers the status of this stock unknown (NMFS 2020). Because hogfish is vulnerable to fishing and abundance is unknown, we have awarded a score of "high" concern.

**Factor 1.3 - Fishing Mortality**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**

There has been no formal population assessment of hogfish for the U.S. Caribbean. But an independent data-limited assessment of Puerto Rico reef fishes was conducted in 2014, and hogfish fishing mortality was assessed as unsustainable. The average fishing mortality rate from 2010 to 2013 was estimated to be 50% above the fishing mortality at maximum sustainable yield ($F/F_{MSY}$ = 1.55), and fishing mortality was estimated to have been above sustainable levels since the late 1980s (Ault and Smith 2015).

In Puerto Rico, hogfish is managed within a "wrasse" complex, which includes two other species, Spanish hogfish and puddingwife, but hogfish accounts for nearly all the wrasse unit catches (NOAA 2011). Catch limits are in place for the commercial and recreational wrasse fisheries in Puerto Rico, but they are based on average catches rather than the maximum sustainable catch (CFMC and NOAA 2011). Additionally, the catch limits have been exceeded in several years, and in 2016, NOAA fisheries listed hogfish as experiencing overfishing because catch levels exceeded the established overfishing limit (CFMC 2016) (NMFS 2016c). However, the wrasses complex was removed from the overfishing list in 2017 and is still not undergoing overfishing in 2020 (NMFS 2020). Because hogfish was only recently removed from the overfishing list, F may be fluctuating around sustainable levels, and a "moderate" concern is awarded.

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Low Concern**

The most recent assessment of hogfish indicates that the Eastern Gulf of Mexico population is not experiencing overfishing (Addis et al. 2018). Fishing mortality was determined to be less than the fishing mortality at maximum sustainable yield ($F_{MSY}$); however, there is a large amount of uncertainty in the fishing mortality estimate because of limited and uncertain data.

In 2019, 86% of the hogfish catches in this area were taken by the recreational fishery and 14% by the commercial fishery. Catch limits are in place for the commercial and recreational hogfish fisheries, though these limits have occasionally been exceeded (NMFS SERO 2016). Total landings were 50.9% of the ACL in 2019 (NMFS SERO 2019). Because it is probable that overfishing is not occurring on this population but there is some uncertainty, we have awarded a "low" concern score.

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderate Concern**

NOAA Fisheries recently removed hogfish in the Eastern Florida region from the overfishing list (NMFS 2019). However, in the most recent full stock assessment, fishing mortality on hogfish in the Eastern Florida/Florida Keys region was well above the target level of fishing at maximum sustainable yield ($F/F_{MSY}$ = 1.59) (Cooper et al. 2014). Fishing mortality in the Georgia-Carolinas region was estimated as only slightly above the target level ($F/F_{MSY}$ = 1.17) (Cooper et al. 2014); however, results were uncertain for this population. (NOAA 2016). Hogfish is commonly targeted by both commercial and recreational fishers using spears, vertical lines, and pots/traps. The most recent stock assessment indicates that overfishing is occurring on the Eastern Florida/Florida Keys stock, but catch data suggests that current fishing levels are sustainable (i.e. below annual catch limits). Because hogfish was only recently removed from the overfishing list, F may be fluctuating around sustainable levels, and a "moderate" concern is awarded.

**Justification:**

In 2014, 75% of the hogfish catches in this area were taken by the recreational fishery and 25% by the commercial fishery. Catch limits are in place for the commercial and recreational hogfish fisheries, but these limits have occasionally been exceeded (NMFS SERO 2016). A recent amendment to the Snapper Grouper Fishery splits South Atlantic hogfish into two stocks, and includes regulations aimed at rebuilding the stock and curtailing overfishing (Federal Register 2016).

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Moderate Concern**

The most recent assessment of hogfish indicates that the Georgia to North Carolina stock could be experiencing overfishing, especially in recent years, but these results are confounded by a lack of data (Cooper et al. 2014) (Cooper et al. 2014). Relatively large individual fish and low total landings in this region (SAFMC 2016) suggest a comparatively healthy stock with low fishing pressure. Because results of the SEDAR assessment were highly uncertain, NOAA Fisheries considers fishing mortality on this population unknown (NMFS 2020). All commercial fishing for hogfish on this population occurs off the North and South Carolina coasts; no catches are taken off the Georgia coast. Limited diver-based fishing occurs off SC and NC, compared to the FL Keys stock. Implementation of Amendment 37 to the

Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region splits the South Atlantic stock into two stocks and is likely to curtail overfishing (SAFMC 2016) (Federal Register 2016).

Because fishing mortality on this population is uncertain but management is in place, we have awarded a score of "moderate" concern.

## Criterion 2: Impacts on Other Species

*All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:*

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

*Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical*

**Guiding Principles**

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

# Criterion 2 Summary

**Criterion 2 score(s) overview**

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

| HOGFISH | | | |
|---|---|---|---|
| **REGION / METHOD** | **SUB SCORE** | **DISCARDS+BAIT / LANDINGS** | **SCORE** |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 1.414 | 0.950: 20-40% | Red (1.343) |
| Western Central Atlantic \| Hand implements \| United States \| Florida | 1.414 | 1.000: < 20% | Red (1.414) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | 1.414 | 0.950: 20-40% | Red (1.343) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | 1.414 | 0.950: 20-40% | Red (1.343) |
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | 1.414 | 1.000: < 20% | Red (1.414) |
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | 1.414 | 1.000: < 20% | Red (1.414) |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | 1.732 | 1.000: < 20% | Red (1.732) |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | 3.053 | 1.000: < 20% | Yellow (3.053) |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 1.414 | 0.950: 20-40% | Red (1.343) |

**Criterion 2 main assessed species/stocks table(s)**

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

CARIBBEAN SEA | ATLANTIC, WESTERN CENTRAL | HAND IMPLEMENTS | PUERTO RICO

SUB SCORE: 1.414 | DISCARD RATE: 1.000 | **SCORE: 1.414**

| SPECIES | INHERENT VULNERABILITY | ABUNDANCE | FISHING MORTALITY | SCORE |
|---|---|---|---|---|
| Queen triggerfish | 2.000: Medium | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Schoolmaster | 2.000: Medium | 3.000: Moderate Concern | 1.000: High Concern | Red (1.732) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Red hind | 2.000: Medium | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |
| Stoplight parrotfish | 3.000: Low | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |

GULF OF MEXICO | ATLANTIC, WESTERN CENTRAL | HAND IMPLEMENTS | UNITED STATES | FLORIDA

SUB SCORE: 3.053 | DISCARD RATE: 1.000 | **SCORE: 3.053**

| SPECIES | INHERENT VULNERABILITY | ABUNDANCE | FISHING MORTALITY | SCORE |
|---|---|---|---|---|
| Gray snapper | 2.000: Medium | 4.000: Low Concern | 2.330: Moderate Concern | Yellow (3.053) |
| Hogfish | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |
| Gag | 1.000: High | 3.000: Moderate Concern | 5.000: Very Low Concern | Green (3.873) |
| Red grouper | 1.000: High | 4.000: Low Concern | 5.000: Very Low Concern | Green (4.472) |

GULF OF MEXICO | ATLANTIC, WESTERN CENTRAL | HANDLINES AND HAND-OPERATED POLE-AND-LINES | UNITED STATES | FLORIDA

SUB SCORE: 1.414 | DISCARD RATE: 0.950 | **SCORE: 1.343**

| SPECIES | INHERENT VULNERABILITY | ABUNDANCE | FISHING MORTALITY | SCORE |
|---|---|---|---|---|
| Greater amberjack | 2.000: Medium | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Red snapper | 1.000: High | 2.000: High Concern | 3.670: Low Concern | Yellow (2.709) |
| Gray snapper | 2.000: Medium | 4.000: Low Concern | 2.330: Moderate Concern | Yellow (3.053) |
| Hogfish | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |
| Gag | 1.000: High | 3.000: Moderate Concern | 5.000: Very Low Concern | Green (3.873) |
| Red grouper | 1.000: High | 4.000: Low Concern | 5.000: Very Low Concern | Green (4.472) |
| Vermilion snapper | 2.000: Medium | 5.000: Very Low Concern | 5.000: Very Low Concern | Green (5.000) |
| Yellowtail snapper | 2.000: Medium | 5.000: Very Low Concern | 5.000: Very Low Concern | Green (5.000) |

WESTERN CENTRAL ATLANTIC | HAND IMPLEMENTS | UNITED STATES | FLORIDA

SUB SCORE: 1.414 | DISCARD RATE: 1.000 | **SCORE: 1.414**

| SPECIES | INHERENT VULNERABILITY | ABUNDANCE | FISHING MORTALITY | SCORE |
|---|---|---|---|---|
| Red grouper | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Gray snapper | 2.000: Medium | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |
| Yellowtail snapper | 2.000: Medium | 5.000: Very Low Concern | 5.000: Very Low Concern | Green (5.000) |

| WESTERN CENTRAL ATLANTIC \| HAND IMPLEMENTS \| UNITED STATES \| NORTH CAROLINA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.414 | DISCARD RATE: 1.000 | | **SCORE: 1.414** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Red grouper | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Scamp | 2.000: Medium | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| Gag | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |

| WESTERN CENTRAL ATLANTIC \| HAND IMPLEMENTS \| UNITED STATES \| SOUTH CAROLINA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.732 | DISCARD RATE: 1.000 | | **SCORE: 1.732** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Greater amberjack | 2.000: Medium | 3.000: Moderate Concern | 1.000: High Concern | Red (1.732) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Scamp | 2.000: Medium | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| Gag | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |

| WESTERN CENTRAL ATLANTIC \| HANDLINES AND HAND-OPERATED POLE-AND-LINES \| UNITED STATES \| FLORIDA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.414 | DISCARD RATE: 0.950 | | **SCORE: 1.343** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Red grouper | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Red porgy | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Gray snapper | 2.000: Medium | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |
| Gray triggerfish | 2.000: Medium | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |
| White grunt | 1.000: High | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| Black grouper | 1.000: High | 3.000: Moderate Concern | 5.000: Very Low Concern | Green (3.873) |
| Vermilion snapper | 2.000: Medium | 5.000: Very Low Concern | 3.670: Low Concern | Green (4.284) |
| Mutton snapper | 1.000: High | 5.000: Very Low Concern | 5.000: Very Low Concern | Green (5.000) |
| Yellowtail snapper | 2.000: Medium | 5.000: Very Low Concern | 5.000: Very Low Concern | Green (5.000) |

| WESTERN CENTRAL ATLANTIC \| HANDLINES AND HAND-OPERATED POLE-AND-LINES \| UNITED STATES \| NORTH CAROLINA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.414 | DISCARD RATE: 0.950 | | **SCORE: 1.343** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Red grouper | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Red porgy | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Gray triggerfish | 2.000: Medium | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |

| WESTERN CENTRAL ATLANTIC \| HANDLINES AND HAND-OPERATED POLE-AND-LINES \| UNITED STATES \| NORTH CAROLINA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.414 | DISCARD RATE: 0.950 | | **SCORE: 1.343** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Scamp | 2.000: Medium | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| White grunt | 1.000: High | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| Gag | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |
| Vermilion snapper | 2.000: Medium | 5.000: Very Low Concern | 3.670: Low Concern | Green (4.284) |

| WESTERN CENTRAL ATLANTIC \| HANDLINES AND HAND-OPERATED POLE-AND-LINES \| UNITED STATES \| SOUTH CAROLINA | | | | |
|---|---|---|---|---|
| SUB SCORE: 1.414 | DISCARD RATE: 0.950 | | **SCORE: 1.343** | |
| **SPECIES** | **INHERENT VULNERABILITY** | **ABUNDANCE** | **FISHING MORTALITY** | **SCORE** |
| Red grouper | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Red porgy | 1.000: High | 2.000: High Concern | 1.000: High Concern | Red (1.414) |
| Greater amberjack | 2.000: Medium | 3.000: Moderate Concern | 1.000: High Concern | Red (1.732) |
| Hogfish | 1.000: High | 2.000: High Concern | 2.330: Moderate Concern | Red (2.159) |
| Almaco jack amberjack | 1.000: High | 3.000: Moderate Concern | 2.330: Moderate Concern | Yellow (2.644) |
| Scamp | 2.000: Medium | 3.000: Moderate Concern | 3.670: Low Concern | Green (3.318) |
| Gag | 1.000: High | 4.000: Low Concern | 3.670: Low Concern | Green (3.831) |
| Vermilion snapper | 2.000: Medium | 5.000: Very Low Concern | 3.670: Low Concern | Green (4.284) |

The North Carolina handline fishery captures vermilion snapper, scamp, red grouper, gag grouper, white grunt, red porgy, and gray triggerfish. The lowest-scoring species in the handline fishery is red grouper due to overfished and overfishing status. The North Carolina spear/diver fishery captures gag grouper, red grouper, and scamp; red grouper is both overfished and undergoing overfishing. The South Carolina handline fishery captures vermilion snapper, scamp, red grouper, gag grouper, red porgy, greater amberjack,and almaco jack. The lowest-scoring species in the handline fishery is red grouper, again due to overfished and overfishing status. The South Carolina diver/spear fishery captures gag grouper, scamp, and greater amberjack; there is high concern with the current level of fishing mortality on greater amberjack in this region.

The Florida Atlantic handline fishery captures vermilion snapper, yellowtail snapper, gray snapper, mutton snapper, red grouper, black grouper, white grunt, red porgy, and gray triggerfish, while the Florida Atlantic spear/dive fishery captures some gray snapper, yellowtail snapper, and red grouper. The lowest-scoring species is red grouper due to its overfished and overfishing status. The Florida Gulf handline fishery captures red snapper, gray snapper, yellowtail snapper, vermilion snapper, red grouper, gag grouper, and greater amberjack, while the Florida Gulf spear/dive fishery captures gag grouper, red grouper, and gray snapper. The lowest-scoring species in the handline fishery is greater amberjack, due its overfished and overfishing status, while the lowest scoring in the spear/diver fishery is gray snapper, due to moderate concern over its abundance.

In Puerto Rico dive fisheries, hogfish is targeted, but these trips also mainly land queen triggerfish, red hind, schoolmaster snapper, and stoplight parrotfish. The lowest-scoring species is queen triggerfish because it is "Near-threatened" and likely undergoing overfishing in Puerto Rico.

Discards in the handline fisheries are moderate, while discards in the spear fisheries are negligible. Data used to determine other target and bycatch species in these fisheries included Trip Interview Program (TIP) data, commercial dealer reports for species caught on trips that catch hogfish, and scientific literature {McKarthy 2014} (Scott-Denton et al. 2011) {Scott-Denton and Williams 2013} (GSAFFI 2008) (GSAFFI 2010) (GSAFFI 2013).

## Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
*(same as Factor 1.1 above)*

Factor 2.2 - Fishing Mortality
*(same as Factor 1.2 above)*

Factor 2.3 - Modifying Factor: Discards and Bait Use
Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

*Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.*

| Ratio of bait + discards/landings | Factor 2.3 score |
|---|---|
| <100% | 1 |
| >=100 | 0.75 |

# Almaco jack amberjack

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**High**
FishBase has assigned a high vulnerability rating (74 out of 100) to almaco jack (Froese and Pauly 2016). Almaco jack *(Seriola rivoliana)* is a large jack (Carangidae), reaching a maximum length of 160 cm and maximum weight of 60 kg (SAFMC 2015e)(Froese and Pauly 2016). The size at maturity is unknown. Almaco jack is associated with pelagic habitats near outer reef slopes and offshore banks to a depth of 160 m, and is found worldwide in tropical and subtropical waters (SAFMC 2015e). Juveniles aggregate around floating debris. Almaco jack primarily feeds on fish, and has been known to harbor ciguatoxin in coral reef areas (Froese and Pauly 2016).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**Moderate Concern**
The International Union for the Conservation of Nature (IUCN) considers almaco jack to be a species of "Least Concern" (Smith-Vaniz et al. 2015). It has expanded its range along the European Coast with warming water temperatures (Querro 1998), but data for the East Coast of the U.S. are lacking. Almaco jack in the U.S. South Atlantic region is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery. No formal stock assessment has been completed for almaco jack, but the population is currently under assessment in combination with other data-limited species (SEDAR 2016). Almaco jack is managed under the South Atlantic Jacks Complex, for which NOAA Fisheries lists both overfishing and overfished status as unknown (NMFS 2016c). Given the "Least Concern" assessment by the IUCN but unknown abundance in the U.S. South Atlantic, we are awarding "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**Moderate Concern**
Fishing mortality status for almaco jack is unknown. Almaco jack in the U.S. South Atlantic region is commonly targeted by commercial fishers and headboats using vertical lines as part of a multispecies snapper-grouper fishery (Stephen and Harris 2010). NOAA reports that total commercial landings of jacks as a group declined from 1999 to 2002, while recreational catch increased during this period (NOAA SERO 2005) and almaco jack made up 6% of the total landings. Commercial landings of almaco jack in 2014 for the South Atlantic region were 170,148 lbs (NMFS 2016a), while recreational data were unavailable for this period. Given the unknown fishing mortality on almaco jack in the South Atlantic, we are awarding "moderate" concern.

# Black grouper

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**High**
The FishBase inherent vulnerability score for black grouper is 63 (Froese and Pauly 2016), corresponding to a "high" inherent vulnerability. Black grouper is a slow-growing, large-bodied predatory species, known to live over 30 years. It is a protogynous hermaphrodite, first sexually maturing as a male and then changing to female later in life (SAFMC 2012). Black grouper *(M. bonaci)* in the southeastern United States is primarily found in southern Florida and the Florida Keys, although it has been recorded from Massachusetts to Texas. Its distribution extends to southeastern Brazil and east to Bermuda. It is are associated with rocky ledges and coral reefs from 10 to 100 m (SEDAR 2010b).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderate Concern**
The International Union for the Conservation of Nature (IUCN) lists black grouper as "Near Threatened" (Ferreira et al. 2008). In the U.S., black grouper in the South Atlantic and Gulf of Mexico regions are considered to compose a single stock, and the last assessment was in 2010. According to this assessment, black grouper is not overfished, with spawning stock biomass above the target abundance reference point ($SSB_{2008}/SSB_{MSY}$ proxy = 1.40) (SEDAR 2010b). We have awarded a score of "moderate" concern because the stock assessment is no longer considered to contain reliable data per the Seafood Watch Standard (see details below).
**Justification:**
The Seafood Watch Standard (version F2) defines reliable data as "Data produced or verified by an independent third party. Reliable data may include government reports, peer-reviewed science, audit reports, etc. Data are not considered reliable if significant scientific controversy exists over the data, or if data are old or otherwise unlikely to represent current conditions (e.g., survey data is several years old and fishing mortality has increased since the last survey)." Given that the stock assessment for black grouper is more than ten years old, the overfished determination may no longer reliably represent the status of black grouper.

A new benchmark, originally scheduled for 2015, was delayed until 2017, and has since been delayed again due to concerns over allocation of misreported gag landings in the early years of reporting (pers. comm., J. Byrd, SEDAR, 5/5/2017) and changes to management in both regions that complicated index development (pers. comm., J. Stephen, NMFS, 8/2/2018). The most recent stock assessment is therefore the 2010 benchmark (SEDAR 2010b).

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**
U.S. black grouper is not experiencing overfishing (NMFS 2016c). The most recent stock assessment estimated fishing mortality to be well below the fishing mortality at maximum sustainable yield proxy ($F/F_{MSY}$ proxy = 0.50) (SEDAR 2010b). Although there has not been an updated stock assessment since 2010, landings have remained below ACL's in recent years (NMFS SERO 2019). We have therefore awarded a "very low" concern score.

# Gag

**Factor 2.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**High**
FishBase has assigned a high vulnerability rating (68 out of 100) to gag grouper (Froese and Pauly 2016). Gag grouper *(Mycteroperca microlepis)* is a medium-sized grouper that can reach 145 cm in length. Gag grouper is a protogynous hermaphrodite that reaches sexual maturity as female at approximately 50 cm size, and then later metamorphoses into male (Froese and Pauly 2016). Adult gag grouper are found associated with coral reefs and rocky ledges from North Carolina to the Yucatan Peninsula and throughout the Gulf of Mexico, where they feed on smaller fish, crustaceans, and squid (Froese and Pauly 2016) (GMFMC 2015c). Spawning takes place from January to March in the Gulf of Mexico, and juveniles aggregate in shallow seagrass beds (Casey et al. 2007) {Switzer et al. 2012}.

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderate Concern**
The International Union for the Conservation of Nature (IUCN) considers gag grouper to be a species of "Least Concern" {Bertoncini et al. 2008a}. Gag grouper in the Gulf of Mexico is managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan, and the most recent stock assessment was published in 2014 (SEDAR 2014b). This assessment published two estimates of spawning stock biomass: one used female fish only and produced an estimate of spawning stock biomass at twice the limit reference point ($SSB_{FEMALES}$/MSST = 2.05 (SEDAR 2014b)), whereas the second used combined female and male fish and produced an estimate of combined spawning stock as below the limit reference point ($SSB_{COMBINED}$/MSST = 0.496 (SEDAR 2014b)). The first estimate (females only) indicates that this stock is not overfished, but the assessment review panel recommended using the second (combined females and males) because it is the more conservative estimate and does indicate that the stock is overfished (SEDAR 2014b). NOAA Fisheries reports Gulf of Mexico gag grouper as not overfished (NOAA 2016), which is based on the 2014 assessment but uses the less conservative estimate. Given the vastly different abundance estimates and uncertainty as to which estimate is more appropriate, we have rated abundance a "moderate" concern.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Low Concern**
The International Union for the Conservation of Nature (IUCN) considers gag grouper to be a species of "Least Concern" (Bertoncini et al. 2008). Gag grouper along the South Atlantic Coast is managed by the U.S. South Atlantic Fishery Management Council under the Snapper-Grouper Fishery. The most recent stock assessment found that South Atlantic gag grouper spawning stock biomass is above the minimum stock size threshold (SSB/MSST = 1.13) as of 2012, indicating that the population is not overfished (SEDAR 2014). There is high confidence in this estimate, with 97.5% of model runs indicating that the population is not overfished (SEDAR 2014). Spawning stock biomass was found to be near but just below the target level of biomass at maximum sustainable yield ($SSB/SSB_{MSY}$ = 0.97 (SEDAR 2014)). But the assessment indicated that abundance is projected to decline after 2012 because of poor recruitment from 2010 to 2011. Because the South Atlantic gag grouper population is not overfished, but abundance is below the target level and potentially declining, we have awarded a "low" concern score.

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Very Low Concern**
Gag grouper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. In the Gulf of Mexico, 687,655 lbs of gag grouper were caught in the commercial fishery and 926,510 lbs were caught in the recreational fishery in 2014 (NMFS 2016a) (NMFS 2016b). The most recent assessment for Gulf of Mexico gag grouper indicates that fishing mortality is below the fishing mortality at maximum sustainable yield ($F/F_{MSY}$ = 0.765); therefore, gag grouper is not experiencing overfishing (SEDAR 2014b) (NMFS 2016c). The assessment also indicated that fishing mortality has declined substantially from peak levels in 2008 (SEDAR 2014b). Because it is highly likely that overfishing is not occurring, this factor is scored "very low" concern.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Low Concern**
The 2014 stock assessment for U.S. South Atlantic gag grouper indicated that the average fishing mortality for the years 2010–2012 exceeded the target level of fishing at maximum sustainable yield ($F/F_{MSY}$ = 1.23), indicating that overfishing was occurring (SEDAR 2014). But the South Atlantic Council's Scientific and Statistical Committee (SSC) noted that the fishing mortality rate for 2012, and the projected fishing mortality rate in 2013 based on the actual landings, suggested that overfishing did not occur in 2012 and 2013. Additionally, after the 2014 assessment, managers took action to revise the annual catch limit for gag grouper for the 2015–2019 fishing years to ensure that overfishing does not occur in the future (Federal Register 2015). NOAA Fisheries currently considers gag grouper in the South Atlantic to be no longer experiencing overfishing (NMFS 2016c), but a new assessment has yet to be completed. Gag grouper is commonly targeted by commercial fishers using vertical lines, as well as by divers, and by headboat and private recreational fishers using vertical lines. In 2014, 380,252 lbs of gag grouper were caught in the commercial fishery and 177,606 lbs were caught in the recreational fishery in the South Atlantic (NMFS 2016a) (NMFS 2016b). Because of the recent suggestion that overfishing on South Atlantic gag grouper is no longer occurring, we have rated this factor a "low" concern.

# Gray snapper

**Factor 2.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Medium**
Gray snapper is considered moderately vulnerable to fishing, with a FishBase score of 40 out of 100 (Froese and Pauly 2016). Sexual maturity is reached at 9.1 inches fork length (FL) for females and 8.7 inches FL for males (Starck and Schroeder 1971)(Manooch and Matheson 1981). Maximum size is estimated to be approximately 90 cm TL (total length) (Bortone and Williams 1986) and individuals can reach at least 28 years of age (Fischer et al. 2005). Larger females produce more eggs, and several fecundity estimates (# of eggs) range from 600,000 to 6,000,000 (Bortone and Williams 1986) per female, but more recent updates on fecundity are unavailable. Differences in life-history traits (such as size and age) between areas with different levels of fishing pressure (e.g., North vs. South Florida) suggest that demography changed as a result of exploitation (Manooch and Matheson 1981) (Burton 2001) (Allman and Goetz 2009). Adults are found offshore, associated with reef structures and hard bottoms (Bortone and Williams 1986), while juveniles are estuarine-dependent and are commonly associated with seagrass and mangrove habitats (Flaherty 2014).

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Low Concern**
Three genetically distinct gray snapper populations exist: the northwest Gulf, northcentral/northeastern Gulf, and the south Atlantic (east coast of Florida) (Gold 1998). Grey snapper was assessed for the first time in the Gulf of Mexico in 2018 under an integrated statistical catch-at-age model (Stock Synthesis 3) (SEDAR 2018). Stock status reference points are based on an MSY-proxy, SPR30%, the minimum stock size threshold (MSST) is 50% SSB_SPR 30, and the maximum fishing mortality threshold (MFMT) is $F_{30\%SPR}$. Based on these new reference points, the stock is not overfished ($SSB_{2015}/SSB_{SPR30}$ = 0.703) and has not been since 1995. However, the stock has experienced a continuous decline in total biomass and egg production and is now estimated to be at the lowest annual value (SEDAR 2018).

Since a recent stock assessment shows that the gray snapper biomass is above the LRP, but is below 75% of the TRP, Seafood Watch scores abundance as a "low" concern.
**Justification:**
The stock assessment suggests that total biomass and egg production have decreased throughout the time series, and are currently at or around the lowest annual value. Management regulations were implemented in 1990 to protect the stock; however, there has been little improvement in the stock biomass. It is unclear why this increase has not occurred, but the stock assessment has suggested that unexpectedly high discards in both the commercial and recreational fleets following size limit regulations may be a key contributor (SEDAR 2018).

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderate Concern**
At least two genetically distinct gray snapper populations exist: the Gulf of Mexico and the South Atlantic (SEDAR 2017b). No formal stock assessments have been conducted for the South Atlantic population, though gray snapper is a species that has been well studied in recent years (FWRI 2011) (FWRI 2011b) (Flaherty 2014) (Flaherty-Walia et al. 2015). Despite research, no target abundance or reference points have been defined (NMFS 2016c). Some scientific studies have suggested that high fishing levels in South Florida have reduced biomass and spawning potential to low levels, and that gray snapper in this area was overfished (Ault et al. 1998) (Ault et al. 2005). The area of South FLorida likely includes fish from both the northeastern Gulf and South Atlantic populations because the Florida Keys represent a common boundary between them. Because the abundance level of gray snapper is unknown, and this species has a moderate inherent vulnerability to fishing, abundance is rated a "moderate" concern. "

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderate Concern**

According to the most recent stock assessment, gray snapper in the Gulf of Mexico is undergoing overfishing and the stock has generally been experiencing overfishing since 1976 ($F_{current}/F_{SPR30}$ = 1.20), where $F_{current}$ is the average fishing mortality rate from 2013-2015 (SEDAR 2018). However, based on the most recent catch data, NOAA has determined that gray snapper is no longer undergoing overfishing (NMFS 2020). Landings have not exceed the ACL in any year since the gray snapper ACL was implemented in 2012. However, landings in 2014 and 2016 did exceed the ACLs proposed in Amendment 51 (see details below). Because there is conflicting information on the sustainability of fishing levels, we have awarded a "moderate" concern score.

**Justification:**

NMFS is currently reviewing the GMFMC's proposed Amendment 51 to the Fishery Management Plan (FMP) for the Reef Fish Resources of the Gulf of Mexico (GMFMC 2019). The purpose of Amendment 51 is to end overfishing by modifying status determination criteria and harvest levels for gray snapper in the Gulf of Mexico. Under this proposed rule, the overfishing limit (OFL), acceptable biological catch (ABC) and annual catch limit (ACL) would change as shown below. The current maximum fishing mortality threshold (MFMT) is $F_{30\%SPR}$, and projections from the stock assessment suggest that overfishing ended in 2017 {GMFMC 2019b}.

Proposed changes under Amendment 51 to the FMP for the Reef Fishery of the Gulf of Mexico

| | Current | 2020 | 2021 and Subsequent Fishing Years |
|---|---|---|---|
| OFL | 2.88 million lbs | 2.58 million lbs | 2.57 million lbs |
| ABC | 2.42 million lbs | 2.51 million lbs | 2.51 million lbs |
| ACL | 2.42 million lbs | 2.24 million lbs | 2.23 million lbs |

Total landings (commercial and recreational) of gray snapper in the Gulf of Mexico, 2014-2019 (NOAA SERO 2019)(GMFMC 2019)

| | |
|---|---|
| 2012 | 1.50 million lbs |
| 2013 | 1.98 million lbs |
| 2014 | 2.34 million lbs |
| 2015 | 2.05 million lbs |
| 2016 | 2.36 million lbs |
| 2017 | 1.96 million lbs |
| 2018 | 1.71 million lbs |
| 2019 | 1.85 million lbs |

The highest fishing pressure in both the commercial and recreational fisheries is centered around south Florida (FWRI 2014), but gray snapper is increasingly being targeted by handline fishers in Louisiana, after restrictions on red snapper {pers. comm., David Nieland 2015}.

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderate Concern**

There have been no formal population assessments for the South Atlantic gray snapper population, so fishing mortality is unknown (NMFS 2016c). But some reports suggest that fishing mortality on gray snapper is high in South Florida waters (Ault et al. 1998). The highest fishing pressure in both the commercial and recreational fisheries is centered around South Florida (FWRI 2014), but gray snapper is increasingly being targeted by handline fishers in Louisiana, following restrictions on red snapper (pers. comm., David Nieland 2017). Gray snapper makes up 13% of the landings on trips that target hogfish with commercial divers and 4% using commercial handlines; in the Gulf of Mexico, gray snapper accounts for 16% and 8% of landings, respectively (TIP 2016). Between 2005 and 2014, the U.S. commercial fishery was a substantial contributor to gray snapper mortality, with yearly average catches of 288,000 lbs (NMFS 2016a). During the same period, the recreational fishery catches averaged 1.8 million lbs annually (NMFS 2016b). A data-limited study in 2005 estimated fishing mortality on gray snapper in South Florida waters to be 2.5 times the fishing mortality at maximum sustainable yield (FMSY), indicating that overfishing was occurring ((Ault et al. 2005), Figure 3). More recent information is not available. Because of the limited information, we have awarded a score of "moderate" concern for fishing mortality."

# Gray triggerfish

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Medium**
FishBase has assigned a medium vulnerability rating (49 out of 100) to gray triggerfish (Froese and Pauly 2016). Gray triggerfish *(Balistes capriscus)* is found in the Eastern Atlantic from Europe to Angola and in the Western Atlantic from Canada to Argentina (Froese and Pauly 2016). Gray triggerfish reaches maturity at 16 cm, with a maximum reported size of 60 cm and maximum weight of 6 kg (Lombardi et al. 2015) {Froese & Pauly 2016}. Adult gray triggerfish are found associated with reefs, rocky bottoms, and wrecks to a depth of 100 m, while juveniles are found associated with floating algae (SAFMC 2015b) (Froese and Pauly 2016). During spawning, gray triggerfish males build and defend demersal nest territories on sandy bottoms, while females guard and ventilate eggs in the nest after fertilization (Simmons and Szedlmayer 2012). After hatching, the larvae are pelagic and the juveniles drift with floating *Sargassum* (Antoni et al. 2011). Gray triggerfish feeds primarily on benthic invertebrates, including mussels, barnacles, and sea urchins (SAFMC 2015e).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Moderate Concern**
The abundance of gray triggerfish in the U.S. South Atlantic is uncertain. The International Union for the Conservation of Nature (IUCN) assessed gray triggerfish as “Vulnerable” because of declines in many parts of its range; however, no evidence of decline was reported for the U.S. Atlantic (Jing et al. 2015). Gray triggerfish in the U.S. South Atlantic region is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery. A recent assessment of South Atlantic gray triggerfish could not estimate abundance relative to target and overfished abundance reference points due to high uncertainty in the assessment model (SEDAR 2016b) (NMFS 2016c). But, the review panel for the assessment stated "that there was no evidence of a decline in abundance or biomass at this time" (SEDAR 2016b). A previous assessment in 2011 also concluded that abundance status was "highly uncertain" due to a small data set (Broome et al. 2011). Potts and Brennan (2001) found that mean weights of gray triggerfish had declined in both the commercial and recreational fishery from 1983 to 1999, possibly indicating a drop in abundance, but the authors also noted that the spawning potential ratio (SPR) at the time was 62%, indicating a healthy biomass (Potts and Brennan 2001). Rudershausen et al. (2008) found that gray triggerfish in the vertical line fishery off the coast of North Carolina had declined both in catch-per-unit-of-fishing-effort (CPUE) and as a percentage of total species caught from the 1970s to 2005–2006, indicating possible declines in biomass in this area (Rudershausen et al. 2008). Given the conflicting and uncertain abundance information, and this species' medium vulnerability to fishing, we have awarded a score of “moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Moderate Concern**
The first stock assessment for U.S. South Atlantic gray triggerfish was completed in April 2016, and determined that exploitation status is unknown due to uncertainty in the assessment model (SEDAR 2016b). Gray triggerfish is targeted by commercial, recreational, and headboat fishers using vertical lines, and made up the sixth-highest landings by weight in the Snapper-Grouper Management complex for the South Atlantic region (Burton 2001). Landings are roughly evenly split between the commercial (54.6%) and recreational (45.4%) sectors for this species (Burton et al. 2015). Landings increased sharply in the 1990s because of increased consumer demand for this species, declined from 1999 to 2003, and increased again from 2004 to 2010 (Burton et al. 2015). But the review panel report from the assessment states that, based on the information available to the panel, "there was no evidence that current levels of removals have resulted in overfishing" (SEDAR 2016b). Landings of this species are difficult to quantify, because gray triggerfish is often listed in dealer reports as generic "triggerfishes," which include queen, ocean, and gray triggerfish in the South Atlantic (pers. comm., Joseph Myers 2016). Because of the unknown fishing mortality for this species, we have awarded “moderate" concern.

# Greater amberjack

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Medium**
FishBase has assigned a medium vulnerability rating (54 out of 100) to greater amberjack (Froese and Pauly 2016). Greater amberjack *(Seriola dumerili)* is a large, widely distributed jack belonging to the family Carangidae. The species is found worldwide in tropical and temperate oceans, including the East Coast of the U.S., the Gulf of Mexico, and the Caribbean (Manooch and Potts 1997). Genetic studies suggest that there are subpopulations in the southeast U.S.: one in the northern Gulf of Mexico and one in the South Atlantic {Gold and Richardson 1998}. Greater amberjack lives to at least 17 years (Manooch and Potts 1997) and attains a maximum size of 190 cm and 81 kg (Froese and Pauly 2016). In the Gulf of Mexico, most greater amberjack reach sexual maturity at 4 years of age and 90 cm fork length (FL) (Murie and Parkyn 2008), while maturity is reached earlier in the southeast Atlantic, around 1.3 years and 64–73 cm FL (Harris et al. 2007). Adult greater amberjack are found associated with the seaward sides of coral and rocky reefs, wrecks, and oil platforms, ranging in depths from 18 to 73 m, while juveniles may be found in shallower water or associated with floating algae and debris (Berry and Burch 1978) (GMFMC 2015b). Spawning takes place in the summer and the eggs are pelagic. Greater amberjack feeds on fish, squid, and crustaceans (Manooch and Haimovici 1983) (Carpenter 2002).

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**High Concern**
U.S. Gulf of Mexico greater amberjack is overfished (NMFS 2020) (Cummings 2014). The most recent 2014 stock assessment for Gulf of Mexico greater amberjack was initially unable to determine the status of this population because of variable and inconsistent results in the assessment model (SEDAR 2014c). But additional analyses requested by the assessment workshop review panel concluded that spawning stock biomass was well below the limit and target abundance reference points ($SSB_{CURRENT}/SSB_{MSST}$ = 0.65; $SSB/SSB_{MSY}$ = 0.47), indicating overfished status (Cummings 2014) (GMFMC 2014). Greater amberjack has been overfished since the 1990s. The first rebuilding plan for greater amberjack was put in place in 2003, but was unsuccessful at recovering the population (SEDAR 2014c). Greater amberjack in the GOM were in a 10-year rebuilding plan, but did not achieve the rebuilding target. Therefore a new plan was implemented in January 2016 with a target of rebuilding by 2019, which has not yet occurred (NMFS 2020). Due to its overfished status, Seafood Watch deems abundance as a "high" concern.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Moderate Concern**
Greater amberjack along the U.S. South Atlantic Coast is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery. The most recent stock assessment in 2008 evaluated greater amberjack in the South Atlantic as not overfished as of 2006, with the spawning stock biomass near the target level of biomass at maximum sustainable yield and well above the limit reference point of minimum sustainable stock size ($B/B_{MSY}$ = 1.10, B/MSST = 1.46 (SEDAR 2008)). South Atlantic greater amberjack has not been assessed or further analyzed since 2008, so the last stock assessment (SEDAR 2008) continues to be the best available scientific information (pers. comm., Erik Williams 2016). We have awarded a score of "moderate" concern because the stock assessment is no longer considered to contain reliable data per the Seafood Watch Standard (see details below).

**Justification:**
The Seafood Watch Standard (version F2) defines reliable data as "Data produced or verified by an independent third party. Reliable data may include government reports, peer-reviewed science, audit reports, etc. Data are not considered reliable if significant scientific controversy exists over the data, or if data are old or otherwise unlikely to represent current conditions (e.g., survey data is several years old and fishing mortality has increased since the last survey)." Given that the stock assessment for greater amberjack is more than ten years old, the overfished determination may no longer reliably represent the status of this stock.

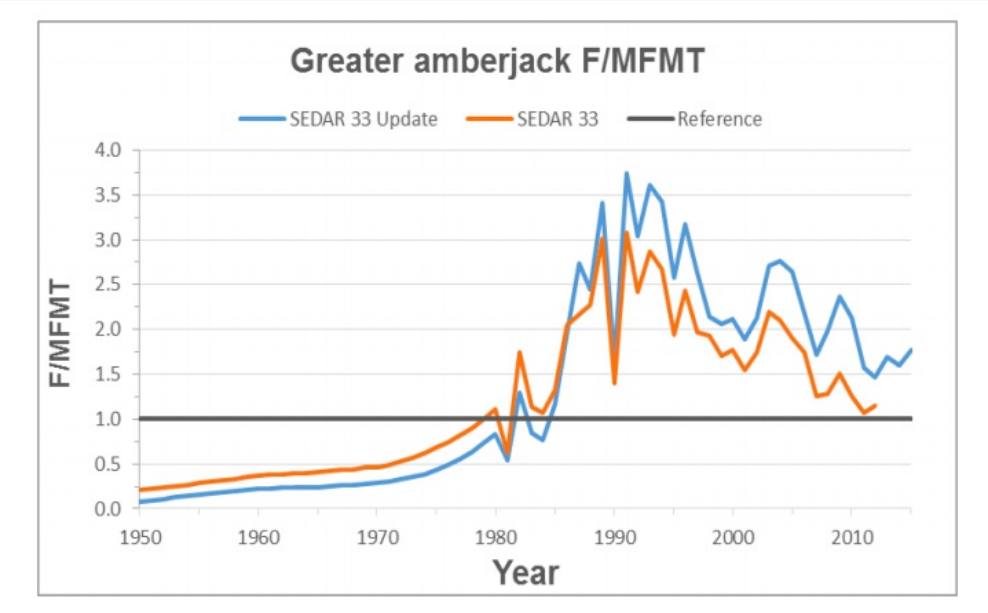
**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**High Concern**

For greater amberjack in the GOM, overfishing occurs when current fishing mortality ($F_{current}$) is greater than the maximum fishing mortality threshold (MFMT). MFMT is defined as $F_{30\%SPR}$, or the fishing mortality rate that produces a spawning potential ratio (SPR) of 30%. Because $F_{current}$/MFMT=1.68 (see figure below), GOM greater amberjack is considered to be undergoing overfishing, and has been since 1985 (SEDAR 2016d). Since the species is undergoing overfishing, Seafood Watch deems fishing mortality as a "high" concern.

**Justification:**




Estimated annual trajectory of F/FMFMT for greater amberjack in the Gulf of Mexico. Figure from SEDAR 2016d.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**High Concern**

Greater amberjack along the U.S. South Atlantic Coast is subject to overfishing, based on 2018 catch data (NMFS 2020). The last stock assessment was performed in 2008 and is no longer considered reliable for the purpose of this report. Greater amberjack is commonly targeted by commercial and recreational fishers using vertical lines, and by divers using spears. Commercial landings for the South Atlantic have exceeded the annual catch limit (ACL) in the three of the last five fishing seasons (2013-2018) and annual commercial landings have averaged 103% of ACL over that time {NOAA SERO 2019}. Similarly, recreational landings have exceeded the recreational ACL each year for the last three years {NOAA SERO 2019}. Only preliminary landings data is available for 2019 and 2020. Fishing mortality is scored as "high" concern because this stock is currently undergoing overfishing.

**Justification:**

| Greater Amberjack | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Fishing Year | Seasonal Closure | Total Landings | Units | ACL | ACL % | Closure Date | Data Source |
| 2017-2018 | Mar 1 - Feb 28/29 | Apr 1 - Apr 30 | 806,175 | gw | 769,388 | 104.8 | 10/18/17 | ACL_FILES_11152019 |
| 2016-2017 | | | 757,171 | | 769,388 | 98.4 | 10/4/16 | |
| 2015-2016 | | | 733,838 | | 769,388 | 95.4 | 1/21/16 | |
| 2014-2015 | | | 773,572 | | 769,388 | 100.5 | | |
| 2013-2014 | May 1 - Apr 31 | | 911,603 | ww | 800,163 | 113.9 | | |
| 2012-2013 | | | 547,577 | | 800,163 | 68.4 | | |
| 2011-2012 | | | 1,034,313 | gw | 1,169,931 | 88.4 | | |
| 2010-2011 | | | 857,838 | | 1,169,931 | 73.3 | | |
| 2009-2010 | | | 837,079 | | 1,169,931 | 71.5 | | |
| 2008-2009 | | | 648,250 | | 1,169,931 | 55.4 | | |
| 2007-2008 | | | 542,438 | | 1,169,931 | 46.4 | | |

Historical South Atlantic Commercial Landings and Annual Catch Limits. ACL = Annual Catch Limit, ww = whole weight, gw = gutted weight. Figure downloaded from NOAA SERO 2019.

In the most recent 2008 stock assessment, fishing mortality was estimated to be 53% of the target level of fishing at maximum sustainable yield ($F/F_{MSY}$ = 0.53), and fishing mortality had consistently declined over the years 1999–2006 (SEDAR 2008), but this

assessment is over ten years old.

# Mutton snapper

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**High**

Mutton snapper *(Lutjanus analis)* has a high vulnerability to fishing (55 out of 100 FishBase score) (Froese and Pauly 2016) and is considered "Near Threatened" by the IUCN (Lindeman et al. 2016d). It reaches sexual maturity at approximately 52 cm and grows to a maximum size of 94 cm; the oldest reported age is 29 years (Burton 2002). Mutton snapper is found in the Western Atlantic from Massachusetts to the coast of Brazil, including throughout the Gulf of Mexico and Caribbean, but is most abundant in the Antilles, Bahamas, and southern Florida (Carpenter 2002). It is typically found in inshore habitats to a depth of 70 m, and is associated with coral reefs, rocky bottoms, seagrass beds, and mangroves (Allen 1985) (GMFMC 2015b). Mutton snapper feeds on fish, crustaceans, squid, and gastropods (Burton 2002). This species is known to form offshore spawning aggregations from February to June, at depths of 20–40 m near shelf breaks over rocky or coral rubble bottoms (SEDAR 2007), which potentially increases its vulnerability to exploitation (Graham et al. 2008).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**

The International Union for the Conservation of Nature considers mutton snapper to be a Near Threatened species (Lindeman et al. 2016). In the U.S. South Atlantic, it is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Complex. Mutton snapper in the U.S. South Atlantic, eastern Gulf of Mexico, and U.S. Caribbean are considered to be a single population, centered in South Florida (Carson et al. 2011) (Shulzitski et al. 2009). But there may be various subpopulations of mutton snapper that have different demographics (Carson et al. 2011). The most recent stock assessment for South Atlantic and Gulf of Mexico mutton snapper indicates that, as of 2013, the species is not overfished and abundance is above the target level or the biomass at maximum sustainable yield proxy ($B/B_{MSY}$ proxy of 1.13) (SEDAR 2015b) (NMFS 2016c). Abundance of mutton snapper has increased since the mid-1990s (SEDAR 2015b). Because the current mutton snapper population is healthy, this results in a score of “very low” concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**

Mutton snapper in the U.S. South Atlantic and Gulf of Mexico is not subject to overfishing (NMFS 2016c). The most recent stock assessment estimates the mean total fishing mortality for 2011 to 2013 (0.12) to be well below the fishing mortality at maximum sustainable yield proxy (0.18) (SEDAR 2015b). Mutton snapper is commonly targeted by commercial fishers using longlines and vertical lines, and by headboats and private recreational fishers using vertical lines. In 2014, commercial fisheries landed 200,965 lbs of mutton snapper (NMFS 2016a) and recreational fisheries landed 432,897 lbs of mutton snapper (NMFS 2016b) in the South Atlantic and Gulf of Mexico combined. Because of recent estimates of low fishing mortality, we have awarded a score of "very low" concern.

# Queen triggerfish

**Factor 2.1 - Inherent Vulnerability**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Medium**
FishBase has assigned a medium vulnerability score (36 out of 100) to queen triggerfish (Froese and Pauly 2016). Queen triggerfish belongs to the family Balistidae, which are laterally compressed marine fish that are commonly referred to as "triggerfish." Queen triggerfish is widespread throughout the Caribbean, but is common from Brazil to North Carolina in the western North Atlantic Ocean (Matsuura 2002) (Jing et al. 2015b). Adults are highly associated with reefs and sandy or grassy areas (Matsuura 2002); little is known about the behavior of juveniles. Queen triggerfish is unique from most other reef fish; it displays territorial behavior, creates demersal nests and guards eggs, and form sharems of one male and several females (Munro et al. 1973). Spawning occurs year-round, but peaks in the fall and winter (Munro et al. 1973). It feeds on benthic invertebrates, preferring echinoderms such as the long-spined sea urchin (*Diadema* sp.) (Matsuura 2002), which experienced a mass die-off in the Caribbean in the 1980s and has not yet fully recovered (Lessios 2016). Sexual maturity occurs at approximately 2 years of age and it grows to a maximum size of about 45 cm (Aiken 1983) (Tyler and Munroe 2015); the theoretical maximum age of queen triggerfish is 14 years (Jing et al. 2015b).

**Factor 2.2 - Abundance**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**High Concern**
Queen triggerfish in the U.S. Caribbean fishery was last assessed in 2013; this assessment included Puerto Rico and the U.S. Virgin Islands (USVI) (SEDAR 2013b). Because of data limitations, this assessment could not provide accurate estimates of stock abundance or biomass (SEDAR 2013b), so these remain unknown (NMFS 2016c). Limitations from this assessment included lack of life-history information, fishery-independent data, and species-specific reporting (SEDAR 2013b).

The International Union for the Conservation of Nature (IUCN) considers queen triggerfish a "Near Threatened" species (Jing et al. 2015b), which may be due partly to high site fidelity (Addis et al. 2016). Abundance metrics for queen triggerfish are difficult to discern from commercial and recreational data, because this species was grouped with and reported as "triggerfish" (including gray, ocean, and queen triggerfish) for much of the time series (SEDAR 2013b). Because the abundance of queen triggerfish in the U.S. Caribbean is unknown and this species is considered "Near Threatened" by the IUCN, we have rated abundance as "high" concern.

**Factor 2.3 - Fishing Mortality**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**High Concern**
Queen triggerfish in the U.S. Caribbean was assessed in 2013 (SEDAR 2013b), but this report was unable to estimate stock status or fishing mortality because of data limitations. But a recent data-limited assessment of Puerto Rico reef fishes estimated fishing mortality of queen triggerfish to be nearly four times the fishing mortality at maximum sustainable yield from 2010 to 2013 ($F/F_{MSY}$ = 3.94; (Ault and Smith 2015)). Ault and Smith (2015) state that this high estimate is uncertain due to a lack of accurate life-history information for this species.

NOAA Fisheries recently listed the status of Puerto Rico Triggerfishes and Filefishes Complex as experiencing overfishing due to commercial landings increasing and exceeding the established overfishing limit (CFMC 2016) (NMFS 2016c). Between 2012 and 2014, landings of filefish and triggerfish were 121% of the annual catch limits (ACL) (CFMC 2016); diver-based fisheries account for nearly half of the landings of queen triggerfish in Puerto Rico (CFMC 2016). Queen triggerfish is frequently caught on trips targeting hogfish, where approximately one queen triggerfish is caught for every four hogfish (TIP 2017). Because of recent estimates of high fishing mortality and because the frequently exceeded commercial ACLs suggest insufficient management, we have awarded "high" concern.

# Red grouper

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**High**
FishBase has assigned a high vulnerability rating (64 out of 100) to red grouper (Froese and Pauly 2016). Red grouper *(Epinephelus morio)* is a medium-sized grouper that reaches a maximum size of 125 cm. It is a protogynous hermaphrodite, with 50% of females reaching sexual maturity at approximately 54 cm (Moe 1969) and then metamorphosing into males around age 9 (Allsop and West 2003). Adult red grouper and young-of-the-year juveniles are associated with offshore rocky and muddy bottoms to a depth of 330 m (Heemstra and Randall 1993), while juvenile fish ages 1–6 are common on nearshore coral reefs (GMFMC 2015b). Spawning takes place from January to March. Red grouper is found from North Carolina to the coast of Brazil and throughout the Gulf of Mexico and Caribbean, feeding on smaller fish, squid, and crustaceans (Moe 1969) (GMFMC 2015b).

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Low Concern**
Red grouper in the Gulf of Mexico is managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan. After a previous overfished status, the Gulf of Mexico red grouper stock was declared rebuilt in 2007 (FishWatch 2015). Formal stock assessments (SEDAR 2009) (SEDAR 2015b) list this stock as not overfished, with abundance well above the target level of biomass at maximum sustainable yield and increasing from 2009 to 2013. But the assessment review panel noted that there is some uncertainty around the abundance estimate, and there is debate regarding the appropriate reference points (SEDAR 2015b). The stock was assessed with new reference points in 2019 (see details below). Under the new MSST definition, the stock is not overfished ($SSB_{2017}/MSST_{NEW}$ = 1.64), but the stock is considered overfished under the old definition of MSST ($SSB_{2017}/MSST_{OLD}$ = 0.96). Red grouper SSB has continuously declined over the last six years. Additionally, $SSB_{2017}/SSB_0$ is 0.25 (SEDAR 2019) and Seafood Watch standards require that appropriate reference points do not allow biomass to fall below 30% of $B_0$.

The 2019 stock assessment deems GOM red grouper as no longer overfished, it is well over the LRP, but below the TRP, and well below virgin levels. Biomass is above the LRP, but there is controversy around the suitability of the reference point. Therefore, Seafood Watch deems abundance as a "low" concern.
**Justification:**
As a result of Amendment 44 to the Gulf of Mexico Reef Fish Fishery Management Plan, the reference points for red grouper have changed. Previously MSST was calculated as (1-M)*$SSB_{SPR30\%}$, where M = 0.144, but is now is calculated as 0.5*$SSB_{SPR30\%}$. If the previous MSST calculation had still been used with the most up-to-date stock information, the red grouper resource would still be considered overfished ($SSB_{2017}/MSST_{OLD}$ = 0.96) (SEDAR 2019).

This species is vulnerable to toxic red tide events, which could reduce biomass (SEDAR 2009)(FishWatch 2015) and may impact various age-classes differently; this introduces a major source of uncertainty in the stock assessment (SEDAR 2019). The constat recruitment approach--which implies that recruitment doesn't falter even at very low stock sizes--may not be appropriate for species like red grouper that may experience large declines due to red tides (SEDAR 2019).

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**High Concern**
The International Union for the Conservation of Nature (IUCN) considers red grouper to be a “Near Threatened” species (Garcia-Moliner and Eklund 2004). Red grouper in the U.S. South Atlantic is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Complex. The last stock assessment for red grouper in the South Atlantic estimated abundance as of 2015 to be at 38% of the minimum stock size threshold ($SSB_{2015}/MSST$ = 0.38) (SEDAR 2017); the assessment concluded that red grouper in the South Atlantic was overfished. The species is in year 5 of a 10-year rebuilding plan (NMFS 2017). Because red grouper is considered overfished, abundance is rated “high” concern.

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**
Red grouper in the Gulf of Mexico is not experiencing overfishing (NMFS 2016c). Red grouper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. Landings for the Gulf of Mexico in 2014 were 6,545,646 lbs by the commercial fishery and 426,494 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Fishing mortality was estimated to be below the fishing mortality at maximum sustainable yield in both recent stock assessments ($F/F_{MSY}$ = 0.778 in 2008; $F/F_{MSY}$ = 0.76 in 2013; $F_{CURRENT}$/MFMT = 0.784 in 2019) (SEDAR 2009) (SEDAR 2015c)(SEDAR 2019). Therefore, red grouper fishing mortality is a "very low" concern.

**Western Central Atlantic | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**High Concern**
Red grouper in the South Atlantic is subject to overfishing (NMFS 2017), with an assessment of fishing mortality at 154% of maximum sustainable yield for 2013 through 2015 ($F_{2013–2015}/F_{MSY}$ = 1.54; (SEDAR 2017)). Red grouper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. Landings for the U.S. South Atlantic in 2014 were 71,576 lbs by the commercial fishery and 29,437 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because South Atlantic red grouper is experiencing overfishing, it is rated as "high" concern.

# Red hind

**Factor 2.1 - Inherent Vulnerability**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Medium**
Red hind is a grouper in the family Epinephilidae; FishBase assigns it a high vulnerability (61 out of 100) (Froese and Pauly 2016) while the IUCN considers red hind to be a species of "Least Concern" (Sadovy et al. 2008). In their 2014 stock assessment, the Southeast Data Assessment and Review panel noted several vulnerable life-history characteristics of this species, such as slow growth, protogynous development, and spawning aggregations (SEDAR 2014d). Life-history attributes suggest that it has low vulnerability (see following table).

Red hind is widespread throughout the Caribbean, but is common from North Carolina to Venezuela (Heemstra and Randall 1993). Adults are associated with reefs and rocky substrate, from 2 to 100 m or deeper. It feeds on crustaceans, other fish, and cephalopods (Heemstra and Randall 1993). It is protogynous, and sexual maturity occurs at approximately 21 cm and 3 years of age (Sadovy et al. 1994). It grows to a maximum size of about 76 cm (Heemstra and Randall 1993) and maximum age of 17 years (Ault and Smith 2015). Red hind is highly targeted by fisheries in the U.S. Caribbean (Heemstra and Randall 1993). Red hind has numerous spawning aggregations throughout its range, which were highly targeted in the past (Ojeda et al. 2007).

Given the conflicting vulnerability information and the life-history characteristics, we assign "medium" vulnerability.
**Justification:**
Table 1: Results from Seafood Watch fish vulnerability rubric (SFW criteria document, p. 4). Attribute scores can range from 1 to 3, with higher scores signifying more resilient life-history attributes.

| Vulnerability attribute | Category | Score |
|---|---|---|
| Average age at maturity | < 5 years | 3 |
| Average maximum age | 10–25 years | 2 |
| Fecundity | > 100 eggs | N/A |
| Average maximum size | < 100 cm | 3 |
| Average size at maturity | < 40 cm | 3 |
| Reproductive strategy | Broadcast spawner | 3 |
| Trophic level | > 3.25 | 1 |
| Average Score | Low Vulnerability | 2.5 |

Species with average attribute scores between 2.44 and 3.0 are deemed to have a "low" vulnerability.

**Factor 2.2 - Abundance**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**

Red hind in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of the "Caribbean Groupers" complex (NMFS 2016c). This complex is considered to be one stock for Puerto Rico and the U.S. Virgin Islands. The most recent formal stock assessment was published in 2014; this assessment did not make any determination of biomass because of data limitations (SEDAR 2014d). NOAA Fisheries currently lists the biomass of the Caribbean Groupers complex as "unknown" (NMFS 2016c).

Previous studies found red hind biomass to be depleted in the U.S. Caribbean during the 1970s to 1980s (Sadovy et al. 1992). In a more recent assessment in Puerto Rico, demonstrated biomass was 40% of the target abundance reference point from 2000 to 2002 ($B/B_{MSY}$ = 0.40; (Ault et al. 2008)). The 2014 stock assessment notes several vulnerable life-history characteristics of this species, such as slow growth, protogynous development, and spawning aggregations (SEDAR 2014d).

Based on the limited abundance information, we have rated abundance a "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**

The Caribbean Groupers complex is currently listed as not subject to overfishing by NOAA Fisheries (NMFS 2016c). However, the most recent formal stock assessment for Caribbean red hind suggests overfishing could be occurring, but there were substantial disagreements in the review panel report (SEDAR 2014d). The probability of overfishing on red hind ranged from 25 – 40% in Puerto Rico; the review panel concluded that these probabilities were high enough to suggest this species may be experiencing overfishing (SEDAR 2014d). A recent data-limited assessment for Puerto Rico red hind found that fishing pressure was right around the target fishing mortality benchmark ($F/F_{msy}$ = 0.95) but that mortality has declined over time for this species and mortality rates were likely sustainable (Ault and Smith 2015). Commercial diving trips for red hind have increased in recent years by 600%, while other methods like pots and traps have declined (SEDAR 2014d). Red hind make up about 20% of the landings on trips that target hogfish (TIP 2017); diver-based methods also generally target the largest red hind (SEDAR 2014d).

Commercial landings averaged below the annual catch limits for the Grouper complex between 2010 and 2013 (NOAA SERO 2016b). Due to conflicting data over fishing mortality, we have rated fishing mortality as "moderate concern".

# Red porgy

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**High**
FishBase has assigned a high vulnerability rating (66 out of 100) to red porgy (Froese and Pauly 2016). Red porgy *(Pagrus pagrus)* is a protogynous hermaphrodite reaching sexual maturity at approximately 22 cm (3 years of age) as female and then metamorphosing into male at 35–40 cm (Hood and Johnson 2000). Adults are found associated with rocky coral rubble or with sandy bottoms to a depth of 250 m, and juveniles are found in shallower waters and seagrass beds (Froese and Pauly 2016) (SAFMC 2015e). Red porgy is found in the Western Atlantic from New York to Argentina, including the Gulf of Mexico and the Caribbean, and in the Eastern Atlantic from the British Isles to Angola and throughout the Mediterranean. Red porgy feeds on smaller fish, crustaceans, and other invertebrates (Froese and Pauly 2016).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**High Concern**
Red porgy is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Fishery in the U.S. South Atlantic is considered overfished and is in year 21 of a 19-year rebuilding plan (NMFS 2020). The spawning stock biomass has continued to decline since the 2011 assessment and is below the minimum stock size threshold ($SSB_{2017}$/MSST = 0.347) (SEDAR 2020b). Because of this depleted status, red porgy abundance is a "high" concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**

**High Concern**
Red porgy in the U.S. South Atlantic was assessed with the Beaufort Assessment Model, a statistical catch-age model, in 2020. This stock is currently experiencing overfishing, even though fishing mortality is generally low; $F_{2015\text{-}2017}/F_{MSY}$ = 1.73) (SEDAR 2020b). Red porgy is currently recovering from a depleted state, and rebuilding has slowed in recent years. The stock has a 0.5 - 6.2% probability of rebuilding by 2026 under all scenarios considered (SEDAR 2020). Red porgy is commonly targeted by commercial fishers, headboats, and private recreational boats using vertical lines. Because this stock is experiencing overfishing, we awarded a "high" concern for fishing mortality.

# Red snapper

**Factor 2.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**High**
FishBase has assigned a high vulnerability rating (55 out of 100) to red snapper (Froese and Pauly 2016). Red snapper *(Lutjanus campechanus)* is a large snapper with pinkish-red to red coloration, ranging in size up to 100 cm (Froese and Pauly 2016). Red snapper reaches sexual maturity around 40 cm at age 2, and adults may live several decades, up to age 57 (Froese and Pauly 2016) (GMFMC 2015b). Adult red snapper are found over rocky bottoms, while juveniles inhabit shallow waters, including sandy and muddy bottoms. Red snapper is found in the Western North Atlantic from Massachusetts to Florida and throughout the Gulf of Mexico, but it is rare north of North Carolina (Froese and Pauly 2016). Red snapper feeds on smaller fish, crustaceans, squid, other invertebrates, and some planktonic prey (Froese and Pauly 2016) (GMFMC 2015b).

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**High Concern**
Red snapper in the Gulf of Mexico is managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan, and the most recent stock assessment was published in 2015 (SEDAR 2015d). This assessment concluded that Gulf of Mexico red snapper is recovering, but remains overfished. The assessment estimated spawning stock biomass at 57% of the limit reference point or minimum stock size threshold, a point below which the population is considered overfished (SSB/MSST = 0.573; (SEDAR 2015d)). This is an improvement from the previous stock assessment, which found spawning stock biomass to be only 40% of the limit reference point (SEDAR 2013). Red snapper is currently in year 11 of a 27-year rebuilding plan (NMFS 2016c). Because of the overfished status of red snapper in the Gulf, we have awarded a "high" concern score.

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Low Concern**
Red snapper in the U.S. Gulf of Mexico is not subject to overfishing (NMFS 2016c). Red snapper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines; juvenile red snapper is caught as bycatch in the shrimp trawl fishery. Landings for the Gulf of Mexico in 2014 were 5,721,585 lbs by the commercial fishery and 2,873,120 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). The fishing mortality from 2011 to 2013 is estimated to be just below the fishing mortality at maximum sustainable yield ($F/F_{MSY}$ = 0.995; (SEDAR 2015d)), which represents an increase since the last stock assessment ($F/F_{MSY}$ = 0.695 in 2009–2011; (SEDAR 2013)). Because fishing mortality has increased in recent years but remains below the overfishing limit, we have awarded "low" concern.

# Scamp

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Medium**
FishBase has assigned a high vulnerability rating to scamp (68 out of 100) (Froese and Pauly 2016), but its life history, including early maturity and high fecundity, suggests a medium vulnerability to fishing (see Rationale). Scamp *(Mycteroperca phenax)* is a medium-sized grouper, ranging in size up to 107 cm (Heemstra and Randall 1993) {Froese & Pauly 2016}. Scamp is a protogynous hermaphrodite that reaches sexual maturity as female and then metamorphoses into male. It has been recorded to live 21 years (Matheson et al. 1986) but may live for as long as 30 years. Juvenile scamp are found inshore associated with mangroves, jetties, and piers, while adult scamp are found over rocky or coral bottoms at depths of 30–100 m (Heemstra and Randall 1993). Spawning typically takes place from March through May (Harris et al. 2002) (GMFMC 2015b). Scamp is found from North Carolina to the coast of Venezuela and throughout the Gulf of Mexico and Caribbean, feeding on smaller fish, squid, and crustaceans (Heemstra and Randall 1993) (GMFMC 2015b).
**Justification:**
Table 2: Results from Seafood Watch fish vulnerability rubric (SFW criteria document, p. 4). Attribute scores can range from 1 to 3, with higher scores signifying more resilient life-history attributes.

| Vulnerability attribute | Category | Score |
|---|---|---|
| Average age at maturity | 5–15 years | 2 |
| Average maximum age | > 25 years | 1 |
| Fecundity | > 100 eggs | N/A |
| Average maximum size | 100–300 cm | 2 |
| Average size at maturity | 40–200 cm | 2 |
| Reproductive strategy | Broadcast spawner | 3 |
| Trophic level | > 3.25 | 1 |
| Average Score | Medium Vulnerability | 1.83 |

Species with average attribute scores between 1.80 and 2.43 are deemed to have a "medium" vulnerability.

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Moderate Concern**
The International Union for the Conservation of Nature (IUCN) considers scamp to be a species of "Least Concern" (Rocha et al. 2008). Scamp in the U.S. South Atlantic is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Complex, and the last stock assessment for this species was published in 1998 (Manooch et al. 1998). Spawning potential ratio (SPR) of scamp was thought to be between 35% and 52% of an unfished level, based on commercial and recreational landings and a range of likely natural mortality values, indicating a recovering stock (Manooch et al. 1998) (Potts and Brennan 2001). Recent stock status updates from NOAA Fisheries list South Atlantic scamp abundance as "unknown" (NMFS 2016c). Because of the lack of a recent stock assessment and medium vulnerability, we have rated abundance a "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**

**Low Concern**
Scamp in the U.S. South Atlantic region is not considered subject to overfishing (NMFS 2016c), although the most recent formal stock assessment and fishing mortality estimate was published in 1998 (Manooch et al. 1998). Scamp is commonly targeted by commercial fishers, headboats, and private recreational fishers using vertical lines. Scamp landings in 2014 for the South Atlantic were 170,998 lbs and 58,794 lbs for the commercial and recreational fisheries, respectively (NMFS 2016a) (NMFS 2016b). Between 2012 and 2015, scamp landings have not exceeded 62% of the established annual catch limit (NMFS SERO 2016). We have awarded a score of "low" concern because it is unlikely that overfishing is occurring.

# Schoolmaster

**Factor 2.1 - Inherent Vulnerability**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Medium**
Schoolmaster snapper is considered moderately vulnerable to fishing, with a FishBase score of 35 out of 100 (Froese and Pauly 2016). The International Union for the Conservation of Nature (IUCN) considers schoolmaster snapper to be a species of "Least Concern" (Lindeman et al. 2016c). Schoolmaster is found in the western Atlantic from Massachusetts to northern Brazil (Allen 1985). Sexual maturity is reached at 30 cm (Allen 1985). Maximum size is estimated to be approximately 57 cm TL (total length) and individuals can reach at least 15 years of age (Ault and Smith 2015). Little is known about the reproductive behavior and fecundity of this species. Typical prey items include fish and crustaceans (Rooker 1995). Adults are associated with coral and rocky reefs, while juveniles will utilize mangrove and brackish habitats (Allen 1985) (Anderson 2002) and are typically found in shallow waters, nearly at 70 m (Lindeman et al. 2016c) (Potts et al. 2016).

**Factor 2.2 - Abundance**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**
Schoolmaster snapper in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of the "Caribbean snappers" complex (NMFS 2016c). The Caribbean snappers are considered to be one stock for Puerto Rico and the U.S. Virgin Islands. No formal stock assessment exists for schoolmaster snapper in Puerto Rico. In a previous data-limited assessment, Puerto Rico schoolmaster snapper biomass for 2000–2002 was estimated to be at 41% of the target abundance reference point ($B/B_{MSY}$ = 0.41; (Ault et al. 2008)). The biomass of the Caribbean snappers complex is listed as "unknown" by NOAA Fisheries (NMFS 2016c). Based on unknown biomass and the IUCN "Least Concern" status, abundance is rated a "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**High Concern**
NOAA Fisheries currently lists the Caribbean snappers complex as not subject to overfishing (NMFS 2016c). But in a recent data-limited assessment of Puerto Rico reef fish, fishing mortality of schoolmaster snapper was estimated at more than one-and-a-half times the target reference point ($F/F_{MSY}$ = 1.67; (Ault and Smith 2015)). Caribbean snapper complex unit 1 commercial landings averaged 197,598 lbs/year in Puerto Rico over 2010–2012, which was well below (69%) the annual catch limit for this complex (NOAA SERO 2016b). Schoolmaster accounts for about 7% of landings from commercial dive trips that target hogfish (TIP 2017), but the total contribution of mortality by this fishery is unknown.

Because the fishery contribution is unknown, and there is evidence for overfishing of this species, we have awarded a score of "high" concern.

# Stoplight parrotfish

**Factor 2.1 - Inherent Vulnerability**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Low**
Stoplight parrotfish is considered to have low to moderate vulnerability, with a FishBase score of 31 out of 100 (Froese and Pauly 2016), and the International Union for the Conservation of Nature (IUCN) considers stoplight parrotfish in the Caribbean to be of "Least Concern" (Rocha et al. 2012). Stoplight parrotfish in the family Scaridae is a subtropical fish, found from Florida to Brazil, with a typical depth range of 3 to 50 m (Froese and Pauly 2016). Maximum age is approximately 12 years and it can reach 61 cm in length (Ault and Smith 2015). It is a protogynous hermaphrodite, with females capable of producing more than 60,000 eggs at a time and transitioning at around 15 to 25 cm standard length (Koltes 1993). Adults are found on coral reefs while juveniles may be found inshore in seagrass beds (Froese and Pauly 2016). Parrotfish play an important role in maintaining coral reef health because of their corallivory (coral polyps consumption) (Roff et al. 2011).

**Factor 2.2 - Abundance**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**
In the Caribbean, 10 parrotfish species are managed by the Caribbean Fishery Management Council under the Caribbean parrotfish complex. NOAA Fisheries lists Caribbean parrotfish biomass as not overfished, but approaching overfished condition (NMFS 2016c). Annual catch limits (ACL) were exceeded by an average of 102% during the period 2011–2013 because of increases in landings (CFMC 2016b). Stoplight parrotfish has not been assessed the Southeast Data, Assessment, and Review process, so detailed abundance data are not available.

Given insufficient information to determine abundance relative to reference points, we have awarded a score of "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**
NOAA Fisheries lists the Caribbean parrotfish complex as not subject to overfishing (NMFS 2016c). A data-limited assessment of fishing mortality found that stoplight parrotfish was experiencing fishing mortality at levels nearly four times the fishing mortality at maximum sustainable yield in Puerto Rico ($F/F_{MSY}$ = 3.8); however, these estimates were uncertain due to a lack of accurate life-history information (Ault and Smith 2015).

Dive fisheries tend to target stoplight parrotfish (NOAA 2016b). Other species of parrotfish may be caught in small numbers, but stoplight parrotfish make up about 7% of the landings on trips that catch hogfish with spears (TIP 2017). Commercial landings have been well below the annual catch limit (ACL) for this complex since at least 2010 (NOAA SERO 2016b).

Because of conflicting information over fishing mortality, we have awarded a score of "moderate" concern.

# Vermilion snapper

**Factor 2.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Medium**
FishBase has assigned a medium vulnerability rating (50 out of 100) to vermilion snapper (Froese and Pauly 2016). Vermilion snapper *(Rhomboplites aurorubens)* can grow to a size of 60 cm in length (Froese and Pauly 2016). Vermilion snapper reaches sexual maturity around 23 cm at 3–4 years of age, and adults may live up to a decade (Manooch 1987) (GMFMC 2015b). Adult vermilion snapper are found over rock, gravel, or sand bottoms down to 300 m, while juveniles inhabit shallower waters but still deeper than 25 m (Allen 1985). Vermilion snapper is found in the Western North Atlantic from North Carolina to the coast of Brazil and throughout the Gulf of Mexico and Caribbean (Floeter et al. 2003). Vermilion snapper feeds on smaller fish, crustaceans, squid, benthic invertebrates, and some planktonic prey (Froese and Pauly 2016) (GMFMC 2015b).

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**
Vermilion snapper in the U.S. Gulf of Mexico is managed by the Gulf of Mexico Fishery Management Council under the Reef Fish Management Plan, and was last assessed in 2020 (SEDAR 2020c). This assessment concluded that vermilion snapper in the Gulf of Mexico was not overfished, with spawning stock biomass well above the target level or spawning stock biomass at maximum sustainable yield ($SSB_{current}/SSB_{FSPR30\%}$ = 1.75; $SSB_{current}/MSST_{FSPR30\%}$ = 3.5) (SEDAR 2020c). Because vermilion snapper was not overfished, with abundance well above the target level, we have awarded a "very low" concern score.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Very Low Concern**
Vermilion snapper in the U.S. South Atlantic is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Complex, and was last assessed in 2018; $SSB_{2016}$ /MSST = 1.51 and $SSB_{2016}$ /$SSB_{MSY}$ = 1.13 (SEDAR 2018b). Therefore, the biomass is above both the LRP and the TRP but is quite close to MSY. The age structure in the 2016 model run showed there is an increasing proportion of old fish compared to previous years, with strong recruitment in the 2000s and slightly fewer young fish. There was average- to below-average recruitment in recent years (SEDAR 2018b).

Since a recent stock assessment suggests that biomass is above the target reference point with no scientific controversy, Seafood Watch scores vermilion snapper in the South Atlantic as a "very low" concern

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Very Low Concern**

Vermilion snapper in the U.S. Gulf of Mexico is not subject to overfishing (NMFS 2020), and the most recent stock assessment (2020) estimates fishing mortality to be 56% of the target level ($F_{current}/MFMT_{FSPR30\%}$ = 0.56) (SEDAR 2020c). Vermilion snapper is commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the Gulf of Mexico in 2014 were 1,761,456 lbs by the commercial fishery and 825,328 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Juvenile vermilion snapper is also caught as bycatch in the shrimp trawl fishery. It was noted that recent declines in overall shrimp trawl effort across the Gulf have resulted in decreased fishing mortality for vermilion snapper (SEDAR 2011b). Given that fishing mortality is below the target level, we have awarded a "very low" concern score.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Low Concern**

Vermilion snapper along the U.S. South Atlantic coast is not experiencing overfishing (NMFS 2020). Vermilion snapper is commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the South Atlantic in 2014 were 907,528 lbs by the commercial fishery and 259,146 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). The most recent update stock assessment in the South Atlantic vermilion fishery found that the current F (with the geometric mean from the period 2014 to 2016), was estimated by the base run to be $F_{2014\text{-}2016}/F_{MSY}$ = 0.609, and the median value was $F_{2014\text{-}2016}/F_{MSY}$ = 0.564 (SEDAR 2018c) (Figure 17). There is much uncertainty in the assessment (see Justification) but there is less than a 50% chance that fishing mortality is less than the sustainable level. Since fishing mortality is much lower than $F_{MSY}$ , the stock is considered to be a "low" concern.

**Justification:**

Around 83.2% of MCB runs agreed with the base run that the stock is currently not experiencing overfishing, but there is much uncertainty in the terminal years.

# White grunt

**Factor 2.1 - Inherent Vulnerability**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**High**
FishBase has assigned a high vulnerability to white grunt (62 out of 100) (Froese and Pauly 2016). White grunt *(Haemulon plumieri)* occurs in tropical and warm-temperature waters from Virginia to Brazil, including Bermuda, the Caribbean, and the Gulf of Mexico. It produces an audible grunting sound by grinding the pharyngeal teeth. It is reported to live as long as 13 years, and grow to a length of around 60 cm. Sexual maturity occurs around age 3 and 25 cm in length. Spawning occurs in the late spring and summer. White grunt feeds on bottom-dwelling invertebrates (SAFMC 2015e).

**Factor 2.2 - Abundance**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Moderate Concern**
The International Union for the Conservation of Nature (IUCN) has assessed white grunt as a species of "Least Concern" because of its widespread population. In the U.S. Atlantic, there is little evidence for regional declines (Lindeman et al. 2016b). But this species has not been formally assessed, and its abundance relative to target abundance references points is undefined (NMFS 2016c). We have therefore awarded a score of "moderate" concern.

**Factor 2.3 - Fishing Mortality**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Low Concern**
White grunt in the U.S. South Atlantic has not been formally assessed, so fishing mortality for white grunt is unknown (NMFS 2016c). In Eastern Florida, white grunt represents 14% to 20% of landings on trips that land hogfish (TIP 2016) (McCarthy 2014). In North Carolina, white grunt represents 5%–9% of landings on hogfish commercial handline trips, but landings of hogfish are about 2.5 times greater in this region than in Florida (TIP 2016). In both regions, hogfish landings are low relative to the Florida Keys (SAFMC 2016), so associated white grunt mortality is likely to be low. Because fishing mortality for this species is unknown but the species is not considered vulnerable, we awarded a score of "low" concern.

# Yellowtail snapper

**Factor 2.1 - Inherent Vulnerability**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Hand implements | United States | Florida**

**Medium**
FishBase has assigned a high vulnerability rating (65 out of 100) to yellowtail snapper (Froese and Pauly 2016), but its life history suggests a low vulnerability to fishing (see Detailed Rationale below). Additionally, a Productivity Susceptibility Analysis for yellowtail snapper found that it ranked as medium risk (MRAG 2009). Taking into account these different assessments, we have ranked its vulnerability as "medium." Yellowtail snapper *(Ocyurus chrysurus)* is a medium-sized snapper, ranging up to 86 cm (Allen 1985). It reaches sexual maturity around 24 cm in length and 3 years of age, and may form large spawning aggregations {Burton et al. 2005}. The maximum observed age is 23 years {O'Hop et al. 2012}. Adult yellowtail snapper are found well above coral reef bottoms, commonly over a depth range of 10–70 m, while juveniles inhabit seagrass beds (Froese and Pauly 2016). Yellowtail snapper is found in the Western North Atlantic from North Carolina to the coast of Brazil and throughout the Gulf of Mexico and Caribbean (FMNH 2005). Yellowtail snapper feeds on both benthic and planktonic prey, including fish, crustaceans, gastropods, cephalopods, and worms (Froese and Pauly 2016)(SAFMC 2015e).
**Justification:**
Table 2: Results from Seafood Watch fish vulnerability rubric (SFW criteria document, p. 4). Attribute scores can range from 1 to 3, with higher scores signifying more resilient life-history attributes.

| Vulnerability attribute | Category | Score |
|---|---|---|
| Average age at maturity | < 5 years | 3 |
| Average maximum age | 10–25 years | 2 |
| Fecundity | > 100 eggs | N/A |
| Average maximum size | < 100 cm | 3 |
| Average size at maturity | < 40 cm | 3 |
| Reproductive strategy | Broadcast spawner | 3 |
| Trophic level | > 3.25 | 1 |
| Average Score | Low Vulnerability | 2.5 |

Species with average attribute scores between 2.44 and 3.0 are deemed to have a “low” vulnerability.

**Factor 2.2 - Abundance**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Hand implements | United States | Florida**

**Very Low Concern**
U.S. yellowtail snapper is managed by the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council, and the most recent stock assessment {O'Hop et al. 2012} treats this species as a single population that ranges into both South Atlantic and Gulf of Mexico management zones. The 2020 SEDAR 64 Base Model stock assessment concluded that yellowtail snapper is not overfished, with abundance well above the target level ($SSB_{2015\text{-}2017}/SSB_{SPR30\%}$ of 1.69) (SEDAR 2020). We have therefore awarded a score of "very low" concern.

**Factor 2.3 - Fishing Mortality**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Hand implements | United States | Florida**

**Very Low Concern**
Yellowtail snapper in the U.S. Gulf of Mexico and South Atlantic regions is not subject to overfishing (NMFS 2020). The most recent stock assessment estimated fishing mortality to be well below the fishing mortality at maximum sustainable yield ($F_{current}/F_{30\%SPR}$ = 0.67) (SEDAR 2020). This ratio was based on an F that would yield a spawning potential ratio (SPR) of 30%. Yellowtail snapper is commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the Gulf of Mexico in 2014 were 1,880,973 lbs by the commercial fishery and 506,987 lbs by the recreational fishery, while landings for the South Atlantic in 2014 were 89,303 lbs by the commercial fishery and 395,124 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because of the very low overall fishing mortality, we have awarded a rating of "very low" concern for this species.

**Factor 2.3 - Modifying Factor: Discards and Bait Use**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**20-40%**
The total discards/landings ratio for the U.S. Gulf of Mexico reef fish fishery was 33.8% between 2006 and 2009 (Scott-Denton et al. 2011) and nearly identical from data collected in 2010–2011 (33.3%; {Scott-Denton and Williams 2013}). Discards/landings ratios for four of the most commonly discarded species that are frequently caught with hogfish are: red snapper, 24%; vermilion snapper, 5%; red grouper, 41%; and gag grouper, 40% (Scott-Denton et al. 2011).

**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**< 20%**
Discard mortality is low when diver-based methods are used (< 5%), with discards resulting from the unintended catch of undersized individual fish (Frisch et al. 2012).

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**

**20-40%**
Commercial discards in the snapper-grouper fishery in the U.S. South Atlantic are moderate. The total discards/landings ratio for the fishery was 23.2% between 2007 and 2011 (GSAFFI 2013). A large proportion of the discards in the fishery are undersized discards (36%–98%, depending on the species) (GSAFFI 2008). Discards/landings ratios for some of the most commonly discarded species are: vermilion snapper, 17%; red snapper, 45%; and red grouper, 250% (GSAFFI 2010).

## Criterion 3: Management Effectiveness

*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 there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.*

The Criterion 3 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

**Criterion 3 Summary**

| FISHERY | HARVEST STRATEGY | BYCATCH MANAGEMENT STRATEGY | SCORE |
|---|---|---|---|
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | 1.000 | 0.000 | **Red (1.000)** |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | 3.000 | 0.000 | **Yellow (3.000)** |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 3.000 | 3.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Hand implements \| United States \| Florida | 3.000 | 0.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | 3.000 | 0.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | 3.000 | 0.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | 3.000 | 3.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | 3.000 | 3.000 | **Yellow (3.000)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | 3.000 | 3.000 | **Yellow (3.000)** |

**Factor 3.1 Summary**

| FISHERY | STRATEGY | RECOVERY | RESEARCH | ADVICE | ENFORCE | TRACK | INCLUSION |
|---|---|---|---|---|---|---|---|
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | Ineffective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Ineffective | Highly effective |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | Moderately Effective | N/A | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Western Central Atlantic \| Hand implements \| United States \| Florida | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |

| FISHERY | STRATEGY | RECOVERY | RESEARCH | ADVICE | ENFORCE | TRACK | INCLUSION |
|---|---|---|---|---|---|---|---|
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly effective |

**Factor 3.2 Summary**

| FISHERY | ALL SPECIES RETAINED? | CRITICAL? | STRATEGY | RESEARCH | ADVICE | ENFORCE |
|---|---|---|---|---|---|---|
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | Yes | No | Highly effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | Yes | No | Highly effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | No | No | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Hand implements \| United States \| Florida | Yes | No | Highly effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | Yes | No | Highly effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | Yes | | Highly effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | No | No | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | No | No | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | No | No | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective |

**Criterion 3 Assessment**

SCORING GUIDELINES

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.*

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.*

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 achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

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.*

Subfactor 3.1.5 – Enforcement of Management Regulations
*Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.*

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 is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*

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 rating is given if the management process is transparent and includes stakeholder input.*

Subfactor 3.2.2 – 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.)*

Subfactor 3.2.3 – 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*

Subfactor 3.2.4 – 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.*

Subfactor 3.2.5 – 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 consistent enforcement of regulations and verification of compliance.*

**Factor 3.1.1 - Critical?**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**No**

**Factor 3.1.2 - Mgmt Strategy / Implement**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Ineffective**
The Puerto Rico hogfish fishery is managed by the Caribbean Fisheries Management Council (CFMC) under the Reef Fish Management Plan and the PR Department of Natural and Environmental Resources. For Puerto Rico, territorial waters are those within 9 nautical miles of shore and make up 95% of fishable waters (NOAA 2011). Hogfish is managed within a "wrasse unit" along with two other species (puddingwife and Spanish hogfish), but hogfish make up the majority of the catches in this unit (NOAA 2011). Management regulations include license requirements, annual catch limits, and closed fishing areas (NOAA 2011). The "wrasse unit" ACLs for the commercial and recreational fisheries in Puerto Rico are 24.56 MT (54,147 lbs) and 2.29 MT (5,050 lbs), respectively (NOAA 2011). In Puerto Rico territorial waters, regulations include gear specifications for traps/pots, and they prohibit the use of spear guns < 100 ft from the coast or near docks and artificial reefs (PR-DNER 2010). Some species have specific regulations, but there are no specific regulations for hogfish in Caribbean territorial waters (NOAA 2011).

Other species frequently caught in the diver fishery with hogfish have not been assessed, or are data-limited. Schoolmaster snapper and red hind are both likely to be overfished and undergoing overfishing (SEDAR 2014d) (Ault and Smith 2015). ACLs are in place for these species, and monitoring for these species in Puerto Rico fisheries is improving in an attempt to limit overages (CFMC 2016). Stoplight parrotfish landings have increased in recent years (CFMC 2016), and it is likely approaching an overfished condition, suggesting insufficient management.

Because current management goals are unlikely to help rebuild species populations in this region, and there have been no formal and conclusive population assessments for hogfish or the species frequently caught with it, we awarded a score of "ineffective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
In federal waters, hogfish is managed by the South Atlantic Fishery Management Council (SAFMC) and the Gulf of Mexico Fishery Management Council (GMFMC). Hogfish is also managed by the states in state waters. Regulations for hogfish include annual catch limits, minimum size limits, bag limits for the recreational fishery, and commercial trip limits (Cooper et al. 2014) (SC-DNR 2015) (NC-DMF 2015).

Until recently, hogfish across the South Atlantic and Gulf of Mexico has been treated as a single population, but in 2013 genetic research indicated that there are three distinct stocks: Eastern Gulf of Mexico (Florida panhandle to Florida Keys), Florida Keys and East Florida, and Georgia to North Carolina (Seyoum et al. 2014). These new population designations were used for the first time during the 2014 hogfish population assessment and are now recognized by managing agencies as unique management units (Cooper et al. 2014) {NOAA 2015} {NOAA 2015f}. The Florida Keys fall under the jurisdiction of both the GMFMC and SAFMC, but with the new genetic information, discussion of management authority and whether responsibilities should be shared is ongoing (SAFMC 2014) {NOAA 2015f} (SAFMC 2015b) (SAFMC 2015c) (SAFMC 2015d) (SAFMC/GMFMC 2015). Additionally, the South Atlantic Fishery Management Council passed an amendment that will restrict recreational harvest, increase the minimum size, and decrease the bag limit of the overfished Florida Keys and East Florida stock; these regulations will go into effect in 2017 (Federal Register 2016).

Other species caught in these fisheries are also managed through catch limits, size limits, and recreational bag limits. Most species are abundant, but a few species remain overfished (NMFS 2016c). Overall, the management strategy is considered "moderately effective."
**Justification:**
Annual catch limits for hogfish for 2014 and 2015 were set at 22.44 MT (49,469 lbs) for the South Atlantic commercial fishery, 38.72 MT (85,355 lbs) for the South Atlantic recreational fishery, and 94.35 MT (208,000 lbs) for the Gulf of Mexico commercial and recreational fisheries combined. In 2015 and 2016, the South Atlantic recreational fishery exceeded catch limits by 342% and 137%, respectively. In 2016, the SAFMC closed the recreational hogfish fishery on November 30th because ACLs were exceeded (NMFS SERO 2016).

**Factor 3.1.3 - Recovery of Stock Concerns**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
The abundance of hogfish in Puerto Rico is uncertain because there has been no formal population assessment (NMFS 2015c). But a recent data-limited assessment of Puerto Rico reef fishes suggests that hogfish is likely overexploited (Ault and Smith 2015). Additionally, the International Union for the Conservation of Nature (IUCN) has assessed hogfish globally as "Vulnerable" (Choat et al. 2010). A catch limit is in place for this fishery, but it remains uncertain if the catch limit is sufficient to sustain the Puerto Rico hogfish population {CFMC/NMFS 2014a}. Recently, this catch limit was exceeded and NOAA Fisheries declared overfishing to be occurring (NMFS 2016c). Because of the uncertain status of the Puerto Rico population, we have rated this factor "moderately effective."

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**N/A**
The eastern Gulf of Mexico hogfish population is not considered overfished and no other species targeted in the spear fishery are overfished (Cooper et al. 2014) (NMFS 2016c). This factor is therefore rated N/A.

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderately Effective**
The eastern Gulf of Mexico hogfish population is not considered overfished (Cooper et al. 2014) (NMFS 2016c). But greater amberjack is caught in the handline fishery along with hogfish and has been overfished since the 1990s (SEDAR 2011) (SEDAR 2014c). The first rebuilding plan for greater amberjack was established in 2003. This program was unsuccessful, and a new 3-year rebuilding plan was recently established. New regulations for greater amberjack, including a decrease in the annual catch limit and an increase in the recreational size limit, went into effect in January 2016 (SFB 2015). Recovery of species of concern is considered "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
The most recent 2014 population assessment of hogfish indicates that the East Florida and Florida Keys population is depleted and that overfishing is occurring (Cooper et al. 2014). The assessment concluded that the status of the Georgia to North Carolina population could not be determined due to uncertain data, but there is a possibility that the population is also overfished (Cooper et al. 2014). Currently, the South Atlantic Fishery Management Council is developing a new amendment to modify the hogfish management units, revise the hogfish annual catch limits, and establish a rebuilding plan for the East Florida/Florida Keys population (SAFMC 2015b) (SAFMC 2015c) (SAFMC 2015d).

Red porgy is also overfished in this region, but is rebuilding and is being fished at an appropriate level (NMFS 2016c). Recovery of species of concern is rated "moderately effective."

**Factor 3.1.4 - Scientific Research / Monitoring**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
Puerto Rico's Department of Natural and Environmental Resources has a fisheries research laboratory and commercial statistics program that assist in the collection of fisheries data (NOAA 2009). Commercial fishers report catches through trip tickets monthly. The fisheries reporting system makes it difficult to effectively collect data on commercial catches, especially for hogfish because it is reported with two other species as a "wrasse unit" and not always by species (NOAA 2011). Additions are made to annual catches by the government to account for misreporting and nonreporting. This is done by using a ratio of weight reported to weight observed during surveys (NOAA 2009). Additionally, there is little research on life history of Caribbean species, and limited recreational data are collected (Munoz et al. 2013); however, the MRIP system has been collecting recreational fishing data since 2000 (NMFS 2016a). A full population assessment has not been conducted for hogfish in this region, but there is some evidence that overfishing could be occurring based on an assessment of catch data (Ault and Smith 2015). Though some progress has been made on data collection, research is still lacking in Puerto Rico, especially long-term data (NOAA 2009) (Munoz et al. 2013). Overall, research and monitoring is considered "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
Population assessments have been conducted on hogfish in 2004 and 2013 by the Southeast Data, Assessment, and Review (SEDAR) (SEDAR 2004)(Cooper et al. 2014). Data collected in this fishery includes commercial catch data (commercial trip tickets and logbooks), recreational catches (marine recreational fishery statistic survey, marine recreational information program, and headboat survey) and fishery independent data (video surveys, trawl surveys, and visual dive surveys) (Cooper et al. 2014). Limitation to fishery dependent data can include: reporting reliability, accuracy of recreational catches, being limited by what is caught (i.e. catchable size), and non-random nature of fishing (Cooper et al. 2014)(Smith et al. 2014)(Switzer et al. 2014). Limitations to fishery-independent data can include: sampling frequency, sampling coverage, and sample size, all of which can be partially attributed to funding, weather, equipment issues, or study design (Cooper et al. 2014)(Switzer et al. 2014). In both population assessments scientists report that were data limitations and some uncertainty, especially when it comes to recreational catches (Cooper et al. 2014). Overall a high level of uncertainty exists in the Georgia to North Carolina fishery due to lack of data, but within the west Florida and east Florida/Florida Keys fisheries, uncertainty was attributed to variability within data (standard error) (Cooper et al. 2014). Many species caught along with hogfish have been been assessed within the past 5 years, but others have not been assessed (gray snapper, almaco jack, white grunt), or assessments are considerably out of date (scamp). Overall research and monitoring is considered moderately effective.

**Factor 3.1.5 - Scientific Advice**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
The Scientific and Statistical Committee within the Caribbean Fishery Management Council is responsible for providing scientific advice and recommendations on overfishing limits and annual catch limits (CFMC 2011b) (NOAA 2011) {CFMC/NMFS 2014a}. Recently, these recommendations have been used in proposed amendments but, in some cases, more conservative adjustments have been made to the recommendations when creating reference points (NOAA 2011){CFMC/NMFS 2014a}. An assessment of reef fish in Puerto Rico in 2014 revealed that some species, including hogfish, were being harvested unsustainably and the assessment offered advice to modify databases, improve data-collection techniques, and focus future research on fish life-history (Ault and Smith 2015). Future regulations will incorporate these results and advice (Lilyestrom 2015). Because federal and territory management use scientific advice but do not have mitigation in place for some species that are likely overfished and undergoing overfishing (Ault and Smith 2015), a score of "moderately effective" is awarded.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
The South Atlantic Fishery Management Council Scientific and Statistical Committee and the Gulf of Mexico Fishery Management Council Scientific and Statistical Committee advise managers on acceptable biological catch, annual catch limits, and accountability measures, and managers generally seem to follow scientific advice. But independent research conducted a decade ago did indicate that the U.S. hogfish population in South Florida was being overfished, and recommendations were made then to adjust regulations. Research showed that increasing the minimum size limit for hogfish in Florida waters would increase both recruitment of hogfish and fishery yield (Ault et al. 2003) (McBride and Murphy 2003). In 2012, an amendment was proposed to increase the minimum catch size, but the proposal was removed until a formal population assessment could be performed (SAFMC 2015d). The recent SEDAR population assessment confirmed that hogfish in South Florida had been undergoing overfishing for decades. As a result, new management regulations for hogfish are now finally in development (SAFMC 2015b) (SAFMC 2015c) (SAFMC 2015d) (SAFMC/GMFMC 2015). Because scientific advice is often followed but managers have not always been quick to respond to outside scientific information, we have awarded a "moderately effective" score.

**Factor 3.1.6 - Enforce**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
Enforcement in Puerto Rico is shared by the U.S. Coast Guard, National Oceanographic and Atmospheric Administration (NOAA) Office of Law Enforcement, and Puerto Rico's authorities through a Joint Enforcement Agreement (NOAA 2011). Puerto Rico's fishery management agency is the Fisheries Research Laboratory (PR-FRL) of the Department of Natural and Environmental Resources (DNER). Besides assisting with the management of federal waters, the PR-FRL is solely responsible for regulating state waters (within 9 nautical miles of shore) (NOAA 2011). Puerto Rico DNER has over 380 enforcement officers; more than one-third are dedicated to marine fisheries. But there is minimal coordination between resource managers and enforcement personnel (Lilyestrom 2015).

Commercial annual catch limits (ACLs) in Puerto Rico and the U.S. Virgin Islands are monitored through paper logbooks only (NMFS 2015b); there is no observer program, so landings are consistently underreported (Trumble 2011). Further, the lag in receipt of accurate landings logbook data prevents effective management of commercial ACL monitoring (Trumble 2011), although there have been recent improvements to commercial reporting (CFMC 2016). An electronic reporting pilot study is currently underway for the Caribbean {NOAA 2015}. ACLs for several species, including hogfish, have recently been exceeded (CFMC 2016). We have therefore awarded a "moderately effective" score.

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderately Effective**
Commercial annual catch limits (ACLs) in the Gulf of Mexico are monitored through paper logbooks, electronic reporting by dealers, vessel monitoring systems (VMS), and by observers. Additionally, a pilot study is underway to assess the feasibility of the use of e-logbooks for reef fish bycatch (NMFS 2015b). In the hogfish fishery, total catches exceeded the combined commercial and recreational ACL in 2012 and 2013, but were below the ACL in 2014 and 2015. Greater amberjack commercial ACLs have also been exceeded frequently in recent years, but ACLs of other species in the fishery are not routinely exceeded (NMFS SERO 2016). Enforcement is therefore rated as "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
Commercial annual catch limits (ACLs) for species in the Southeast Atlantic are monitored through paper logbooks and electronic reporting (NMFS 2015b), but no vessel monitoring system (VMS) or observer program currently exists (SAFMC 2014). An improved dealer reporting amendment was implemented in 2014 (SAFMC 2014) and a pilot study is underway to assess the feasibility of the use of e-logbooks (NMFS 2015b). In some years, catch limits have been exceeded for some species (NMFS SERO 2016). In the hogfish fishery, catch limits have often been exceeded in the recreational portion of the fishery {NOAA 2013b} (Cooper et al. 2014) {NOAA 2014} {NOAA 2014b}. In 2014 and 2015, the South Atlantic recreational fishery exceeded catch limits by 31% and 167%, respectively. On August 24, 2015, the SAFMC closed the recreational hogfish fishery for the remainder of the year because ACLs were exceeded {NOAA 2015g}. Given this information, we have rated enforcement "moderately effective."

**Factor 3.1.7 - Track Record**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Ineffective**

Hogfish is managed along with two other species (Spanish hogfish and puddingwife) within the “wrasse unit” under the Reef Fish Fisheries Management Plan. Hogfish is the predominant species caught in the "wrasse unit" {CFMC/NMFS 2005}. Regulations and amendments over the years have included gear restrictions (type, mesh size, panel specifications, etc.), annual catch limits (ACLs), prohibited fishing (species and area closures), and seasonal/area closures. In 2012, multiple amendments were implemented, including island-specific ACLs for Puerto Rico, St. Croix, and St. Thomas/St. John, commercial and recreational ACLs for Puerto Rico, accountability measures to prevent and mitigate overfishing, and revisions of some management reference points {CFMC/NMFS 2014a}. An assessment of reef fish was performed in 2014 in Puerto Rico, which showed that some species, including hogfish, red hind, and schoolmaster snapper, were being harvested unsustainably (Ault and Smith 2015). NOAA Fisheries recently declared that overfishing was occurring on hogfish due to the catch limit being exceeded (NMFS 2016c). In another example, red hind has been depleted for some time with little improvement in biomass (SEDAR 2014d). These result in a score of "ineffective."

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderately Effective**

Hogfish is managed within the Reef Fish Management Plan, which was enacted in 1984 and encompasses 42 species. Since 1984, regulations have been implemented that affect hogfish, including prohibited gear (explosives, poisons, trawls, etc.), gear restrictions, permit restrictions, bag limits, annual catch limits, minimum catch size, area closures, and gear specifications (Cooper et al. 2014). In 2011, accountability measures and annual catch limits were set for the commercial and recreational fisheries combined (Cooper et al. 2014). The most recent population assessment reports the West Florida population as sustainable (not overfished/no overfishing), but the East Florida and Florida Keys population (a portion of which is in the Gulf Management area) as overfished with overfishing occurring (Cooper et al. 2014) {NOAA 2015}. Currently, the GMFMC and South Atlantic Fishery Management Council are evaluating management of the Keys and incorporating findings from the population assessment into regulations (SAFMC 2015b) (SAFMC 2015c) (SAFMC 2015d) (SAFMC/GMFMC 2015). Other species caught along with hogfish are also managed under the Reef Fish Management Plan, and most are abundant but a few are overfished (amberjack). This results in a track record rating of "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**

Hogfish is managed within the Snapper-Grouper Fishery Management Plan, which was enacted in 1983 and includes 60 species. Since 1983, regulations have been made that affect the hogfish fishery, including prohibiting trawls, area closures, minimum catch size, daily bag limits, annual catch limits, and gear specifications (Cooper et al. 2014). In 2012, comprehensive annual catch limits (ACLs) and accountability measures were established for hogfish, and in 2013, the ACLs were revised to allow for more catches in the commercial fishery and fewer catches in the recreational fishery (Cooper et al. 2014). In 2012, an amendment was proposed to increase the minimum catch size, but the proposal was removed until a population assessment could be performed (SAFMC 2015d). The most recent population assessment reports the East Florida/Florida Keys fishery as overfished with overfishing occurring and the Georgia to North Carolina fishery as unknown (Cooper et al. 2014). Currently, the managers are evaluating the results from the 2013 population assessment and developing new management regulations (SAFMC 2015d). Other species caught along with hogfish are also managed under the Snapper-Grouper Fishery Management Plan, and most are abundant. Because of the successful management of many specie, but concern over the management of hogfish, a "moderately effective" score is awarded.

**Factor 3.1.8 - Stakeholder Inclusion**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Highly effective**
The Caribbean Fishery Management Council (CFMC) is responsible for managing the hogfish populations in the U.S. Caribbean waters (U.S. Virgin Islands and Puerto Rico). This council comprises one member from the National Oceanographic and Atmospheric Administration (NOAA), one member from the USVI fishery agency, one member from Puerto Rico's fishery agency, and four members from the public, who are appointed by the U.S. Secretary of Commerce (NOAA 2011). The CFMC encourages public interest and involvement in the management process through open public meetings, advisory panels, and open comment periods on regulatory documents. Because stakeholder input is sought and utilized by managers, we have awarded a "highly effective" score.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Highly effective**
The South Atlantic Fishery Management Council (SAFMC), Gulf of Mexico Fishery Management Council, and the Florida Fish and Wildlife Conservation Commission (FWC) involve stakeholders in the management process through public meetings, public comments, formal reviews, board membership, data collection, and workshops (NOAA 2006) (GMFMC 2015) (SAFMC 2015). Any changes to the management regulations must go through a public review process (GMFMC 2015) (SAFMC 2015). Because stakeholder involvement is integrated into the management process and outlined by each agency, a score of "highly effective" is awarded.

**Factor 3.2.1 - All Species Retained?**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Yes**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**No**

**Factor 3.2.2 - Critical?**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**No**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**No**

**Western Central Atlantic | Hand implements | United States | Florida**

**No**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**

**No**

**Factor 3.2.3 - Mgmt Strategy / Implement**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Highly effective**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**

**Moderately Effective**
The most common discards in the commercial handline fishery in the Gulf of Mexico are red snapper, vermilion snapper, red grouper, and gag grouper (Scott-Denton et al. 2011). Changes to regulations, such as the introduction of individual fishing quotas (IFQs) in 2007, were implemented partly to reduce bycatch associated with "derby" fishing situations (NOAA 2011b). There are regulatory requirements in place to reduce mortality to incidentally caught sawfish and sea turtles (NOAA 2011b). All vessels in the reef fish fishery are required to use nonstainless-steel circle hooks and have de-hooking tools aboard to minimize bycatch mortality (GMFMC 2015b). The effectiveness of circle hooks as a bycatch management tool remains uncertain, and further study is required. Some studies have indicated that circle hooks have reduced bycatch and bycatch mortality of some species, but other studies have been inconclusive (Sauls and Ayala 2012) (Garner et al. 2014). Bycatch management is scored as "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Moderately Effective**
The most frequently discarded species in the South Atlantic snapper-grouper fishery include red snapper, scamp, red porgy, vermilion snapper, and Atlantic sharpnose shark (GSAFFI 2013). The handline fishery was not expected to contribute to significant mortality of any threatened or endangered species. Annual expected mortality of sea turtles is expected to be less than 30 individuals, and no mortality is expected for smalltooth sawfish (SAFMC 2014). All vessels in the fishery are required to use nonstainless-steel circle hooks and have de-hooking tools aboard to minimize bycatch mortality (SAFMC 2015f). The effectiveness of circle hooks as a bycatch management tool remains uncertain, and further study is required. Some studies have indicated that circle hooks have reduced bycatch and bycatch mortality of some species, but other studies have been inconclusive (Garner et al. 2014) (Sauls and Ayala 2012) (Wilson and Diaz 2012). Bycatch management is scored as "moderately effective."

**Factor 3.2.3 - Scientific Research / Monitoring**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderately Effective**
Discard logbooks are required for 20% of vessels in the reef fish fishery, with approximately 50% compliance (Batty and McElderry 2013). The observer program is small, covering just 1% of vessels (Scott-Denton et al. 2011), resulting in a score of "moderately effective."

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderately Effective**
Discard logbooks are required for 20% of vessels in the snapper-grouper fishery, but no observer program currently exists (SAFMC 2014) (NMFS 2015b). Some preliminary observer-based discard data provide estimates of discard mortality (GSAFFI 2008) (GSAFFI 2010) (GSAFFI 2013). This results in a score of "moderately effective."

**Factor 3.2.5 - Scientific Advice**

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderately Effective**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
See 3.1.4 in the Harvest Strategy section for detailed information.

**Factor 3.2.6 - Enforce**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderately Effective**
See 3.1.5 in the Harvest Strategy section for detailed information.

## 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 (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:*

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

*Rating cannot be Critical for Criterion 4.*

**Criterion 4 Summary**

| FISHERY | FISHING GEAR ON THE SUBSTRATE | MITIGATION OF GEAR IMPACTS | ECOSYSTEM-BASED FISHERIES MGMT | SCORE |
|---|---|---|---|---|
| Caribbean Sea \| Atlantic, Western Central \| Hand implements \| Puerto Rico | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Gulf of Mexico \| Atlantic, Western Central \| Hand implements \| United States \| Florida | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Gulf of Mexico \| Atlantic, Western Central \| Handlines and hand-operated pole-and-lines \| United States \| Florida | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Hand implements \| United States \| Florida | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Hand implements \| United States \| North Carolina | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Hand implements \| United States \| South Carolina | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| Florida | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| North Carolina | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |
| Western Central Atlantic \| Handlines and hand-operated pole-and-lines \| United States \| South Carolina | Very Low Concern | Minimal Mitigation | Moderate Concern | **Green (3.571)** |

**Criterion 4 Assessment**

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate
Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - 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. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - 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.*

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts
Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management
Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

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

**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Very Low Concern**
Diver-based fishing (spearfishing) may result in some incidental contact with the reef, but has little expected or observable impacts on benthic coral habitat (Frisch et al. 2012). This results in a rating of "very low" concern.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**

**Very Low Concern**
Fishing for hogfish principally occurs in and around coral reef habitats, which are sensitive to habitat damage. Handline gear is among the least damaging to bottom substrates, but may cause minor damage to coral and sponges when fishing on reefs (Morgan and Chuenpagdee 2003). We have awarded a score of "very low" concern.

**Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts**

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**
**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Minimal Mitigation**
A small portion of Gulf of Mexico waters (0.5%) and eight MPAs in the southeast Atlantic are designated no-take MPAs where fishing activity is prohibited (SAFMC 2007) (OOCRM 2011). Less than 5% of Puerto Rico waters are no-take marine reserves, but there are several areas that are closed to fishing to protect spawning aggregations (NOAA and CFMC 2015). Contact between diver or handline gear and the environment is minimal; however, little habitat is protected from fishing. This factor receives a score of "minimal mitigation."

**Factor 4.3 - Ecosystem-based Fisheries Management**

**Caribbean Sea | Atlantic, Western Central | Hand implements | Puerto Rico**

**Moderate Concern**
Ecosystem-based management has lagged behind in the Caribbean, because fisheries management has focused on traditional single-species yields and not ecosystem or habitat protection (Stump 2007). But some marine sanctuaries to protect reef habitat and sea turtle nesting have been established in Puerto Rico and the U.S. Virgin Islands (NOAA 2016e). There is a Protected Caribbean Corals Recovery Plan (NMFS 2015c), but this plan is not yet integrated with fishery management, and implementation of this plan is not clear. Two habitat reserves have been established in Puerto Rico—Northeast Reserve and Culebra Island—to protect coral reef habitats, seagrass beds, mangroves, and sea turtle nesting beaches (NOAA 2016). Several locations are closed seasonally to all fishing activity, in part to protect spawning aggregations of grouper and snapper species (NOAA and CFMC 2015).

There is no evidence that hogfish should be considered a species of exceptional importance. But the potential food web or other ecological effects related to removal of the species within this fishery have not been determined. This results in a score of "moderate" concern.

**Gulf of Mexico | Atlantic, Western Central | Handlines and hand-operated pole-and-lines | United States | Florida**
**Gulf of Mexico | Atlantic, Western Central | Hand implements | United States | Florida**

**Moderate Concern**
The Gulf of Mexico Fishery Management Council (GMFMC) is in the planning phase of ecosystem-based management (EBM) development. The council has designated an Ecosystem-Based Fishery Management Working Group to develop objectives related to EBM implementation (ESMWG 2014). Additionally, NOAA commissioned a study to act as a framework from which ecosystem-based management of the Gulf of Mexico will be built (Karnauskas et al. 2013). There is no indication that hogfish or most other species caught in the fishery should be considered species of exceptional importance. But red grouper *(Epinephelus morio)* may serve as a habitat modifier, potentially increasing biodiversity and the abundance of economically and ecologically important species such as spiny lobster, sponges, and corals (Coleman et al. 2010). The GMFMC has not evaluated the potential food web or other ecological impacts of removal of these species from the ecosystem. This results in a score of "moderate" concern.

**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | South Carolina**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | Florida**
**Western Central Atlantic | Handlines and hand-operated pole-and-lines | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | North Carolina**
**Western Central Atlantic | Hand implements | United States | South Carolina**
**Western Central Atlantic | Hand implements | United States | Florida**

**Moderate Concern**
The South Atlantic Fishery Management Council is working toward adopting an ecosystem-based approach to management through a Fishery Ecosystem Plan. The plan addresses five key areas needed to implement this ecosystem approach: 1) an overview of the South Atlantic system; 2) species, habitats, and essential fish habitat; 3) information on coastal fishing communities; 4) threats to the system and recommendations; and, 5) research and data needs (SAFMC 2009). The most recent adoption of the Comprehensive Ecosystem-Based Amendment 2 implements some goals of ecosystem-based management, including providing special management zones for snapper-grouper species in South Carolina and requiring the review of potential essential fish habitat closures in the future (NOAA 2011). There is no indication that hogfish or most other species caught within the fishery are species of exceptional ecological importance. But red grouper *(Epinephelus morio)* may serve as a habitat modifier, potentially increasing biodiversity and the abundance of economically and ecologically important species such as spiny lobster, sponges, and corals (Coleman et al. 2010). This results in a score of "moderate" concern.

*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.*

## Acknowledgements

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## Appendix B: Review Schedule

Hogfish in the Florida Keys is set to undergo tighter restrictions in 2017 (date TBD), which should help with overfishing in the region. Changes to Florida regulations could warrant a change in overfishing status quickly, so this could be revisited at the end of 2017 or 2018.

## Appendix

Updates to Hogfish Report : **Updates to the September 5, 2017 U.S. Hogfish report were made on October 5, 2020:**

**Overall Recommendations for hogfish** caught by hand implements in South Carolina downgraded from "Good Alternative" to "Avoid." Changes are due to the recent status change for greater amberjack in the South Atlantic, which is a co-landed species in this fishery.

**Overall Recommendations for hogfish** caught in all other fisheries remained unchanged but there were updates to individual criteria as described below.

**Florida (Western Central Atlantic) Fisheries**

C1.3: Upgraded from "High" Concern to "Moderate" Concern because hogfish were recently removed from NOAA's overfishing list and fishing mortality may be fluctuating around sustainable levels. This change is based on catch data rather than an updated stock assessment.

C2.3: *Red porgy* downgraded from "Low" Concern to "High" Concern for the handline fishery because the 2020 stock assessment indicates that the stock is experiencing overfishing.
C2.2: *Vermilion snapper* upgraded from "Low" Concern to "Very Low" Concern for the handline fishery because the stock is not overfished and there is no scientific controversy.
C2.3: *Black grouper* downgraded from "Low" Concern to "Moderate" Concern for the handline fishery because abundance is based on outdated data that may no longer reliably represent the status of the stock.

**South Carolina Fisheries**
C2.2: *Greater amberjack* downgraded from "Low" Concern to "Moderate" concern because abundance is based on outdated data that may no longer reliably represent the status of the stock.
C2.3 *Greater amberjack* downgraded from "Low" Concern to "High" concern because the stock is experiencing overfishing.
C2.3: *Red porgy* downgraded from "Low" Concern to "High" Concern for the handline fishery because the 2020 stock assessment indicates that the stock is experiencing overfishing.
C2.2: *Vermilion snapper* upgraded from "Low" Concern to "Very Low" Concern for the handline fishery because the stock is not overfished and there is no scientific controversy.

**North Carolina Handline Fishery**
C2.3: *Red porgy* downgraded from "Low" Concern to "High" Concern for the handline fishery because the 2020 stock assessment indicates that the stock is experiencing overfishing.
C2.2: *Vermilion snapper* upgraded from "Low" Concern to "Very Low" Concern for the handline fishery because the stock is not overfished and there is no scientific controversy.

**Puerto Rico Fishery**
C1.3: Upgraded from "High" Concern to "Moderate" Concern because hogfish were recently removed from NOAA's overfishing list and fishing mortality may be fluctuating around sustainable levels. This change is based on catch data rather than an updated stock assessment.

**Florida (Gulf of Mexico) Fisheries**
C2.3: *Greater amberjack* downgraded from "Low" Concern to "High" Concern because the stock is experiencing overfishing.
C2.2: *Gray snapper* upgraded from "Moderate" Concern to "Low" Concern because a recent stock assessment indicates that the population is not overfished.