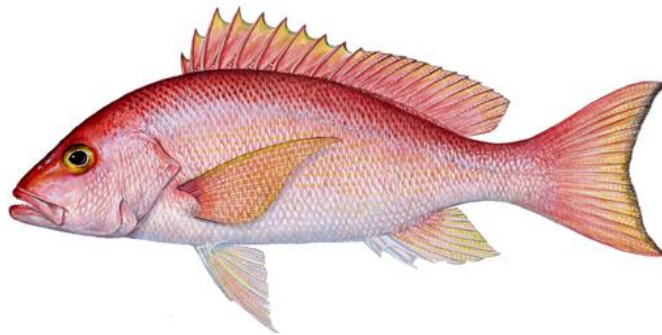


and

Monterey Bay Aquarium
Seafood Watch®

Gray Snapper

Lutjanus griseus



(Image © Diane Rome Peebles)

United States

Handline, Diver

January 7, 2016

The Safina Center Seafood Analysts

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About The Safina Center

The Safina Center (formerly Blue Ocean Institute) translates scientific information into language people can understand and serves as a unique voice of hope, guidance, and encouragement. The Safina Center (TSC) works through science, art, and literature to inspire solutions and a deeper connection with nature, especially the sea. Our mission is to inspire more people to actively engage as well-informed and highly motivated constituents for conservation.

Led by conservation pioneer and MacArthur fellow, Dr. Carl Safina, we show how nature, community, the economy and prospects for peace are all intertwined. Through Safina's books, essays, public speaking, PBS television series, our Fellows program and Sustainable Seafood program, we seek to inspire people to make better choices.

The Safina Center was founded in 2003 by Dr. Carl Safina and was built on three decades of research, writing and policy work by Dr. Safina.

The Safina Center's Sustainable Seafood Program

The Center's founders created the first seafood guide in 1998. Our online seafood guide now encompasses over 160-wild-caught species. All peer-reviewed seafood reports are transparent, authoritative, easy to understand and use. Seafood ratings and full reports are available on our website under [Seafood Choices](#). TSC's Sustainable Seafood Program helps consumers, retailers, chefs and health professionals discover the connection between human health, a healthy ocean, fishing and sustainable seafood.

- Our online guide to sustainable seafood is based on scientific ratings for more than 160 wild-caught seafood species and provides simple guidelines. Through our expanded partnership with the Monterey Bay Aquarium, our guide now includes seafood ratings from both The Safina Center and the Seafood Watch® program.
- We partner with Whole Foods Market (WFM) to help educate their seafood suppliers and staff, and provide our scientific seafood ratings for WFM stores in the US and UK.
- Through our partnership with Chefs Collaborative, we created [Green Chefs/Blue Ocean](#), a free, interactive, online sustainable seafood course for chefs and culinary professionals.
- Our website features tutorials, videos, blogs, links and discussions of the key issues such as [mercury in seafood](#), bycatch, overfishing, etc.

Check out our Fellows Program, learn more about our Sustainable Seafood Program and Carl Safina's current work at www.safinacenter.org.

The Safina Center is a 501 (c) (3) nonprofit organization based in the School of Marine & Atmospheric Sciences at Stony Brook University, Long Island, NY. www.safinacenter.org admin@safinacenter.org | 631.632.3763

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

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

Guiding Principles

The Safina Center and Seafood Watch define sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch and the Safina Center have developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

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 the Safina Center's 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

Gray snapper (*Lutjanus griseus*) is a medium-size snapper found in the Western Atlantic from Massachusetts to Brazil, including the Gulf of Mexico. Adults are typically found offshore, associated with reef structure and hard bottoms. This report provides a recommendation for gray snapper captured in the U.S. Gulf of Mexico and Southeast Atlantic handline fisheries, and the Gulf of Mexico diver fishery, which account for more than 95% of all U.S. commercial landings.

Three genetically distinct gray snapper populations exist in U.S. waters: the northwestern Gulf of Mexico, north central/northeastern Gulf, and the Atlantic Coast. Abundance and fishing mortality are unknown for all populations, though some reports suggest fishing pressure is high in southern Florida.

Several overfished and recovering species of concern are targeted and caught with gray snapper in the handline fisheries. These include red snapper, red porgy, and red grouper. Endangered goliath grouper may also be a bycatch in the fisheries. Hogfish, believed to be abundant, is also caught in the diver fishery.

Gray snapper and other species caught in the diver and handline fishery are managed through annual catch limits and minimum size limits. The fisheries in the Gulf of Mexico and Southeast Atlantic are considered moderately well managed.

Handlines and diver-based fishing have very low to no contact with the benthic environment, and the overall effect of these fisheries on the ecosystem is expected to be low.

Overall, gray snapper from the **Gulf of Mexico diver fishery** (10% of landings) is **rated Green/Best Choice** due to the combination of little to no bycatch and no impacts to bottom habitat. The **Gulf of Mexico and Southeast Atlantic handline fisheries** (85% of landings) are **rated Yellow/Good Alternative** because they catch some species of concern.

Table of Conservation Concerns and Overall Recommendations

Species / Fishery	Criterion 1 Impacts on the Species Under Assessment	Criterion 2 Impacts on other Species	Criterion 3 Management Effectiveness	Criterion 4 Impacts on the Habitat and Ecosystem	Overall Recommendation
Gray snapper United States Gulf of Mexico – Handline	Yellow (2.64)	Red (1.82)	Yellow (3.00)	Green (3.57)	Yellow/Good Alternative (2.680)
Gray snapper United States Gulf of Mexico – Diver	Yellow (2.64)	Green (3.83)	Yellow (3.00)	Green (3.87)	Green/Best Choice (3.294)
Gray snapper United States Southeast Atlantic – Handline	Yellow (2.64)	Red (1.34)	Yellow (3.00)	Green (3.57)	Yellow/Good Alternative (2.483)

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).

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Introduction

Scope of the analysis and ensuing recommendation

This report assesses the U.S. Gulf of Mexico and Southeast Atlantic handline fisheries and the Gulf of Mexico diver fishery for gray snapper (*Lutjanus griseus*). In both regions, gray snapper are managed in mixed reef-fish fisheries.

Overview of the species and management bodies

Gray snapper are found in the Gulf of Mexico from Texas through Florida, and in the South Atlantic as far north as Massachusetts, with the population centered around Florida. Information on the population structure of gray snapper suggests that there are three distinct populations: the northwestern Gulf of Mexico, north central/northeastern Gulf, and the Atlantic Coast (Gold et al. 2009). Gray snapper are managed in two main fisheries: the Gulf of Mexico reef fish fishery and the Southeast Atlantic snapper-grouper fishery, with the Florida Keys representing the boundary between regions. The Gulf of Mexico Fishery Management Council (GMFMC) is the management agency in the Gulf of Mexico (Porter et al. 2012); the South Atlantic Fishery Management Council (SAFMC) is the management agency in the Atlantic Ocean (SAFMC 2014). Catches north of Cape Hatteras, North Carolina are uncommon (NMFS 2015a), so gray snapper is not managed in the Mid- or North-Atlantic regions.

Gray snapper (frequently called mangrove snapper) belongs to the family Lutjanidae, marine fish that are commonly referred to as “snappers.” Adults tend to be associated with reef and high relief hard-bottom structure on the continental shelf. Adults spawn offshore between June and September, can grow to greater than 30 inches in length, and reach at least 25 years of age (Manooch and Matheson 1981). Juveniles utilize inshore estuaries and seagrass habitat (Luo et al. 2009) (Flaherty-Walia et al. 2015) (FWRI 2014).

Production statistics

Handline gear is the primary method of capture for gray snapper in all U.S. waters (~85% of commercial catches), with a small but significant fraction caught in the commercial diving fishery in the Gulf of Mexico (10%), and a negligible amount caught in longline fisheries (< 4%) (NMFS 2015a). Most gray snapper are captured on trips that target other species in the fishery, such as red snapper (pers. comm., R. Ellis 2015).

The gray snapper commercial fishery is centered around southern Florida (FWRI 2014). Between 1994 and 2013, an average of 77% of all gray snapper in the commercial fisheries were landed on the west coast of Florida, followed by 13% from eastern Florida, and 9% in Louisiana, with all other states landing < 1% (NMFS 2015a). Total commercial landings ranged from 286,000 to 670,000 lbs between 1994 and 2013 (Figure 1) (NMFS 2015a). Recently, gray snapper dollar value has averaged approximately \$640,000 per year (2009–2013) (NMFS 2015a). The majority of gray snapper landings come from the recreational fishery, which has high landings throughout Florida (FWRI 2014), but relatively higher fishing pressure in

southern Florida (Allman & Goetz 2009) (Burton 2001). A yearly average of 1,860,000 lbs of gray snapper were caught in U.S. recreational fisheries from 1995–2014. (pers. comm., NMFS 2015).

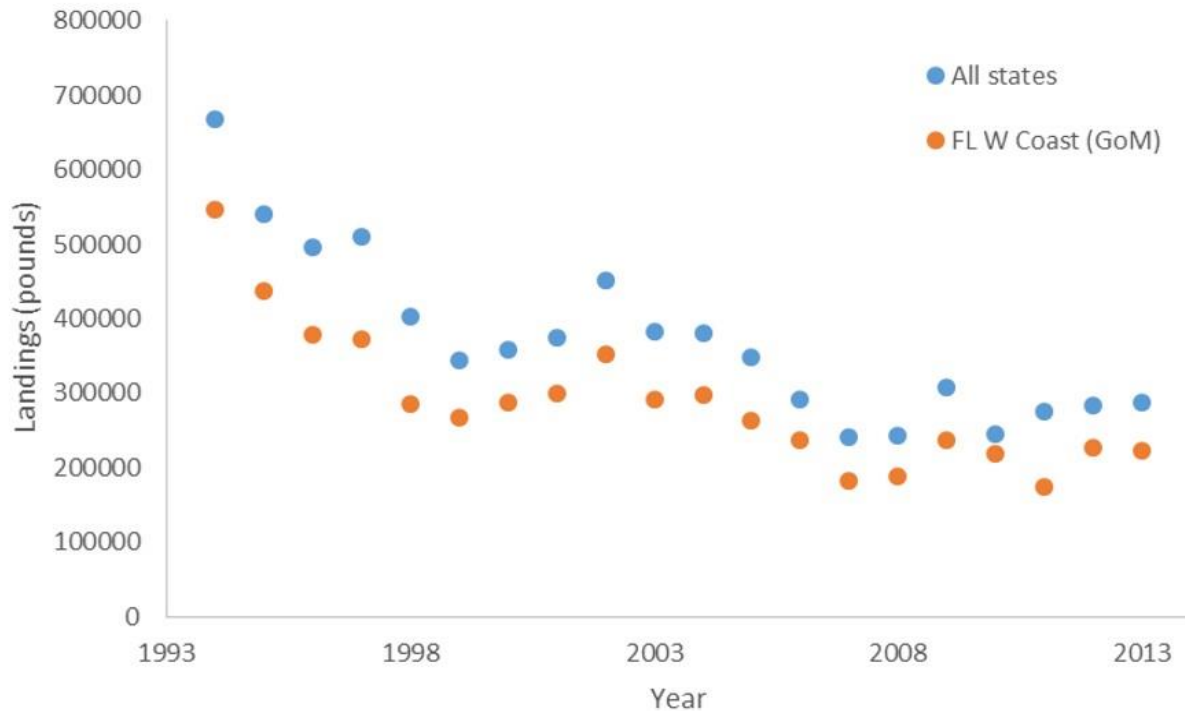


Figure 1. Commercial production statistics for all states and regions 1994 to 2013. Gulf of Mexico and South Atlantic (blue); western Florida (orange) (NMFS 2015a).

Importance to the U.S./North American market

Gray snapper may be imported from the Caribbean, but specific data on this species is not available. Around 15,000 lbs of snapper are imported into the United States per year (2012 and 2013) (NOAA 2013). The United States did not export any snapper species between 2009 and 2014 (NOAA 2015b); product caught in the United States is sold in the U.S. market.

Common and market names

Mangrove snapper, grey snapper, lowyer, mango snapper, black snapper, caballero, pargo prieto, pargo, pargo dienton, pargo de piedra, pargo moreno, vivaneau sarde grise, aquadera (Bortone & Williams 1986).

Primary product forms

Gray snapper is sold fresh and frozen whole, and in skinless filets.

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at <http://www.seafoodwatch.org>.

Criterion 1: Impact on the Species Under Assessment

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

Criterion 1 Summary

GRAY SNAPPER				
Region / Method	Factor 1.1 Inherent Vulnerability	Factor 1.2 Abundance	Factor 1.3 Fishing Mortality	Criterion 1 Score
United States Gulf of Mexico Diver	Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)
United States Gulf of Mexico Handline	Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)
United States Southeast Atlantic Handline	Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)

Criterion 1 Assessment

GRAY SNAPPER

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*

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

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Medium

Gray snapper is considered moderately vulnerable to fishing, with a FishBase score of 40 out of 100 (Froese and Pauly 2015). Sexual maturity is reached at 9.1 in Fork Length (FL) for females and 8.7 in FL for males (Starck & Schroeder 1971) (Manooch and Matheson 1981). Maximum size is approximately 90 cm Total Length (TL) (Bortone & 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 per female (Bortone & Williams 1986), but more recent updates on fecundity are not available. Differences in life history traits, such as size and age, between areas with different levels of fishing pressure (North vs. South Florida) suggest that demography changed as a result of exploitation (Manooch and Matheson 1981) (Burton 2001) (Allman & Goetz 2009). Adults are found offshore, associated with reef structure and hard bottoms (Bortone & Williams 1986), while juveniles are estuarine-dependent and commonly associated with seagrass and mangrove habitats (Flaherty et al. 2014).

Factor 1.2 - Abundance

Scoring Guidelines

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

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Moderate Concern

Three genetically distinct gray snapper populations exist in U.S. waters: the northwestern Gulf of Mexico, north central/northeastern Gulf, and the South Atlantic (east coast of Florida) (Gold et al. 2009). No formal stock assessments have been conducted for any population (SEDAR 2015a), though gray snapper is a species that has been well studied in recent years (FWRI 2011a) (FWRI 2011b) (Flaherty et al. 2014) (Flaherty-Walia et al. 2015). Despite research, no target abundance or reference points have been defined (NOAA 2015a), but a formal stock assessment is planned for 2018 (SEDAR 2015a). 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. 2005b). South Florida likely includes fish from 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 uncertain for all populations, and this species has a moderate inherent vulnerability to fishing, abundance is rated a “moderate” concern.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

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

population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).

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

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Moderate Concern

There have been no formal population assessments for any of the gray snapper populations, so fishing mortality on all populations is unknown (NOAA 2015a). 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 the commercial and recreational fisheries is centered around South Florida (FWRI 2014); following restrictions on red snapper, gray snapper are increasingly targeted by handline fishers in Louisiana (pers. comm., David Nieland 2015). Between 2005 and 2014, the U.S. commercial fisheries contributed substantially to gray snapper mortality, with yearly average catches of 288,000 lbs. During the same period, recreational fishery catches averaged 1.8 million lbs annually (NMFS 2015a) (NMFS 2015c). A data-limited study in 2005 estimated gray snapper fishing mortality in South Florida waters was 2.5 times the fishing mortality at maximum sustainable yield (F_{MSY}), indicating overfishing was occurring (Figure 2) (Ault et al. 2005b). More recent information is not available. Because of the limited information, the gray snapper is rated a “moderate” concern for fishing mortality.

Rationale:

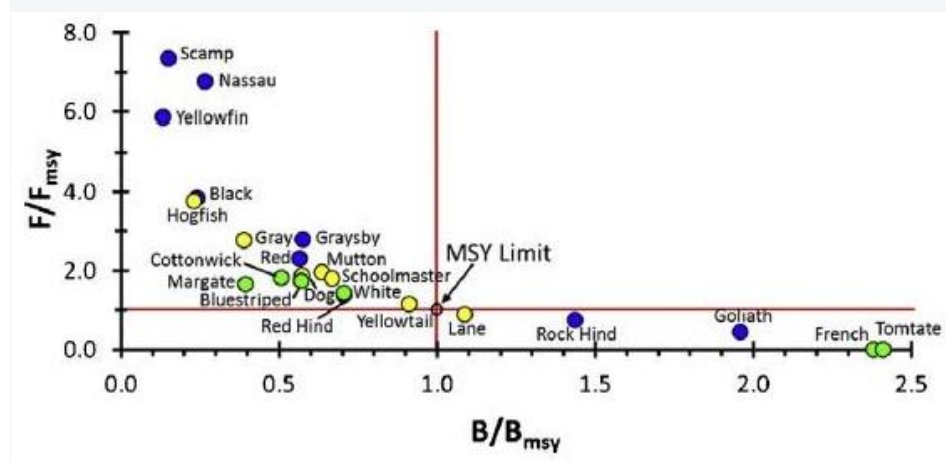


Figure 2. Estimate of F/F_{MSY} for the reef fish complex in South Florida (from Ault et al. 2005).

Criterion 2: Impacts on Other Species

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

Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix A.

Gray snapper				
Region / Method	Factors 2.1-2.3		Factor 2.4 Discard Rate Modifying Score ((Discards+Bait)/Retained Catch)	Criterion 2 Score
	Lowest Scoring of Other Species	Lowest Species Subscore		
United States Gulf of Mexico, Diver	Hogfish	3.831	1.00 (<20%)	Green (3.831)
United States Gulf of Mexico, Handline	Goliath	1.916	0.95 (20-40%)	Red (1.820)
United States Southeast Atlantic, Handline	Red Snapper	1.414	0.95 (20-40%)	Red (1.343)

The Gulf of Mexico gray snapper handline fishery captures and discards red snapper, red grouper, red porgy, and gag (Scott-Denton et al. 2011), with potential catch of goliath grouper and hogfish (pers. comm., R. Ellis 2015). Total discards to landings ratio for the fishery is 34%, and the ratio for individual, common bycatch species can be as high as 41% (Scott-Denton et al. 2011). The lowest scoring species for the Gulf of Mexico is goliath grouper, primarily because of concerns over low population abundance, even though fishing mortality is expected to be low (SEDAR 2011).

The Gulf of Mexico diver fishery primarily targets hogfish (NMFS 2015a), with small, opportunistic catches of other reef fish species. Hogfish is believed to be relatively abundant in the Gulf of Mexico. Bycatch/discards in this fishery are expected to be minor (Frisch et al. 2008).

In the Southeast Atlantic, commercial handline fisheries target red grouper, vermilion snapper, and red snapper, along with gray snapper (GSAFFI 2008). This fishery commonly discards red porgy, red snapper, vermilion snapper (GSAFFI 2008), red grouper (ACCSP 2015), and potentially goliath grouper because they have similar distribution overlap with gray snapper (pers. comm., R. Ellis 2015). Total discards to landings ratio is 23% for the South Atlantic handline fishery. Ratios for the most commonly discarded species in the South Atlantic range from 17% for vermilion snapper to 250% for red grouper, primarily because undersized individuals are caught (GSAFFI 2010). Because red snapper is considered depleted/overfished and is still undergoing overfishing, it is the lowest-scoring species in the South Atlantic (NOAA 2015a).

Bycatch species were included based on catch composition data from commercial sales reports from the Gulf of Mexico and South Atlantic (Florida only) that were collected from trips that catch and report gray snapper; from advice from expert Robert Ellis (GMFMC); and from fisheries observer studies in the literature.

Criterion 2 Assessment

GOLIATH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

High

FishBase has assigned a high vulnerability rating (70 out of 100) to goliath grouper (Froese and Pauly 2015). Goliath grouper (*Epinephelus itajara*), formerly known as “jewfish,” is a large grouper with variable coloration ranging from brownish-yellow to greenish-gray, and dark spots on the head and dorsal surface. Goliath grouper are the largest groupers found in the West Atlantic, reaching up to 250 cm and 455 kg, and can live to at least 37 years of age (Froese and Pauly 2015) (GMFMC 2015c). Goliath grouper are protogynous hermaphrodites, reaching sexual maturity at approximately 128 cm as females and then metamorphosing into males at approximately 150 cm. Goliath grouper are found in shallow, inshore areas associated with rocky bottoms and coral reefs, and have been known to enter estuaries and mangrove swamps (Froese and Pauly 2015) (GMFMC 2015c). These fish frequently have high site fidelity to reef structures and exhibit territorial behavior (Collins et al. 2015). Goliath grouper are found from Florida to the coast of Brazil, throughout the Gulf of Mexico and Caribbean, and also in the East Atlantic along the African coast from Senegal to Congo. Goliath grouper feed on smaller fish, spiny lobsters, turtles, and stingrays (Froese and Pauly 2015) (GMFMC 2015c).

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Very High Concern

The International Union for the Conservation of Nature (IUCN) considers goliath grouper a Critically Endangered species (IUCN 2011). In 1990, goliath grouper in the United States was listed as overfished, and the harvest and possession of goliath grouper was prohibited in state and federal waters (SEDAR 2011a). Goliath grouper in the U.S. Gulf of Mexico and South Atlantic are assessed as a single population. The most recent stock assessment was published in 2011 (another is currently underway to be completed in the summer of 2016 (SEDAR 2015a)). There are not enough data to estimate the abundance of goliath grouper relative to target abundance reference points. The assessment concluded that the status of goliath grouper is unknown (SEDAR 2011a). Because of its critically endangered status and insufficient data on population size, goliath grouper abundance is rated as a “very high” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Low Concern

The National Marine Fisheries Service lists goliath grouper in South Florida as not experiencing overfishing (NOAA 2015a). The fishery was closed in 1990 and fishing mortality is assumed to be approaching zero (NOAA 2015a). Before the moratorium, goliath grouper were commonly targeted by commercial fishers using vertical lines and longlines, divers using spears, and headboat and private recreational fishers using vertical lines. Although commercial landings have been zero since the closure, goliath grouper were reported as bycatch on 0.8% of commercial vertical line fishing trips in South Florida between 2002 and 2009; all of these fish were reportedly released alive (McCarthy 2010). Recreational catch in 2009 was a reported 46,111 fish, all in South Florida (SEDAR 2011a). Although all these fish were reported to have been released alive, post-release mortality from recreational hook and line was estimated at 5% (SEDAR 2011a). Fishing mortality on goliath grouper is difficult to estimate with so many unknowns, but since 1990 the overall trend seems to be decreasing fishing mortality and increasing abundance (SEDAR 2011a). Goliath grouper is therefore rated “low” concern for fishing mortality.

HOGFISH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Diver

High

FishBase has assigned a high vulnerability rating (67 out of 100) to hogfish (Froese and Pauly 2015). Hogfish (*Lachnolaimus maximus*) are large wrasses with variable coloration ranging from gray to pink to mottled brownish red, reaching a maximum length of 91 cm (Froese and Pauly 2015). Hogfish are recognized by three elongated, filamentous spines on the first dorsal fin, a dark spot at the base of the second dorsal fin, and elongated filaments on the upper and lower margins of the caudal fin. They are monandric protogynous hermaphrodites, meaning some of the solely juvenile females may change into terminal males. Hogfish reach sexual maturity at approximately 20 cm (females), and metamorphose into males at approximately 35 cm or 3–5 years old. Hogfish are associated with coral reefs, rocky ledges, and wrecks down to a depth of 30 m from North Carolina to the Gulf of Mexico, Bermuda, and northern South America, where they feed on clams, snails, urchins, and other invertebrates (Froese and Pauly 2015) (GMFMC 2015c).

Factor 2.2 - Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Diver

Low Concern

The IUCN has assessed hogfish as Vulnerable globally (IUCN 2010). But a more recent assessment (2013) was conducted for the U.S. hogfish populations (SEDAR 2013b). This assessment indicated that the western Florida (eastern Gulf of Mexico) population was not overfished, and that abundance was well above the target abundance level or biomass at maximum sustainable yield (B/B_{MSY} = of 3.50). Yet the Florida Keys/eastern Florida population is overfished with its abundance, at only 47% of the target abundance level (B/B_{MSY} = 0.47) (SEDAR 2013b). Further, reviewers of the assessment point to concern over the fisheries-dependent and fisheries-independent measures of catch used to assess abundance (SEDAR 2013b). Because the western Florida hogfish population is unlikely overfished but there is some uncertainty over the abundance estimate, abundance is rated as a “low” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Diver

Low Concern

Hogfish in the Gulf of Mexico are unlikely to be experiencing overfishing. Fishing mortality is estimated well below the fishing mortality at maximum sustainable yield ($F/F_{MSY} = 0.408$) (SEDAR 2013b). But uncertainty about the data used in the assessment leads to some uncertainty about the fishing mortality estimate (SEDAR 2013b). Hogfish are commonly targeted by both commercial and recreational fishers using spears, vertical hook and line gear, and pots/traps. Recreational catches by spearfishing were the majority of all hogfish landings in 2012. Landings of hogfish by recreational fishers in western Florida in 2012 were estimated at 42,549 lbs using hook and line, and 128,530 lbs using spearfishing (SEDAR 2013b). Landings of hogfish by commercial fishers were 58,555 lbs in 2013 (NMFS 2015a). Since it is probable that fishing mortality on Gulf of Mexico hogfish is below a sustainable level, this results in a rating of “low” concern.

RED SNAPPER

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

High

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

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

High Concern

Red snapper in the Gulf of Mexico are 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 2015c). This assessment concluded that Gulf of Mexico red snapper are recovering, but remain 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 ($SSB/M_{SST} = 0.573$) (SEDAR 2015c). This is an improvement from the previous stock assessment, which found spawning stock biomass to be only 40% of the limit reference point (SEDAR 2013c). Red snapper are currently in year 11 of a 27-year rebuilding plan (NOAA 2015a). Because of the overfished status of red snapper in the Gulf, it is awarded a “high” concern score.

United States Southeast Atlantic, Handline

High Concern

Red snapper in the South Atlantic are managed by the South Atlantic Fisheries Management Council under the Snapper-Grouper Fishery. The most recent stock assessment was published in 2010 (SEDAR 2010b). This assessment concluded that South Atlantic red snapper are overfished; spawning stock biomass in 2009 was only 9% of the limit reference point or minimum stock size threshold, below the level a stock is considered overfished ($SSB/M_{SST} = 0.09$) (SEDAR 2010b). Red snapper are currently in year 5 of a 35-year rebuilding plan (NOAA 2015a). Because of this highly depleted status, the South Atlantic red snapper has been awarded a “high” concern score.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

Low Concern

The National Marine Fisheries Service lists red snapper in the Gulf of Mexico as not subject to overfishing (NOAA 2015a). Red snapper are commonly targeted by commercial fishers using vertical lines and longlines, by headboat and private recreational fishers using vertical lines, and juvenile red snapper are bycatch in the shrimp trawl fishery. Landings for the Gulf of Mexico in 2013 were 5,306,925 lbs by the commercial fisheries and 9,058,862 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). The fishing mortality between 2011 and 2013 is estimated at just below the fishing mortality, a

maximum sustainable yield ($F/F_{MSY} = 0.995$) (SEDAR 2015c), which represents an increase since the last stock assessment ($F/F_{MSY} = 0.695$ between 2009 and 2011) (SEDAR 2013c). Because fishing mortality has increased in recent years, but remains below the overfishing limit, a “low” concern score has been awarded.

United States Southeast Atlantic, Handline

High Concern

NOAA Fisheries lists red snapper in the South Atlantic as subject to overfishing (NOAA 2015a), with fishing mortality estimated as more than four times the fishing mortality at maximum sustainable yield ($F/F_{MSY} = 4.12$) from 2007 to 2009 (SEDAR 2010b). This led managers to close the fishery from 2010 to 2012. There was a limited reopening of the fishery from 2013 to 2014, but the fishery is again closed in federal waters in 2015 (NOAA SERO 2015a). Red snapper are commonly targeted by commercial fishers using vertical lines and longlines, by headboat and private recreational fishers using vertical lines, and juvenile red snapper are bycatch in the shrimp trawl fishery. Since red snapper are caught as part of multi-species fisheries, fishing mortality does not drop to zero during the closure (SEDAR 2010b). Landings for the South Atlantic in 2013 were 28,332 lbs by the commercial fisheries and 231,549 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). Because of this very high fishing mortality, a “high” concern score has been awarded.

ALL SPECIES

Factor 2.4 – Modifying Factor: Discards and Bait Use

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 2.4 score
<20%	1
20-40%	0.95
40-60%	0.9
60-80%	0.85
80-100%	0.8
>100%	0.75

United States Gulf of Mexico, Diver

< 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. 2008).

United States Gulf of Mexico, Handline

20–40%

The total discards/landings ratio for the Gulf of Mexico reef-fish fishery was 33.8% between 2006 and 2009, based on observer data (Scott-Denton et al. 2011). Discard to landings ratios for the five most commonly discarded species were: red snapper, 24%; vermilion snapper, 5%; red grouper, 41%; red porgy, 20%; and gag grouper, 40% (Scott-Denton et al. 2011). Commercial discards of gray snapper are relatively low, with data from observer programs suggesting that gray snapper discard rates were ≈6% in vertical line fisheries in the Gulf of Mexico from 2006 to 2009 (Scott-Denton et al. 2011). Discard mortality rates for gray snapper estimated from the recreational fisheries were between 1% and 14%, depending on whether catches happened inshore or nearshore (Flaherty-Walia et al. 2016).

United States Southeast Atlantic, Handline

20–40%

Commercial discards in the snapper-grouper fishery in the Southeast Atlantic are moderate. The total discards/landings ratio for the fishery was 23.2% between 2007 and 2011 (GSAFFI 2013). Of the 15 species assessed in Amendment 29 to the Snapper-Grouper FMP, gray snapper ranked fourth in commercial landings, but first in commercial discards (SAFMC 2014). Discard/landings ratios of some other commonly discarded species, based on a pilot observer program, were: vermilion snapper, 17%; red snapper, 45%; and red grouper, 250% (GSAFFI 2010). A large proportion of the discards in this fishery are undersized discards (36–98%, depending on the species) (GSAFFI 2008).

Criterion 3: Management effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. 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 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*
Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Criterion 3 Summary

Region / Method	Factor 3.1 Harvest Strategy	Factor 3.2 Bycatch Strategy	Criterion 3 Score
United States Gulf of Mexico - Diver	3.00: Moderate Concern	All Species Retained	Yellow(3.000)
United States Gulf of Mexico - Handline	3.00: Moderate Concern	3.00: Moderate Concern	Yellow(3.000)
United States Southeast Atlantic - Handline	3.00: Moderate Concern	3.00: Moderate Concern	Yellow(3.000)

Criterion 3 Assessment

Factor 3.1: Harvest Strategy

Scoring Guidelines

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.

Factor 3.1 Summary

Factor 3.1: Management of fishing impacts on retained species								
Region / Method	Management Strategy and Impl.	Recovery of Species of Concern	Scientific Research & Monitoring	Record of Following Scientific Advice	Enforcement of Regs.	Track Record	Stakeholder Inclusion	Factor 3.1 Score
United States Gulf of Mexico - Diver	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective	3.00: Moderate Concern
United States Gulf of Mexico - Handline	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective	3.00: Moderate Concern
United States Southeast Atlantic - Handline	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective	3.00: Moderate Concern

Subfactor 3.1.1 – Management Strategy and Implementation

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

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

Moderately Effective

Gray snapper, along with the other species evaluated in this report, are managed in federal waters by the GMFMC under the Reef Fish Fishery Management Plan. In state waters they are managed by state agencies such as the Florida Fish and Wildlife Conservation Commission. Gray snapper are managed with a total annual catch limit of 2,420,000 lbs, which covers the commercial and recreational fisheries. In recent years, the fisheries have taken 60%–90% of the annual catch limit. The recreational fisheries

account for around 90% of the gray snapper catch, while the commercial fisheries contribute modestly, accounting for around 10% of the catch (NOAA SERO 2015b). Other species caught with gray snapper are also managed under annual catch limits. Additionally, there are minimum size limits and recreational bag limits for gray snapper and other species in state and federal waters (GMFMC 2015b). There are no abundance conservation goals for gray snapper, and its status is unknown (NOAA 2015a). But data has suggested that overfishing is occurring in South Florida waters (Allman & Goetz 2009) (Ault et al. 2005b). This results in a score of “moderately effective.”

United States Southeast Atlantic, Handline

Moderately Effective

Gray snapper, along with the other species evaluated in this report, are managed by the SAFMC under the Snapper-Grouper Fishery Management Plan, as well as by relevant state agencies. Gray snapper is managed both commercially and recreationally under annual catch limits (ACL), with approximately 25% of the catch allocated to commercial fisheries and 75% allocated to recreational fisheries (SAFMC 2014). The commercial ACL, which is set for a complex of snappers, was increased to 344,884 lbs in 2015 using a new acceptable biological catch (ABC) control rule for snapper species within the complex (Federal Register 2015). Minimum size limit and recreational bag limit regulations are also in place for gray snapper and other commonly retained species caught with gray snapper, including red snapper, red grouper, and vermilion snapper (SAFMC 2015a). Additionally, there are eight deepwater marine protected areas (MPAs) in the South Atlantic, where fishing of snapper and grouper species is prohibited (SAFMC 2007). There are no abundance conservation goals for gray snapper, so its status is unknown. But there has been some suggestion of overfishing in South Florida (Ault et al. 2005b). Additionally, management of other retained species in this fishery has been mixed. This results in a score of “moderately effective.”

Subfactor 3.1.2 – Recovery of Species of Concern

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

United States Gulf of Mexico, Diver

N/A

The diver fishery in the Gulf of Mexico that catches gray snapper primarily targets hogfish, with small catches of other reef fish species (NMFS 2015a). Because there are no overfished, threatened, or endangered species caught in this fishery in significant amounts, a score of N/A was awarded.

United States Gulf of Mexico, Handline**Moderately Effective**

In the Gulf of Mexico, red snapper is targeted and retained during a reduced fishing season, and it is commonly caught with gray snapper. They are overfished in the region, and are currently in year 14 of a 27-year rebuilding plan (NOAA 2015a). Management is responsive to red snapper landings, and the population is rebuilding quickly (NOAA 2015c), resulting in a score of “moderately effective.”

United States Southeast Atlantic, Handline**Moderately Effective**

Red snapper is landed with gray snapper off the South Atlantic coast of Florida (ACCSP 2015). Red snapper is both overfished and experiencing overfishing (NOAA 2015a); in 2014 the Total Allowable Catch was exceeded, resulting in a fishery closure for 2015 (SFSC 2015). Red snapper is in year 5 of a 35-year rebuilding plan in this region (NOAA 2015a), resulting in a score of “moderately effective.”

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.

United States Gulf of Mexico, Diver**United States Gulf of Mexico, Handline****Moderately Effective**

Dealer reports, a small observer program, and dockside interviews of fishers provide information on commercial catches of gray snapper, catch per unit effort, species composition, and fish sizes (Stebbins et al. 2009) (NMFS 2015b). No formal stock assessment has been performed for gray snapper, though recent research has contributed to our understanding of gray snapper (Flaherty et al. 2014) (Flaherty-Walia et al. 2015) (FWRI 2011a) (FWRI 2011b). But one study suggested that gray snapper are overfished in South Florida waters, based on the small size-at-age of gray snapper in this area compared to other areas (Ault et al. 2005b) (Allman & Goetz 2009). A formal stock assessment for gray snapper in the Gulf of Mexico has been scheduled by Southeast Data Assessment and Review (SEDAR) for 2018 (SEDAR 2015a). With the exception of red pogy, the other species targeted and retained in the fishery (e.g., red snapper, gag grouper, vermilion snapper) have formal stock assessments. This results in a score of “moderately effective.”

United States Southeast Atlantic, Handline

Moderately Effective

Data collected on gray snapper come primarily from vessel landings reports, discard logbooks mandated in 20% of vessels, and dealer electronic reports, but no observer coverage exists (GSAFFI 2013) (SAFMC 2014) (NMFS 2015b). No formal stock assessment has been performed for the South Atlantic gray snapper population. But one study suggested that gray snapper are overfished in South Florida waters, based on the small size-at-age of gray snapper in this area compared to other areas (Ault et al. 2005b). Stock assessments have been performed for other commonly caught fish in this fishery. This results in a score of “moderately effective.”

Subfactor 3.1.4 – Management Record of Following Scientific Advice

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

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

Highly Effective

The GMFMC Scientific and Statistical Committee advises managers on acceptable biological catch, annual catch limits, and accountability measures (GMFMC 2015a). There is no evidence that managers do not follow scientific recommendations, resulting in a score of “highly effective.”

United States Southeast Atlantic, Handline

Highly Effective

The SAFMC Scientific and Statistical Committee advises managers on acceptable biological catch, annual catch limits, and accountability measures (SAFMC 2014). There is no evidence to suggest that managers do not follow scientific recommendations, resulting in a score of “highly effective.”

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.

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

Moderately Effective

ACLs for gray snapper and other species 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 electronic logbooks (NMFS 2015b). Several ACLs were exceeded in recent years, including the recreational ACLs for red snapper and red grouper in 2013 (NOAA SERO 2015a) and the total hogfish ACL in 2014 (GMFMC 2014a). There is some suggestion that since the introduction of Individual Fishing Quotas (IFQ) for some species, there have been small, but measurable improvements in compliance (Porter et al. 2012). This results in a rating of “moderately effective.”

United States Southeast Atlantic, Handline

Highly Effective

ACLs for gray snapper and other species in the Southeast Atlantic are monitored through paper logbooks and electronic reporting (NMFS 2015b), but no observer program currently exists (SAFMC 2014). A pilot study is underway to assess the feasibility of the use of electronic logbooks (NMFS 2015b). ACLs for most species in the fishery have not been recently met or exceeded, and an improved dealer reporting amendment was implemented in 2014 (SAFMC 2014). Enforcement is therefore rated as “highly effective.”

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.

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

Moderately Effective

Gray snapper is managed within the Reef Fish Management Plan, which was enacted in 1984 and encompasses 42 species. Amendments over time have led to management measures that include ACLs,

minimum sizes, bag limits, and gear restrictions (Sauls & Ayala 2012) (Scott-Denton et al. 2011). Stock abundance and overfishing status are unknown for gray snapper. The track record for other species caught in the fishery has been mixed; several species are at healthy abundance levels, while others are overfished or have unknown or uncertain statuses (NOAA 2015a). This results in a “moderately effective” track record rating.

United States Southeast Atlantic, Handline

Moderately Effective

Gray snapper is managed within the Snapper Grouper Fishery Management Plan, which was enacted in 1983 and includes 60 species. Amendments over time have led to management measures that include annual catch limits, minimum sizes, bag limits, and gear restrictions (Hawk 2012) (SAFMC 2014). Stock abundance and overfishing status are unknown for gray snapper. Several species in the fishery are overfished but are in a rebuilding plan (red grouper, red porgy, and red snapper); red snapper is currently overfished (NOAA 2015a). This results in a “moderately effective” rating for track record.

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.

United States Gulf of Mexico, Diver

United States Gulf of Mexico, Handline

Highly Effective

The GMFMC posts draft regulation notices for public viewing, has public comment periods for all proposed regulations, and holds regular public meetings. Stakeholder inclusion is therefore rated as “highly effective.”

United States Southeast Atlantic, Handline

Highly Effective

The SAFMC posts draft regulation notices for public viewing, has public comment periods for all proposed regulations, and holds regular public meetings. Stakeholder inclusion is therefore rated as “highly effective.”

Factor 3.2: Bycatch Strategy

Scoring Guidelines

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

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

Factor 3.2 Summary

Factor 3.2: Bycatch Strategy						
Region / Method	All Kept	Management Strategy and Impl.	Scientific Research & Monitoring	Record of Following Scientific Advice	Enforcement of Regs.	Factor 3.2 Score
United States Gulf of Mexico - Diver	Yes	N/A	N/A	N/A	N/A	N/A
United States Gulf of Mexico - Handline	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	3.00: Moderate Concern
United States Southeast Atlantic - Handline	No	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	3.00: Moderate Concern

Subfactor 3.2.1 – Management Strategy and Implementation

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

United States Gulf of Mexico, Handline**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 IFQs in 2007, were implemented partly to reduce bycatch associated with “derby” fishing situations (NOAA 2011). There are regulatory requirements in place to reduce mortality to incidentally caught sawfish and sea turtles (NOAA 2011). All vessels in the reef-fish fishery are required to use non-stainless-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 others studies have been inconclusive (Sauls & Ayala 2012) (Garner et al. 2014). Overall, bycatch management is considered “moderately effective.”

United States Southeast Atlantic, Handline**Moderately Effective**

The most frequently discarded species in the South Atlantic snapper-grouper fishery include red snapper, scamp, red porgy, vermilion snapper, Atlantic sharpnose shark (GSAFFI 2013), and gray snapper (SAFMC 2014). 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 2011). All vessels in the fishery are required to use non-stainless-steel circle hooks and have de-hooking tools aboard to minimize bycatch mortality (SAFMC 2015a). The effectiveness of circle hooks as a bycatch management tool remains uncertain; further study is required. Some studies have indicated that circle hooks have reduced bycatch and bycatch mortality of some species, but others studies have been inconclusive (Wilson & Diaz 2012) (Sauls & Ayala 2012) (Garner et al. 2014). Overall bycatch management is considered “moderately effective.”

Subfactor 3.2.2 – Scientific Research and Monitoring

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

United States Gulf of Mexico, Handline

Moderately Effective

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

United States Southeast Atlantic, Handline

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 provides estimates of discard mortality (GSAFFI 2008) (GSAFFI 2010). This results in a score of “moderately effective.”

Subfactor 3.2.3 – Management Record of Following Scientific Advice

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

United States Gulf of Mexico, Handline

Highly Effective

See Subfactor 3.1.4 in the Harvest Strategy section for detailed information.

United States Southeast Atlantic, Handline

Highly Effective

See Subfactor 3.1.4 in the Harvest Strategy section for detailed information.

Subfactor 3.2.4 – Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen’s compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.

United States Gulf of Mexico, Handline**Moderately Effective**

See Subfactor 3.1.5 in the Harvest Strategy section for detailed information.

United States Southeast Atlantic, Handline**Highly Effective**

See Subfactor 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 (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management 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 cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Factor 4.1 Impact of Gear on Habitat Score	Factor 4.2 Mitigation of Gear Impacts Modifier	Factor 4.3 Ecosystem Based Fisheries Management Score	Criterion 4 Score
United States Gulf of Mexico - Diver	5.00:None	0.00:Not Applicable	3.00:Moderate Concern	Green (3.873)
United States Gulf of Mexico - Handline	4.00:Very Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	Green (3.571)
United States Southeast Atlantic - Handline	4.00:Very Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	Green (3.571)

Criterion 4 Assessment

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

Scoring Guidelines

- *5 (None)—Fishing gear does not contact the bottom*
- *4 (Very Low)—Vertical line gear*
- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*

- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)
Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

United States Gulf of Mexico, Diver

None

Diver-based fishing (spearfishing) has no expected or observable impacts on benthic habitat (Frisch et al. 2012).

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Very Low Concern

Handlines used for reef-associated species are in limited contact with the substrate.

Factor 4.2 – Mitigation of Gear Impacts

Scoring Guidelines

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

United States Gulf of Mexico, Diver

Not Applicable

United States Gulf of Mexico, Handline
United States Southeast Atlantic, Handline
Minimal Mitigation

Circle hooks are required for all vessels in the Gulf of Mexico reef-fish fishery and the South Atlantic snapper-grouper fishery (Sauls & Ayala 2012) (GMFMC 2015b) (SAFMC 2015a); circle hooks are expected to be less likely to snag the substrate (Cooke & Suski 2004), though limited data exists to substantiate this point. A small portion of Gulf of Mexico waters (0.5%) are designated no-take marine protected areas (MPA), where fishing activity is prohibited; there are eight deepwater MPAs in the Southeast Atlantic, where fishing for snapper and grouper species is prohibited (SAFMC 2007) (OOCRMC 2011). But these areas are unlikely to protect a substantial proportion of gray snapper habitat. This factor receives a score of “minimal mitigation.”

Factor 4.3 – Ecosystem-Based Fisheries Management

Scoring Guidelines

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

United States Gulf of Mexico, Diver
United States Gulf of Mexico, Handline

Moderate Concern

The GMFMC is not as far along in the adoption of Ecosystem Based Fisheries Management compared to several of the other U.S. fishery management councils. The Ecosystem Based Fishery Management Working Group within the GMFMC last met in 2014 to develop objectives related to ecosystem based management implementation (GMFMC 2014b). The GMFMC has not evaluated the potential food web or other ecological impacts of the removal of gray snapper or other snapper and groupers caught in this fishery (GMFMC 2014b). It should also be noted that they recently disbanded their ecosystem scientific and statistical committee (GMFMC 2015d).

Yet there is no indication that gray snapper should be considered a species of exceptional ecological importance. Most of the other species caught in the fishery are also not considered species of exceptional importance, with the exception of red grouper. Red grouper (*Epinephelus morio*) may serve as an important habitat modifier, potentially increasing biodiversity and abundance of economically and ecologically important species like spiny lobster, sponges, and corals (Coleman et al. 2010). Because the majority of species caught in this fishery are not “exceptional species,” and ecosystem-based management in the Gulf of Mexico remains in the planning stage, this results in a score of “moderate concern.”

United States Southeast Atlantic, Handline

Moderate Concern

The SAFMC 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 gray snapper is a species of exceptional ecological importance, but red grouper (which is targeted/retained in the fishery) may serve as an important habitat modifier, potentially increasing biodiversity and abundance of economically and ecologically important species like spiny lobster, sponges, and corals (Coleman et al. 2010). The council has created eight deepwater marine protected areas in the South Atlantic (SAFMC 2009), which may confer some benefit to species like red grouper. While some efforts have been made to protect important habitat areas, the potential food web or other ecological effects related to removal of the species within this fishery have not been evaluated, resulting in a score of “moderate concern.”

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Appendix A: Main Species Considered in the Assessment

Summary of all main species considered in the assessment

Gray snapper: United States Gulf of Mexico, Diver				
Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
GRAY SNAPPER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
HOGFISH	High	4.00: Low Concern	3.67: Low Concern	3.831

Gray snapper: United States Gulf of Mexico, Handline				
Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
GOLIATH	High	1.00: Very High Concern	3.67: Low Concern	1.916
GRAY SNAPPER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
RED PORGY	High	3.00: Moderate Concern	2.33: Moderate Concern	2.644
RED SNAPPER	High	2.00: High Concern	3.67: Low Concern	2.709
GAG GROUPER	High	3.00: Moderate Concern	5.00: Very Low Concern	3.873
RED GROUPER	High	4.00: Low Concern	5.00: Very Low Concern	4.472
VERMILION SNAPPER	Medium	5.00: Very Low Concern	5.00: Very Low Concern	5.000
YELLOWTAIL SNAPPER	High	5.00: Very Low Concern	5.00: Very Low Concern	5.000

Gray snapper: United States Southeast Atlantic, Handline				
Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
RED SNAPPER	High	2.00: High Concern	1.00: High Concern	1.414
GOLIATH	High	1.00: Very High Concern	3.67: Low Concern	1.916

GRAY SNAPPER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
RED PORGY	High	2.00: High Concern	3.67: Low Concern	2.709
RED GROUPER	High	4.00: Low Concern	3.67: Low Concern	3.831
VERMILION SNAPPER	Medium	4.00: Low Concern	3.67: Low Concern	3.831

Assessment of main species not included in body of report

GAG GROUPER

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

High

FishBase has assigned a high vulnerability rating (68 out of 100) to gag grouper (Froese and Pauly 2015). Gag groupers (*Mycteroperca microlepis*) are medium-size groupers with brownish-gray colorations and dark markings on the back and sides. They can reach 145 cm in length. Gag groupers are protogynous hermaphrodites, reaching sexual maturity as females at approximately 50 cm size and then later metamorphosing into males (Froese and Pauly 2015). 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 2015) (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

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

Moderate Concern

The IUCN considers gag grouper a species of least concern (IUCN 2008). Gag grouper in the Gulf of Mexico are 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 2014). This assessment published two estimates of spawning stock biomass. One estimate used female fish only

and produced an estimate of spawning stock biomass at twice the limit reference point ($SSB_{\text{FEMALES}}/MSST = 2.05$) (SEDAR 2014). The second used combined female and male fish and produced an estimate of combined spawning stock at below the limit reference point ($SSB_{\text{COMBINED}}/MSST = 0.496$) (SEDAR 2014). Using 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 indicates that the stock is overfished (SEDAR 2014). NOAA Fisheries reports Gulf of Mexico gag grouper as not overfished (NMFS 2014) (NOAA 2015a); this report 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, abundance is rated a “moderate” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

Very Low Concern

Gag grouper are commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. The National Marine Fisheries Service reports that 685,421 lbs of gag grouper were caught in the commercial fisheries in 2013 (NMFS 2015a). The fishing mortality on gag grouper is estimated at below the fishing mortality at maximum sustainable yield ($F/F_{\text{MSY}} = 0.765$); therefore, gag grouper are not experiencing overfishing (SEDAR 2014) (NOAA 2015a). SEDAR notes that “across all sensitivity runs and model configurations, the assessment model predicts that fishing mortality has decline substantially from peak levels in 2008” (SEDAR 2014). Because it is highly likely that overfishing is not occurring, this factor is scored “very low” concern.

RED GROUPE

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

High

FishBase has assigned a high vulnerability rating (63 out of 100) to red grouper (Froese and Pauly 2015). Red grouper is a medium-size grouper with variable coloration ranging from red to mottled reddish-brown, reaching a maximum size of 125 cm. It is a protogynous hermaphrodite that reaches sexual

maturity at approximately 35–98 cm as females, and then metamorphoses into males between the ages of 7 and 14 (Froese and Pauly 2015). Adult red grouper and young-of-the-year juveniles are associated with offshore rocky and muddy bottoms to a depth of 330 m (Froese and Pauly 2015); juvenile fish between 1 and 6 years old are common on nearshore coral reefs (GMFMC 2015c). Spawning takes place from April to May. Red grouper are found from North Carolina to the coast of Brazil, and throughout the Gulf of Mexico and Caribbean, feeding on smaller fish, squid, and crustaceans (Froese and Pauly 2015) (GMFMC 2015c).

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

Low Concern

The IUCN considers red grouper a near-threatened species (IUCN 2004). Red grouper in the Gulf of Mexico are 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, increasing from 2009 to 2013 (B/B_{MSY} proxy = 1.28 in 2009, B/B_{MSY} proxy = 1.83 in 2013). But the assessment review panel notes that there is some uncertainty around the abundance estimate, and there is debate regarding the appropriate reference points (SEDAR 2015b). Also, this species is vulnerable to toxic red tide events, which could reduce biomass (FishWatch 2015) (SEDAR 2009). Based on recovery from previous overfished status, combined with uncertainty in the recent stock assessment, abundance is rated as a “low” concern.

United States Southeast Atlantic, Handline

Low Concern

The IUCN considers red grouper a near-threatened species (IUCN 2004). Red grouper in the South Atlantic are managed by the South Atlantic Fisheries Management Council under the Snapper-Grouper Fishery. The last stock assessment for red grouper in the South Atlantic estimated abundance as of 2008 at 79% of the biomass at maximum sustainable yield ($B_{2008}/B_{MSY} = 0.79$) and at 92% of the minimum stock size threshold ($B/MSST = 0.92$) (SEDAR 2010a). Because abundance was estimated below the limit reference point, the assessment concluded that red grouper in the South Atlantic was overfished. Since then, the way that MSST is calculated was revised, and based on the new MSST value (75% of B_{MSY}), red grouper is no longer classified as overfished (SAFMC 2013). But red grouper abundance remains below the target level, and the species is in year 4 of a 10-year rebuilding plan (NOAA 2015a) (SAFMC 2011b).

Because red grouper is no longer considered overfished but abundance is below the target level, abundance is rated a “low” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

Very Low Concern

The National Marine Fisheries Service lists red grouper in the Gulf of Mexico as not experiencing overfishing (NOAA 2015a). Red grouper are 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 2008 were 1,968,170 lbs gutted by the commercial fisheries and 860,986 lbs gutted by the recreational fisheries (SEDAR 2009). Fishing mortality was estimated 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) (SEDAR 2009) (SEDAR 2015b). Red grouper fishing mortality is a “very low” concern.

United States Southeast Atlantic, Handline

Low Concern

Red grouper in the South Atlantic experienced overfishing in 2008, with fishing mortality well above the target level at maximum sustainable yield ($F/F_{MSY} = 1.35$) (SEDAR 2010a). But the overfishing concerns were addressed with the establishment of a rebuilding plan and annual catch limits in 2012. NOAA Fisheries currently lists red grouper in the South Atlantic as not subject to overfishing (NOAA 2015a), although there is no recent assessment report to support this classification. Red grouper are commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. Landings for the South Atlantic in 2008 were 547,583 lbs gutted by the commercial fisheries and 1,104,543 lbs gutted by the recreational fisheries (SEDAR 2010a). In a recent peer-reviewed report on grouper fisheries, Seafood Watch rated fishing mortality for this stock as “low” concern because of the current lack of overfishing (Seafood Watch 2014).

RED PORGY

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

High

FishBase has assigned a high vulnerability rating (66 out of 100) to red porgy (Froese and Pauly 2015). Red porgy (*Pagrus pagrus*) are medium-size porgies with red-silver coloration. They can grow up to 91 cm (Froese and Pauly 2015). Red porgy are protogynous hermaphrodites, reaching sexual maturity at approximately 22 cm (3 years of age) as females and then metamorphosing into males at 35–40 cm (Hood & Johnson 2000). Adult red porgy are found associated with rocky, coral rubble, or sandy bottoms down to a depth of 250 m, and juveniles are found in shallower waters and seagrass beds (Froese and Pauly 2015) (SAFMC 2015b). Red porgy are 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 feed on smaller fish, crustaceans, and other invertebrates (Froese and Pauly 2015).

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

Moderate Concern

The IUCN considers red porgy a species of least concern (IUCN 2014). Red porgy in the Gulf of Mexico are not managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan, and there are no formal stock assessments published for this species in the Gulf of Mexico. Based on the least concern rating from the IUCN, but noting the lack of stock assessments, porgy abundance is considered a “moderate” concern.

United States Southeast Atlantic, Handline

High Concern

The IUCN considers red porgy a species of least concern (IUCN 2014). But red porgy in the U.S. South Atlantic Coast are considered overfished. The most recent assessment for this species, in 2012, estimated abundance at 61% of the threshold/limit abundance level, and at 47% of the target abundance level, or the biomass at maximum sustainable yield (B_{MSY}) (SEDAR 2012a). Red porgy is

managed by the South Atlantic Fisheries Management Council under the Snapper-Grouper Fishery, and is in year 16 of an 18-year rebuilding program (NOAA 2015a). Because of this depleted status, red porgy abundance is a “high” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

Moderate Concern

In one study, red porgy in the northeastern Gulf of Mexico had reduced sizes and earlier maturity compared to other populations, which could be evidence of size-selective fishing pressure (Hood & Johnson 2000). Red porgy are commonly targeted by commercial fishers, headboats, and private recreational boats using vertical lines. Landings for the Gulf of Mexico in 2013 were 240,466 lbs by the commercial fisheries and 439,055 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). Because stock assessments or fishing mortality estimates are lacking, red porgy fishing mortality is a “moderate” concern.

United States Southeast Atlantic, Handline

Low Concern

Red porgy in the South Atlantic stock are not experiencing overfishing. Fishing mortality between 2009 to 2011 was estimated at 64% of the fishing mortality at maximum sustainable yield (F_{MSY}) (NOAA 2015a) (SEDAR 2012a). Yet red porgy are currently recovering from a depleted state and rebuilding has slowed in recent years. There is a low probability (2%–18%) that the population will rebuild by the 2018 timeline in the rebuilding plan (SEDAR 2012a). Red porgy are commonly targeted by commercial fishers, headboats, and private recreational boats using vertical lines. Landings for the South Atlantic Coast in 2013 were 160,559 lbs by the commercial fisheries and 40,063 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). Because of the current lack of overfishing, but the slow rebuilding of South Atlantic red porgy, fishing mortality is a “low” concern.

VERMILION SNAPPER

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

United States Southeast Atlantic, Handline

Medium

FishBase has assigned a medium vulnerability rating (50 out of 100) to vermilion snapper (Froese and Pauly 2015). Vermilion snapper (*Rhomboplites aurorubens*) is a medium-size snapper with red to reddish-silver coloration, sometimes small yellow or blue markings. It can grow to a size of 60 cm (Froese and Pauly 2015). Vermilion snapper reaches sexual maturity around 23 cm at 3–4 years of age, and adults may live up to a decade (Froese and Pauly 2015) (GMFMC 2015c). 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. Vermilion snapper are found in the western North Atlantic from North Carolina to the coast of Brazil, and throughout the Gulf of Mexico and the Caribbean (Froese and Pauly 2015). Vermilion snapper feeds on smaller fish, crustaceans, squid, benthic invertebrates, and some planktonic prey (Froese and Pauly 2015) (GMFMC 2015c).

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

Very Low Concern

Vermilion snapper in the Gulf of Mexico are managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan, and were last assessed in 2011 (SEDAR 2011b). This assessment concluded that vermilion snapper in the Gulf of Mexico were not overfished as of 2010, with spawning stock biomass in 2010 well above the target level, or spawning stock biomass at maximum sustainable yield ($SSB/SSB_{MSY} = 1.60$) (SEDAR 2011b). Because they are not overfished and abundance is well above the target level, vermilion snapper is rated a “very low” concern.

United States Southeast Atlantic, Handline

Low Concern

Vermilion snapper in the South Atlantic is managed by the South Atlantic Fisheries Management Council under the Snapper-Grouper Fishery, and was last assessed in 2012. The assessment indicates that the abundance of vermilion snapper has declined since 1946, reaching its lowest level in 2011. The biomass

of spawning fish was estimated as slightly below the target level, or the biomass at maximum sustainable yield (B/B_{MSY} of 0.98). But abundance was above the abundance limit reference point, or the minimum stock size threshold ($B/MSST = 1.26$), indicating that the population is not overfished (SEDAR 2012b). Because vermilion snapper is not overfished, but abundance is below the target level, a “low” concern score has been awarded.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline

Very Low Concern

NOAA Fisheries lists vermilion snapper in the Gulf of Mexico as not subject to overfishing (NOAA 2015a); the most recent stock assessment (2010) estimates fishing mortality at 32% of the target level, or fishing mortality at maximum sustainable yield ($F/F_{MSY} = 0.32$) (SEDAR 2011b). Vermilion snapper are 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 2013 were 1,418,723 lbs by the commercial fisheries and 864,784 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). Juvenile vermilion snapper are also 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 well below the target level, a score of “very low” concern has been awarded.

United States Southeast Atlantic, Handline

Low Concern

The National Marine Fisheries Service lists vermilion snapper along the South Atlantic Coast as not experiencing overfishing (NOAA 2015a), and the most recent stock assessment (SEDAR 2012b) estimates fishing mortality at 67% of the target level, or fishing mortality at maximum sustainable yield ($F/F_{MSY} = 0.67$) (SEDAR 2012b) from 2009 to 2011. But the stock assessment also notes a large amount of uncertainty in this overall estimate, with some individual estimates indicating overfishing over the same time period (SEDAR 2012b). In addition, it was noted that decreasing abundance and increasing fishing mortality rates are cause for concern (SEDAR 2012b). Vermilion snapper are commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the South Atlantic in 2013 were 920,713 lbs by the commercial fisheries and 92,153 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). Given the low fishing mortality, but acknowledging uncertainty around this measure, a “low” concern score has been awarded.

YELLOWTAIL SNAPPER

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

United States Gulf of Mexico, Handline

High

FishBase has assigned a high vulnerability rating (65 out of 100) to yellowtail snapper (Froese and Pauly 2015). Yellowtail snapper (*Ocyurus chrysurus*) are medium-size snappers with bluish coloration, recognized by a prominent yellow stripe and yellow caudal fin. They measure up to 86 cm (Froese and Pauly 2015). Yellowtail snapper reach sexual maturity around 24 cm and 3 years of age. The maximum reported age is 14 years (Froese and Pauly 2015) (SAFMC 2015b). Adult yellowtail snapper are found well above coral reef bottoms, commonly over a depth range of 10–70 m, while juveniles inhabit sea grass beds (Froese and Pauly 2015). Yellowtail snapper are found in the western North Atlantic from North Carolina to the coast of Brazil, and throughout the Gulf of Mexico and the Caribbean (Froese and Pauly 2015). Yellowtail snapper feed on both benthic and planktonic prey, including fish, crustaceans, gastropods, cephalopods, and worms (Froese and Pauly 2015) (SAFMC 2015b).

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

United States Gulf of Mexico, Handline

Very Low Concern

Yellowtail snapper in the Gulf of Mexico are managed by the Gulf of Mexico Fisheries Management Council under the Reef Fish Management Plan. The most recent stock assessment (SEDAR 2012c) treats yellowtail snapper in the Gulf of Mexico and South Atlantic as a single population. This assessment concluded that yellowtail snapper are not overfished, with abundance well above the target level, or the biomass at maximum sustainable yield (B/B_{MSY} of 3.36) (SEDAR 2012c). Therefore, the score of “very low” concern has been awarded.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

United States Gulf of Mexico, Handline**Very Low Concern**

The National Marine Fisheries Service lists yellowtail snapper in the Gulf of Mexico as not subject to overfishing (NOAA 2015a). The most recent stock assessment estimated fishing mortality to be well below the fishing mortality at maximum sustainable yield (F/F_{MSY} of 0.154) (SEDAR 2012c). This ratio was based on an F_{MSY} that would yield a spawning potential ratio of 30%. Yellowtail snapper are 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 2013 were 1,961,764 lbs by the commercial fisheries and 559,126 lbs by the recreational fisheries (NMFS 2015a) (NMFS 2015c). This results in a rating of “very low” concern for fishing mortality.

Appendix B: Review Schedule

The first every SEDAR stock assessment for gray snapper is scheduled for 2018 {SEDAR 2015a}.

Other scheduled SEDAR assessments with anticipated completion dates:

(http://sedarweb.org/docs/page/SEDAR_PlanSchedule_Jan2016_0.pdf)

- Gulf of Mexico vermilion snapper - Spring 2016
- South Atlantic red snapper - Spring 2016
- U.S. goliath grouper - Summer 2016
- Gulf of Mexico gag grouper - Winter 2017
- South Atlantic red grouper - Winter 2017
- Gulf of Mexico yellowtail snapper - Spring 2018
- Gulf of Mexico red snapper - Summer 2018