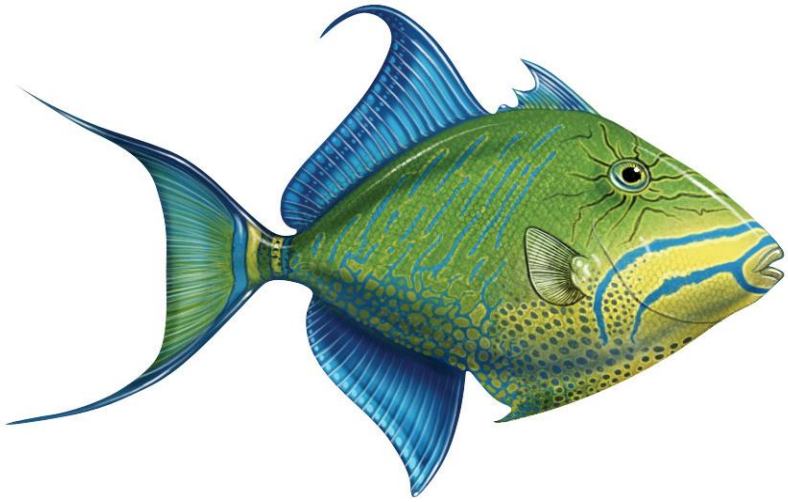
The Safina Center
at Stony Brook University

AND

Monterey Bay Aquarium
Seafood Watch®

Queen Triggerfish

Balistes vetula



U.S. Southeast Atlantic and U.S. Caribbean

Handline, Pots and Traps, Diver, and Bottom Longline

Fisheries Standard Version F3.2

April 3, 2017

The Safina Center Seafood Analysts

Disclaimer

Seafood Watch and The Safina Center strive to ensure that all our Seafood Reports and recommendations contained therein are accurate and reflect the most up-to-date evidence available at the time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or of The Safina Center or their recommendations on the part of the reviewing scientists. Seafood Watch and The Safina Center are solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision.

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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 fished[1] 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

This report provides recommendations for queen triggerfish *(Balistes vetula)* captured in the U.S. Caribbean and Southeast Atlantic. Queen triggerfish is caught in the U.S. Caribbean with pots and traps, with bottom longline, and by divers, and in the Southeast Atlantic with handlines.

Queen triggerfish is widely distributed in the Atlantic Ocean, and found in the western Atlantic from North Carolina to Brazil, most commonly in warmer waters (Matsuura 2002) (Jing et al. 2015a). Adults are highly associated with reefs and hard structure, spawn during the summer months, and feed on benthic invertebrates. In the U.S. Southeast Atlantic, there is no targeted commercial fishery for queen triggerfish, but small landings are reported for Florida only (ACCSP 2016). Queen triggerfish is highly targeted by fisheries in the U.S. Caribbean (Manooch and Drennon 1987) (NOAA 2016b). It is managed in three triggerfish complexes in this region: Puerto Rico, St. Croix, and St. Thomas/St. John. Population abundance in all regions is currently unknown, but overfishing status was recently determined for Puerto Rico triggerfish (NOAA 2016a).

The handline fishery in the U.S. Southeast Atlantic catches some other snapper and grouper species, some of which are abundant while others are overfished and/or are experiencing overfishing. In the Caribbean, high bycatch associated with the pot and trap and longline fisheries (in Puerto Rico) accounts for catches of overfished species and many others for which abundances are unknown. These fisheries also interact with endangered species, such as Nassau grouper in the pot and trap fisheries and sea turtles in the longline fishery in Puerto Rico.

Queen triggerfish is no longer managed in the U.S. Southeast Atlantic because of low catches, but management of other targeted species is considered moderately effective. In the Caribbean, annual catch limits are in place, but there are few other regulations. Limited data and life history information for this and other bycatch species, as well as no effective monitoring program and limited stock assessments in this region, hinder management effectiveness.

The handline and diver fisheries have limited contact with bottom substrates. Benthic longlines have the potential to snag reef habitat, and pot and trap fisheries have moderate contact in potentially sensitive coral habitats. In both regions, managers are working toward the development of ecosystem-based management policies, such as protection of coral habitats, but have not implemented changes to this effect in a large-scale way.

Table of Conservation Concerns and Overall Recommendations

Stock	Fishery	Impacts on the Stock Rank (Score)	Impacts on other Species Lowest scoring species Rating, Score	Manage-ment Rating Score	Habitat and Ecosystem Rank Score	Overall Recommendation Score
Queen triggerfish	Puerto Rico, Bottom Longline	Red 1	Finfish, unspecified, Queen triggerfish, Turtles, unspecified, Lane snapper Red, 1,0.75	Yellow 3	Yellow 2.45	**AVOID 1.532**
Queen triggerfish	Puerto Rico, Diving	Red 1	Queen triggerfish, Hogfish Red, 1,1	Yellow 3	Green 3.46	**AVOID 1.795**
Queen triggerfish	Puerto Rico, Pots and Traps	Red 1	Queen triggerfish, Hogfish Red, 1,0.75	Yellow 3	Yellow 2.45	**AVOID 1.532**
Queen triggerfish	U.S. Southeast Atlantic, Handline	Red 1.73	Red snapper Red, 1,1	Yellow 3	Green 3.46	**AVOID 2.059**
Queen triggerfish	U.S. Virgin Islands, Diving	Red 1.73	Grouper, unspecified Red, 1.53,1.53	Yellow 3	Green 3.46	**AVOID 2.289**
Queen triggerfish	U.S. Virgin Islands, United States, Pots and Traps	Red 1.73	Hogfish Red, 1,0.75	Yellow 3	Yellow 2.45	**AVOID 1.757**

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 either Criterion 1 or Criterion 3 (or both) is Green, and no Red Criteria.
- **Good Alternative/Yellow** = Final score >2.2, and no more than one Red Criterion, and does not meet the criteria for Best Choice/Green (above)
- **Avoid/Red** = Final Score ≤2.2, or two or more Red Criteria, or Management is Critical.

Introduction

Scope of the analysis and ensuing recommendation

This report assesses the U.S. Caribbean and Southeast Atlantic fisheries for queen triggerfish *(Balistes vetula)*. The majority of commercial landings come from the U.S. Caribbean, with fewer landings reported from the Southeast Atlantic (eastern Florida). This assessment covers queen triggerfish commercially caught by divers and pot and trap fisheries in Puerto Rico and the U.S. Virgin Islands (USVI), bottom longlines in Puerto Rico, and handlines in the Southeast Atlantic.

Overview of the species and management bodies

Queen triggerfish belongs to the family Balistidae, which are laterally compressed marine fish that are commonly referred to as "triggerfish." Queen triggerfish is widespread throughout the Caribbean, but is common from Brazil to North Carolina in the western North Atlantic Ocean (Matsuura 2002) (Jing et al. 2015a).

Adults are highly associated with reefs, and sandy or grassy areas (Matsuura 2002); little is known about the behavior of juveniles. Queen triggerfish is unique among most reef fish: it displays territorial behavior, creates demersal nests and guard eggs, and forms harems of one male and several females (Munro et al. 1973). Spawning occurs year-round, but peaks in the fall and winter (Munro et al. 1973). It feeds on benthic invertebrates, preferring echinoderms such as the long-spined sea urchin (*Diadema* sp.) (Matsuura 2002), which experienced a mass die-off in the Caribbean in the 1980s and has not yet fully recovered (Lessios 2016). Sexual maturity occurs at approximately 2 years of age, and queen triggerfish grows to a maximum size of about 45 cm (Aiken 1983) (de Albuquerque et al. 2011); the theoretical maximum age of queen triggerfish is 14 years (Jing et al. 2015a).

In Puerto Rico and the U.S. Virgin Islands, queen triggerfish are managed in triggerfish complexes by the Caribbean Fishery Management Council. But in the Southeast U.S., queen triggerfish landings are low and it is no longer under federal management (Federal Register 2012); it is considered restricted in Florida state waters by a rule on trade of marine life (FAC and FAR 2012). Landings are low in the Gulf of Mexico, so they are not managed by state or federal fisheries. Little is known about the population structure and genetic relatedness of queen triggerfish among these regions.

Production statistics

Global landings of queen triggerfish were unavailable (FAO 2016), but it is commercially important in the Caribbean, Brazil, and Bermuda (Jing et al. 2015a). U.S. Caribbean landings of "triggerfish and filefish" are similar between Puerto Rico and the USVI; landings were 55,834

lbs/year for Puerto Rico from 2011 to 2012, and 70,408 lbs/year for the USVI from 2011 to 2013. In the USVI, about 70% of those landings came from St. Thomas/St. John (NOAA SERO 2016a). But accurate reporting of landings is an ongoing issue in both regions (CFMC 2016). Commercial dollar values for the Caribbean are unknown. In the Caribbean, the dominant triggerfish species caught is queen triggerfish (Jing et al. 2015a), so landings of this complex reflect queen triggerfish catches. In addition to being caught for food, queen triggerfish is also caught and sold in the aquarium trade (Jing et al. 2015a).

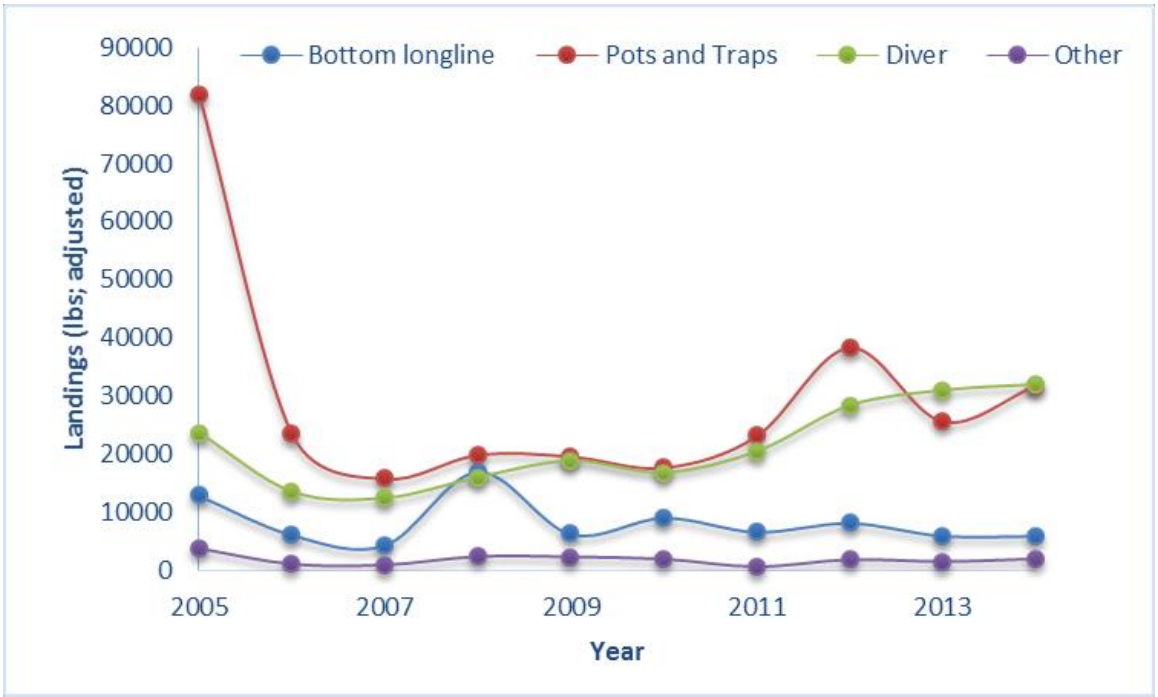

Figure 1. Landings of queen triggerfish by gear type from Puerto Rico (2005–2014). Data provided by David Gloeckner, NOAA. Data are adjusted for known underreporting. Partial landings data are reported here; confidential landings are not included.

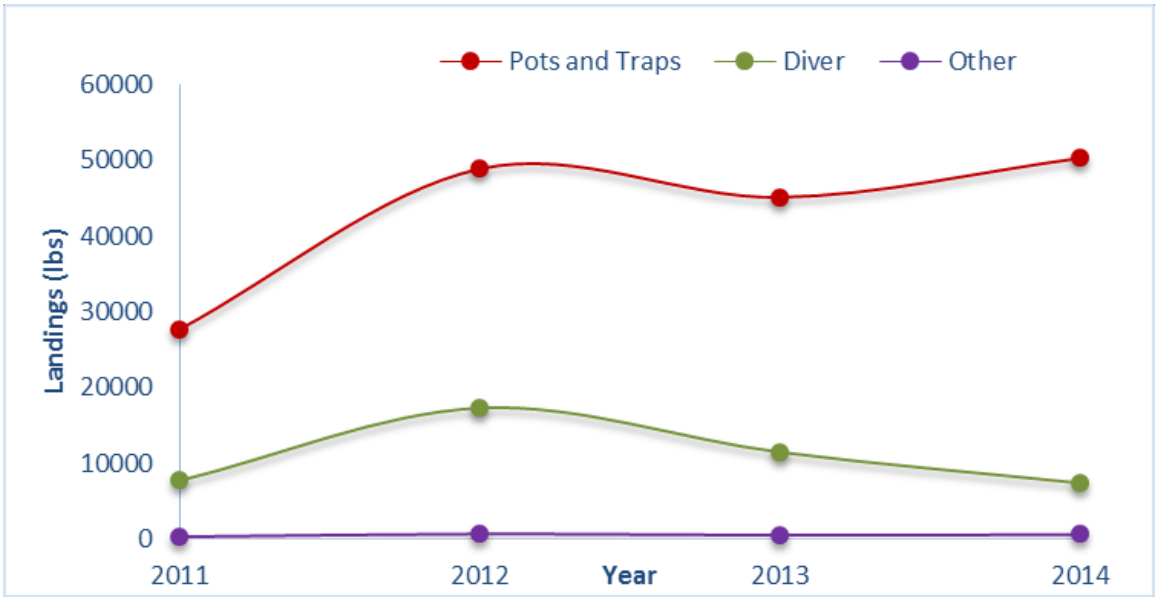

Figure 2. Landings of queen triggerfish by gear type for the U.S. Virgin Islands (2011–2014). Prior to 2011, all triggerfish were reported as "triggerfish, unspecified." Data provided by David Gloeckner, NOAA. Partial landings data are represented here; data do not include triggerfish reported as "triggerfish, unspecified" and confidential landings are not included.

In the southeastern United States, queen triggerfish was valued at $9,888 to $22,075 from 2013 to 2015 (ACCSP 2016); landings were approximately 7,818 lbs in 2014 for the region (NMFS 2016a). Historical landings are difficult to ascertain because most species of triggerfish caught in the Southeast Atlantic were categorized as "triggerfish." Reporting of individual species (queen, gray, and ocean triggerfish) began in 2012, but it has taken several years for this to be widely adopted (pers. comm., Myers 2016). Data on fishing effort and market demand are lacking for this fishery.

Importance to the US/North American market

There is no available information on triggerfish import or export data (NOAA 2016c), suggesting that all commercial triggerfish landed are sold in the U.S., and most likely locally.

Common and market names

Queen triggerfish is also called old wife, ol' wife, triggerfish, turbot (Jing et al. 2015a), old wench, bluestriped triggerfish, and cocino (FDA 2016).

Primary product forms

Queen triggerfish is generally marketed fresh in local markets (Matsuura 2002).

Analysis

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

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

Criterion 1 Summary

Stock	**Fishery**	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Criterion 1** Rating Score
Queen triggerfish	Puerto Rico, Diving	High (1)	High (1)	Red 1
Queen triggerfish	U.S. Southeast Atlantic, Handline	High (1)	Moderate (3)	Red 1.73
Queen triggerfish	Puerto Rico, Pots and Traps	High (1)	High (1)	Red 1
Queen triggerfish	U.S. Virgin Islands, Diving	High (1)	Moderate (3)	Red 1.73
Queen triggerfish	U.S. Virgin Islands, United States, Pots and Traps	High (1)	Moderate (3)	Red 1.73
Queen triggerfish	Puerto Rico, Bottom Longline	High (1)	High (1)	Red 1

Criterion 1 Assessment

QUEEN TRIGGERFISH

Factor 1.1 Abundance

Scoring Guidelines

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

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
High Concern

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

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

United States Southeast Atlantic, Handline
High Concern

Key relevant information:
Queen triggerfish in the U.S. Southeast Atlantic region is not managed by the South Atlantic Fishery Management Council (SAFMC); this species was removed from the Snapper-Grouper Management Complex as of 2012 (Federal Register 2012). No formal stock assessment exists for queen triggerfish in the Southeast Atlantic, and this stock is not listed by NOAA Fisheries in their stock status update (NOAA 2016a). The IUCN lists this species as "Near Threatened" because of recent population declines in Brazil, the Caribbean, and West Africa (Jing et al. 2015a). Because the abundance of queen triggerfish in the U.S. Southeast Atlantic is unknown and this species is considered "Near Threatened" by the IUCN, we have rated abundance as "high" concern.

Factor 1.2 Fishing mortality

Scoring Guidelines

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

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Puerto Rico, Pots and Traps
High Concern

Key relevant information:
Queen triggerfish in the U.S. Caribbean was assessed in 2013 (SEDAR 2013a), but this report was unable to estimate stock status or fishing mortality due to data limitations. But a recent data-limited assessment of Puerto Rico reef fishes estimated fishing mortality of queen triggerfish to be nearly four times the fishing mortality at maximum sustainable yield (MSY) from 2010 to 2013 ($F/F_{MSY} = 3.94$; Appendix B, Ault and Smith 2015). Ault and Smith (2015) state that this high estimate is uncertain due to a lack of accurate life history information for this species. NOAA Fisheries recently listed the status of the Puerto Rico Triggerfishes and Filefishes Complex as experiencing overfishing due to commercial landings increasing and exceeding the established overfishing limit (CFMC 2016) (NOAA 2016a). Between 2012 and 2014, landings of filefish and triggerfish were 121% of the annual catch limits (CFMC 2016).

Because of recent estimates of high fishing mortality, we have awarded "high" concern.

Virgin Islands, United States, Diving
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Queen triggerfish in the U.S. Caribbean was assessed in 2013 (SEDAR 2013a), but that report was unable to estimate stock status or fishing mortality due to data limitations. NOAA Fisheries considers overfishing status unknown for the triggerfishes and filefishes complex in St. Croix and St. Thomas/St. John (NOAA 2016a). Landings for the "triggerfish and filefish" complex have recently been well below the commercial annual catch limits (CFMC 2016), but it is unknown if this trend is due to underreporting. Given these unknowns, we have awarded a score of "moderate" concern.

United States Southeast Atlantic, Handline
Moderate Concern

Key relevant information:
There is no formal stock assessment or estimate of fishing mortality for queen triggerfish in the Southeast Atlantic region. Queen triggerfish is targeted by commercial and recreational fishers using vertical lines, and commercial landings were 7,637 lbs in 2014 (NMFS 2016a), most of which came from the east coast of Florida. But triggerfish in the region are often lumped together as "triggerfish, other," which includes queen, gray, and ocean triggerfish; landings data are often incomplete due to this classification (SEDAR 2013a). Recreational data were unavailable. Because of the lack of a stock assessment and fishery mortality estimates, we have awarded a score of "moderate" concern.

Criterion 2: Impacts on Other Species

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

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

Criterion 2 Summary

Queen triggerfish and associated landings data from 2010 to 2014 for Puerto Rico and the U.S. Virgin Islands (USVI) were provided by David Gloeckner (NOAA Fisheries). Data are of all landed species from trips that also land queen triggerfish. This information was used to determine Puerto Rico- or USVI-specific associated landings by gear type. Species were included if they comprised 5% or more of landed species by weight. This includes species that are overfished (or, > 50% probability of being overfished) such as queen conch, Caribbean spiny lobster, and red hind, which continue to be targeted by various fisheries.

Generally, there was a high degree of species overlap between Puerto Rico and USVI fisheries, except for diver-caught hogfish in Puerto Rico (very few are landed in the diver fishery in USVI) and a bottom longline fishery that is considerably larger in Puerto Rico. The bottom longline fishery reports few landings of queen triggerfish in USVI, so it is not included in this report. In cases where there are several known species within a family (e.g., snapper), we group these and discuss which species are most commonly landed and/or discarded by region, and use a conservative rating given what is known about those common species.

Additionally, several studies on discards (e.g., Clark et al. 2012, Renchen et al. 2014) and a Trip Interview Program synthesis (Bryn 2015) were used to assess potential species or families that may be discarded. Endangered Nassau grouper was included in the pots and traps fishery due to continued potential bycatch of undersized juveniles (Garrison et al. 1998) (Hawkins et al.

2007) (Anh-Thu 2014). Despite small potential catches of Nassau grouper currently, this fishery was instrumental in leading to the decline of this species and therefore continues to pose a threat to recovery (Anh-Thu 2014). Sea turtles were included for the Puerto Rico bottom longline fishery and the pot and trap fisheries for Puerto Rico and the U.S. Virgin Islands. Although there is no report on Puerto Rico or U.S. Virgin Island-specific interactions, sea turtles are known to interact with bottom longline gear and pot and trap rope in other regions (Bjorkland 2011) (Adimey et al. 2014). Inclusion of sea turtles was also based on personal communication with a sea turtle biologist who interviewed Caribbean fishers (pers. comm., Bjorkland 2016).

Data from the U.S. Southeast Atlantic that were used to determine species commonly landed with queen triggerfish included Trip Interview Program data from 2005 to 2014 (TIP 2016) and commercial dealer reports from eastern Florida (ACCSP 2016). Landings of queen triggerfish are small in the Southeast Atlantic, and it tends to be caught on trips that target other species, given that North Carolina is the northern reach of its distribution (Matsuura 2002).

For the handline fishery in the U.S. Southeast Atlantic, red snapper is the lowest scoring species because of its overfished status and continued overfishing. In the Puerto Rico pots and traps fishery and the diver fishery, hogfish score the lowest because of overfished status and current overfishing. Unspecified finfish score lowest for the Puerto Rico bottom longline fishery, which has not been well studied. Hogfish, Nassau grouper, and unspecified snapper score equally low in the U.S. Virgin Islands non-selective pots and traps fishery, while unspecified snapper results in the lowest score for the U.S. Virgin Islands diver fishery.

Puerto Rico, Bottom Longline

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Finfish, unspecified	High (1)	High (1)	1.00	0.75	Red
Turtles, unspecified	High (1)	High (1)	1.00	0.75	Red
Lane snapper	High (1)	High (1)	1.00	0.75	Red
Red hind	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Silk snapper	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Yellowtail snapper	Moderate (2.33)	Low (5)	3.41	2.56	Yellow

Puerto Rico, Pots and Traps

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Hogfish	High (1)	High (1)	1.00	0.75	Red
Caribbean spiny lobster	Moderate (2.33)	High (1)	1.53	1.14	Red
Grouper, unspecified	Moderate (2.33)	High (1)	1.53	1.14	Red
Snapper, unspecified	High (1)	Moderate (3)	1.73	1.30	Red
Nassau grouper	High (1)	Moderate (3)	1.73	1.30	Red
Angelfish	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Boxfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
White grunt	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Porgy	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Parrotfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Surgeonfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Invertebrates, unspecified	Moderate (2.33)	Low (5)	3.41	2.56	Yellow

Virgin Islands, United States, Pots and Traps

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Hogfish	High (1)	High (1)	1.00	0.75	Red
Grouper, unspecified	Moderate (2.33)	High (1)	1.53	1.14	Red

Angelfish	Moderate (2.33)	High (1)	1.53	1.14	Red
Nassau grouper	High (1)	Moderate (3)	1.73	1.30	Red
Snapper, unspecified	High (1)	Moderate (3)	1.73	1.30	Red
Boxfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Surgeonfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Porgy	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Parrotfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
White grunt	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Caribbean spiny lobster	Moderate (2.33)	Moderate (3)	2.64	1.98	Red
Invertebrates, unspecified	Moderate (2.33)	Low (5)	3.41	2.56	Yellow

Puerto Rico, Diving

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Hogfish	High (1)	High (1)	1.00	1.00	Red
Grouper, unspecified	Moderate (2.33)	High (1)	1.53	1.53	Red
Snapper, unspecified	High (1)	Moderate (3)	1.73	1.73	Red
Parrotfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	2.64	Yellow

Virgin Islands, United States, Diving

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Grouper, unspecified	Moderate (2.33)	High (1)	1.53	1.53	Red
Snapper, unspecified	High (1)	Moderate (3)	1.73	1.73	Red
Parrotfish, unspecified	Moderate (2.33)	Moderate (3)	2.64	2.64	Yellow

Southeast Atlantic, Handline

Stock	**Abundance** Category (Score)	**Fishing Mortality** Category (Score)	**Subscore**	**Score** (subscore*discard modifier)	**Rating**
Red snapper	High (1)	High (1)	1.00	1.00	Red
Red porgy	High (1)	Low (5)	2.24	2.24	Yellow
Gray triggerfish	Moderate (2.33)	Moderate (3)	2.64	2.64	Yellow
Gag	Low (3.67)	Low (5)	4.28	4.28	Green
Greater amberjack	Low (3.67)	Low (5)	4.28	4.28	Green
Vermilion snapper	Low (3.67)	Low (5)	4.28	4.28	Green
Red grouper	Low (3.67)	Low (5)	4.28	4.28	Green
Yellowtail snapper	Very low (5)	Low (5)	5.00	5.00	Green

Criterion 2 Assessment

ANGELFISH, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Angelfish are laterally compressed, oblong, or oval-shaped reef fish (in the family Tetraodontiformes) that are commonly captured for the aquarium trade and sold as food fish (Pyle 2001) (Hawkins et al. 2007) (IUCN 2016). The most frequently landed species in the Caribbean include gray, French, and queen angelfish (NOAA 2016b), although other angelfish species are discarded or landed in smaller numbers. There are no abundance conservation estimates for angelfish biomass, but they are generally listed by the IUCN as having stable populations and are species of "Least Concern" (IUCN 2016). We have therefore awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Moderate Concern

Key relevant information:
No formal assessment of angelfish fishing mortality exists. Angelfish abundance has been demonstrated to be related to fishing pressure in the Caribbean; large trapping fisheries were correlated with a decline in angelfish abundance (Hawkins et al. 2007). Commercial landings for Puerto Rico have recently been reported as zero (CFMC 2016), which suggests no commercial market. But they are likely to be caught as bycatch with this gear (Clark et al. 2012) and in small numbers in the recreational fishery (CFMC 2016). NOAA Fisheries lists the fishing mortality status as unknown in Puerto Rico (NOAA 2016a). Because of the limited information, a score of "moderate" concern is awarded.

Virgin Islands, United States, Pots and Traps
High Concern

Angelfish were the fourth-most common group of fish caught in a study on derelict (ghostfishing) traps in the U.S. Virgin Islands (Clark et al. 2012). Landings of angelfish in St. Croix for 2011–2013 were 10,555 lbs/year, which is more than 300% of the annual catch limit (ACL) and landings in St. Thomas/St. John were 16,872 lbs/year, which is more than 200% of the ACL (NOAA SERO 2016a). But these ACL overages were attributed to improved data collection rather than an increase in landings (CFMC 2016). Landings that greatly exceed the commercial ACLs result in a score of "high" concern.

BOXFISH, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Boxfish are a group of small, square-shaped, rigid-bodied fishes that live in tropical waters, and may also be commonly known as cowfish and trunkfish. Several species are commonly caught in the pot and trap fisheries in the region, and these include honeycomb and scrawled cowfish, and smooth, spotted, and buffalo trunkfish (Harper et al. 1990) (Trumble et al. 2006) (STFA 2013). These five species (in the family Ostraciidae) are assessed as "Least Concern" by the IUCN (IUCN 2016). But no abundance measures or conservation goals are available for any species of boxfish in the U.S. Caribbean. Additionally, no age data exist to determine maximum age or age at maturity. Because boxfish are considered species of "Least Concern" by the IUCN but there are no abundance estimates relative to conservation goals, we have awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
No formal assessment of boxfish fishing mortality exists. Boxfish are often prized as good quality eating fish in the Caribbean, and they may be sold fresh locally in small fish markets (Matsuura 2002). These species may be reported by species in fishery landings, but landings are often lumped into the category of "boxfish, unspecified" (NOAA 2016b). Boxfish commercial landings averaged 39,722 lbs/year in Puerto Rico in 2011–2012 and were 15,982 lbs/year for the U.S. Virgin Islands from 2011 to 2013 (NOAA SERO 2016a). Approximately 35%–47% of the commercial annual catch limits (ACLs) were met during those years (NOAA SERO 2016a).

Boxfish are highly targeted in Puerto Rico trap fisheries (Matos-Caraballo et al. 2007). In a study on the effects of trap ghostfishing, boxfish were the fifth-most abundant family of finfish (by number) found in experimental traps—primarily the smooth trunkfish (Clark et al. 2012)—and made up about 38% of the fish trap bycatch from a study in St. Thomas (STFA 2008). The superfamily Tetraodontiformes, which includes boxfish, was demonstrated to be susceptible to fishing pressure throughout the Caribbean (Hawkins et al. 2007). Because of unknown fishing mortality, this factor is rated "moderate" concern.

CARIBBEAN SPINY LOBSTER: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
The IUCN defines Caribbean spiny lobster *(Panulirus argus)* as "Data Deficient" and "declining" (Butler et al. 2013). U.S. Caribbean spiny lobster was likely overfished throughout the 1980s and 1990s because of an intense fishery and variable recruitment (SEDAR 2005a). Abundance of this species is in decline in most of the areas in which it is fished (Butler et al. 2013), but there are no current estimates of abundance in the U.S. Caribbean. Stock status was assessed in 2005, but the stock was too data-limited at the time to determine abundance, despite indications that abundance may be above sustainable levels (SEDAR 2005a). Caribbean spiny lobster in St.

Thomas and St. Croix was assessed in 2016, but abundance relative to conservation goals was not estimated (SEDAR 2016a). Currently, overfished status remains unknown (NOAA 2016a).

The species is thought to have high connectivity among areas of the Caribbean, due largely to long (9–12 month) pelagic larval stages. Further, recruitment appears to be highly correlated to environmental variables, in particular the North Atlantic Oscillation (NAO) and major oceanographic features (Ehrhardt and Fitchett 2010), and to the availability of appropriate juvenile habitat (Butler et al. 2013). The Productivity-Susceptibility Analysis indicates that this species has a medium inherent vulnerability (see Appendix A). Because overfished status is unknown and this species has a medium vulnerability, we have awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
High Concern

Key relevant information:
Caribbean spiny lobster is one of the largest and most lucrative fisheries throughout the Caribbean. But in most of its range, it is likely to be experiencing overfishing (Ehrhardt et al. 2011). The last stock assessment for U.S. Caribbean spiny lobster by SEDAR in 2005 could not determine overfishing status due to limitations in the data available, although there was some indication that overfishing was not occurring (SEDAR 2005a). But NOAA Fisheries recently changed the status of Puerto Rico spiny lobster from "not subject to overfishing" to "subject to overfishing" due to commercial landings increasing and exceeding the established overfishing limit (CFMC 2016) (NOAA 2016a). Between 2012 and 2014, landings were 105% of the commercial annual catch limit (NOAA SERO 2016a). There are several management measures in place, including minimum carapace sizes, protection of egg-bearing females, and gear restrictions (SEDAR 2005a). Because of high fishing mortality in the region and the overfishing status in Puerto Rico, we have awarded a score of "high" concern.

Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
The last stock assessment for U.S. Caribbean spiny lobster by SEDAR in 2005 could not determine overfishing status due to limitations in the data available, although there was some indication that overfishing was not occurring (SEDAR 2005a). A more recent assessment of the USVI lobster fishery also could not determine overfishing status, but again suggested that overfishing was not occurring, at least in St. Thomas. But strong fishing pressure led to a

decrease in mean lobster size in St. Croix (Olsen et al. 2013). St. Croix reported annual average commercial landings of 62,025 lbs (58% of the ACL) over 2012–2014, while St. Thomas/St. John reported higher landings of 85,938 lbs (83% of the ACL) (CFMC 2016). NOAA Fisheries currently lists spiny lobster in St. Croix and St. Thomas/St. John as not experiencing overfishing (NOAA 2016a). There are several management measures in place, including minimum carapace sizes, protection of egg-bearing females, and gear restrictions (SEDAR 2005a). Because fishing mortality with respect to F_{MSY} is unknown, we have awarded a score of "moderate" concern.

FINFISH, UNKNOWN: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
High Concern

Key relevant information:
Unknown finfish may be captured with bottom longline in the Puerto Rican fishery, and are primarily discarded. The Seafood Watch Unknown Bycatch Matrix was used to score unknown finfish. Because small sharks and reef fish (such as grouper) that are considered vulnerable may be caught, this category automatically receives a score of "high" concern (Seafood Watch 2016).

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
High Concern

Key relevant information:
Based on the Seafood Watch Unknown Bycatch Matrix, fishing impacts on unknown finfish caught in bottom longline fisheries are scored as "high" concern (Seafood Watch 2016).

GAG: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
The IUCN considers gag grouper to be a species of "Least Concern" (Bertoncini et al. 2008). Gag grouper along the U.S. Southeast Atlantic Coast is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery in federal waters, and by individual states inshore. The most recent stock assessment estimates Southeast Atlantic gag grouper spawning stock biomass to be above the minimum stock size threshold (SSB/MSST = 1.13) as of 2012, indicating that the population is not overfished (SEDAR 2014a). There is high confidence in this estimate, with 97.5% of model runs indicating that the population is not overfished (SEDAR 2014a). Spawning stock biomass was found to be near but just below the target level of biomass at maximum sustainable yield (SSB/SSB_{MSY} = 0.97; SEDAR 2014a). The assessment indicated that abundance was projected to decline after 2012, due to poor recruitment in 2010–2011. The recent update to this assessment also indicated that multiple models project that the stock continues to be above overfished limits (SEDAR 2016d). Because the Southeast Atlantic gag grouper population is not overfished, but abundance is below the target level and potentially declining, we have awarded a "low" concern score.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
The 2014 stock assessment for Southeast Atlantic gag grouper determined that the average fishing mortality for the years 2010–2012 exceeded the target level of fishing at maximum sustainable yield (F/F_{MSY} = 1.23), indicating that overfishing was occurring (SEDAR 2014a). But the South Atlantic Fishery Management Council's Scientific and Statistical Committee (SSC) noted that the fishing mortality rate for 2012, and the projected fishing mortality rate in 2013 based on the actual landings, suggested that overfishing did not occur in 2012 and 2013. Additionally, after the 2014 assessment, managers took action to revise the annual catch limit for gag grouper for the 2015–2019 fishing years to ensure that overfishing does not occur in the future (Federal Register 2015). NOAA Fisheries currently considers gag grouper in the Southeast Atlantic to be no longer experiencing overfishing (NOAA 2016a), but a new assessment has yet to be completed. Gag grouper is commonly targeted by commercial fishers using vertical lines,

as well as by divers, and by headboat and private recreational fishers using vertical lines. During 2014, 380,252 lbs of gag grouper were caught in the commercial fishery and 177,606 lbs were caught in the recreational fishery in the Southeast Atlantic (NMFS 2016a) (NMFS 2016b). Because of recent suggestions that overfishing on Southeast Atlantic gag grouper is no longer occurring, we have rated this factor a "low" concern.

GRAY TRIGGERFISH: UNITED STATES SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
Moderate Concern

Key relevant information:
The abundance of gray triggerfish in the U.S. Southeast Atlantic is uncertain. The IUCN assessed gray triggerfish to be a "Vulnerable" species due to declines in many parts of its range; however, no evidence of decline was reported for the U.S. Atlantic (Jing et al. 2015).

Gray triggerfish in the Southeast Atlantic region is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Fishery. A recent assessment of Southeast Atlantic gray triggerfish could not estimate abundance relative to target and overfished abundance reference points, because of high uncertainty in the assessment model (SEDAR 2016b) (NOAA 2016a). The review panel for the assessment stated "that there was no evidence of a decline in abundance or biomass at this time" (SEDAR 2016b). A previous assessment in 2011 also concluded that abundance status was "highly uncertain" because of a small data set (Broome et al. 2011). There have been a few other limited studies on gray triggerfish abundance in this region. Potts and Brennan (2001) found that mean weights of gray triggerfish had declined in both the commercial and recreational fishery from 1983 to 1999, possibly indicating a drop in abundance, but they also indicated that the spawning potential ratio (SPR) at the time was 62%, indicating a healthy biomass (Potts and Brennan 2001). Rudershausen et al. (2008) found that gray triggerfish in the vertical line fishery off the coast of North Carolina had declined both in catch per unit of fishing effort (CPUE) and as a percentage of total species caught from the 1970s to 2005–2006, indicating possible declines in biomass in this area (Rudershausen et al. 2008).

Because there is conflicting and uncertain abundance information for gray triggerfish in the Southeast Atlantic, and the Productivity-Susceptibility Analysis indicates this species has a medium vulnerability to fishing (see Appendix A), we have awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
Moderate Concern

Key relevant information:
The first SEDAR assessment was completed for U.S. Southeast Atlantic gray triggerfish in April 2016 and determined that exploitation status is unknown because of uncertainty in the assessment model (SEDAR 2016b). Gray triggerfish is targeted by commercial, recreational, and headboat fishers using vertical lines, and made up the sixth-highest landings by weight in the snapper-grouper management complex for the Southeast Atlantic region (Burton et al. 2015). Landings are roughly evenly split between the commercial (54.6%) and recreational (45.4%) sectors for this species (Burton et al. 2015). Landings increased sharply in the 1990s due to increased consumer demand for this species, declined from 1999 to 2003, and increased again from 2004 to 2010 (Burton et al. 2015). Commercial ACLs were exceeded in 2012 and 2013 (NOAA SERO 2016b), so the South Atlantic Fishery Management Council and the state of Florida increased the size limit in an effort to reduce landings (FFWCC 2015) (SEDAR 2015).

The review panel report from the 2016 SEDAR assessment states that, based on the information available to the panel, "there was no evidence that current levels of removals have resulted in overfishing" (SEDAR 2016b). Landings of this species are difficult to quantify because gray triggerfish is often listed in dealer reports as generic "triggerfishes," which include queen, ocean, and gray triggerfish in the Southeast Atlantic (pers. comm., Myers 2016). Because of the unknown fishing mortality for this species, we have awarded a "moderate" concern score.

GREATER AMBERJACK: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
The IUCN considers greater amberjack to be a species of "Least Concern" (Smith-Vaniz et al. 2015). Greater amberjack along the U.S. Southeast Atlantic Coast is managed by the South Atlantic Fishery Management Council under the Snapper-Grouper Fishery. The most recent stock assessment evaluated greater amberjack in the Southeast Atlantic as not overfished as of

2006, with the spawning stock biomass near the target level of biomass at maximum sustainable yield (MSY) and well above the limit reference point of minimum sustainable stock size (MSST) (B/B_{MSY} = 1.10, B/MSST = 1.46; SEDAR 2008). Southeast Atlantic greater amberjack has not been assessed or further analyzed since 2008, so the last stock assessment (SEDAR 2008) continues to be the best available scientific information (pers. comm., Erik Williams 2016). Because of the abundance of Southeast Atlantic greater amberjack in 2006 and the lack of a recent stock assessment, we have awarded "low" concern for abundance.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
NOAA Fisheries lists greater amberjack along the Southeast Atlantic Coast as not subject to overfishing (NOAA 2016a). In the most recent stock assessment, fishing mortality was estimated to be 53% of the target level of fishing at maximum sustainable yield (F/F_{MSY} = 0.53; SEDAR 2008), and fishing mortality had consistently declined over the years 1999 to 2006. Greater amberjack is commonly targeted by commercial and recreational fishers using vertical lines, and by divers using spears. Landings for the Southeast Atlantic in 2014 were 615,986 lbs for the commercial fishery and 709,290 lbs for the recreational fishery, with the majority of landings from the east coast of Florida (NMFS 2016a) (NMFS 2016b). Commercial catches have remained around the established annual catch limits (ACLs) (73%–105% between 2010 and 2016; NOAA SERO 2016b). Because of the low fishing mortality in 2006 and because catches have largely remained at or below the established ACLs, we have awarded "low" concern for fishing mortality.

GROUPER, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
The IUCN considers the two grouper species most commonly landed with queen triggerfish (coney and red hind grouper) in the Caribbean diving and pots and traps fisheries to be of "Least Concern" (Ferreira et al. 2008, Sadovy et al. 2008). The Productivity-Susceptibility Analysis indicates that these species have a medium inherent vulnerability (see Appendix A). These and several other grouper species are managed by the Caribbean Fishery Management Council under the "Caribbean Grouper Complex" (NOAA 2016a); Nassau and goliath groupers are managed separately due to their status. This complex includes shallow-, mid- and deep-water grouper. NOAA Fisheries currently lists Caribbean grouper abundance as "unknown" (NOAA 2016a). Shallow- and mid-water species other than coney and red hind are likely to be caught in these fisheries, but species composition is unknown.

The most recent assessment of Caribbean red hind could not estimate abundance relative to target and overfished abundance reference points (SEDAR 2014b). But a prior, data-limited analysis found that coney and red hind abundances were significantly lower than the biomass at maximum sustainable yield in Puerto Rico during 2000–2002 (B/B_{MSY} = 0.11 and 0.40, respectively; Ault et al. 2008). The other grouper species in the complex have not been assessed, although a subset of grouper species (former grouper unit 4) were previously considered overfished (NOAA 2016a).

Given the limited abundance information, we have awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Diving
Puerto Rico, Pots and Traps
High Concern

Key relevant information:
Few assessments of Caribbean grouper fishing mortality have been performed. NOAA Fisheries lists Caribbean grouper as not currently experiencing overfishing (NOAA 2016a); between 2011 and 2013, 41% of the commercial annual catch limits was landed (NOAA SERO 2016a). Red hind is the only Caribbean grouper to be formally assessed by the Southeast Data, Assessment, and Review (SEDAR); although no overfishing status could be determined, the review panel stated that the probability of overfishing in Puerto Rico was 25%–40% (SEDAR 2014b). An independent assessment found that fishing mortality of red hind in Puerto Rico was just below fishing mortality at maximum sustainable yield (F/F_{MSY} = 0.95; Appendix B, Ault and Smith 2015), but that mortality has declined over time for this species and mortality rates were likely sustainable (Ault and Smith 2015). Coney grouper fishing mortality was much greater (F/F_{MSY} = 14.74; Appendix B, Ault and Smith 2015) and fishing mortality for a third grouper species, graysby, was estimated to be 25% above fishing mortality at maximum sustainable yield (F/F_{MSY} = 1.25; Ault

and Smith 2015). But the authors note that the coney fishing mortality estimate was "somewhat unrealistic," based on inaccurate demographic parameters (Ault and Smith 2015, p. 12), and thus is unreliable. Additionally, nearly all of the most common reef fish in the commercial fisheries in Puerto Rico are undergoing overfishing (Appendix B, Ault and Smith 2015). Together, these indicate that grouper fishing mortality in Puerto Rico is likely above sustainable levels.

The diver fishery targets red hind, while the pot and trap fisheries target red hind and coney. Other grouper species are highly catchable in the pot and trap fishery, especially as undersized juveniles (Hawkins et al. 2007) (Clark et al. 2012). Because of evidence of overfishing, fishing mortality is rated "high" concern.

Virgin Islands, United States, Diving
Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
Few assessments of Caribbean grouper fishing mortality have been performed. Red hind was assessed in 2014 and, although overfishing could not be determined, independent reviewers indicated that overfishing was likely occurring in the USVI; probabilities of overfishing ranged from 42% to 57% in St. Thomas, and 54% to 66% in St. Croix (SEDAR 2014b). Fishing mortality estimates are generally unknown for other grouper in the USVI. Commercial landings for the entire Grouper Complex averaged 73,379 lbs/yr in Puerto Rico over 2010–2012; 27,881 lbs/yr in St. Croix over 2011–2013; and 44,419 lbs/yr in St. Thomas/St. John over 2011–2013 (NOAA SERO 2016a). Recreational data were not available. Catches were at 92% of the commercial annual catch limit for 2011–2013 (NOAA SERO 2016a). NOAA Fisheries lists Caribbean grouper as not subject to overfishing (NOAA 2016a).

The diver fishery targets red hind, while the pot and trap fisheries target red hind and coney. USVI pot and trap fisheries catch other grouper species including graysby, rock hind, and red grouper, which is near threatened but represents a small fraction of catches (Garrison et al. 1998) (Garrison et al. 2004). Other grouper species are highly catchable in the pot and trap fishery, especially as undersized juveniles (Hawkins et al. 2007) (Clark et al. 2012). Because of limited and conflicting information but evidence that at least one grouper species is undergoing overfishing and another is near threatened in the USVI, we have awarded a conservative score of "high" concern.

HOGFISH: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
The IUCN considers hogfish *(Lachnolaimus maximus)* to be a "vulnerable" species (Choat et al. 2010). Hogfish in the U.S. Caribbean is managed by the Caribbean Fishery Management Council within a mixed wrasse complex. NOAA Fisheries lists abundance and overfished status of the wrasse complex in all regions of the U.S. Caribbean as "unknown" (NOAA 2016a).

But a data-limited assessment estimated hogfish biomass in Puerto Rico at only 30% of the biomass at maximum sustainable yield for 2000–2002 (B/B_{MSY} = 0.30; Ault et al. 2008). Because of the unknown status of hogfish in the U.S. Caribbean but evidence of decline in this region and surrounding regions (Choate et al. 2010), we have rated abundance as "high" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Diving
Puerto Rico, Pots and Traps
High Concern

Key relevant information:
NOAA Fisheries recently listed the Puerto Rico wrasse complex (which includes hogfish, Spanish hogfish, and puddingwife) as experiencing overfishing because of commercial landings increasing and exceeding the overfishing limit (CFMC 2016) (NOAA 2016a). Improvements to the way in which overfishing limits are calculated are underway as a follow-up to the SEDAR 46 Caribbean data-limited assessment, and these preliminary improvements suggest that the overfishing limit may be exceeded by 10,000 to 20,000 lbs per year (NOAA 2016f). Wrasse commercial landings exceeded the current commercial annual catch limit from 2012 to 2014 by 9% (CFMC 2016). Ault and Smith (2015) estimated hogfish fishing mortality in Puerto Rico to be more than 50% above the fishing mortality at maximum sustainable yield (F/F_{MSY} = 1.55). There is also indication of increased fishing pressure on hogfish globally (Choate et al. 2010).

Hogfish forms small, temporary spawning aggregations and is typically easy to catch by divers due to its curious nature, potentially making it particularly vulnerable to spearfishing (Choat et al. 2010) (Munoz et al. 2010). Hogfish is commonly targeted by both commercial and recreational fishers using spears in Puerto Rico, but it may also be caught in smaller numbers by pots and traps throughout the Caribbean, especially as undersized juveniles (Munro et al. 2003). Because of a high probability of overfishing, we have rated fishing mortality as "high" concern.

Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
NOAA Fisheries lists fishing mortality on the wrasse complex in St. Croix and in St. Thomas/St. John as "unknown" (NOAA 2016a); however, commercial catches have been more than 300% of the annual catch limits (ACLs) for wrasses in recent years (2012–2014) (CFMC 2016). Because fishing mortality is well above the commercial ACLs, we have awarded a score of "high" concern.

INVERTEBRATES, UNKNOWN: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Caribbean, Pots and Traps
Moderate Concern

Key relevant information:
Unknown benthic invertebrates may be captured with pots and traps and are primarily discarded. The Seafood Watch Unknown Bycatch Matrix was used to score unknown invertebrates. Because these are unlikely to be highly vulnerable species, this category automatically receives a score of "moderate" concern (Seafood Watch 2016).

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Caribbean, Pots and Traps
Low Concern

Key relevant information:
Based on the Seafood Watch Unknown Bycatch Matrix, fishing impacts on unknown benthic invertebrates caught in pot and trap fisheries are scored as "low" concern (Seafood Watch 2016).

NASSAU GROUPER: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
Nassau grouper is listed as "Endangered" by the IUCN (Cornish and Eklund 2003) and was recently listed as "Threatened" by the U.S. Fish and Wildlife Service (Federal Register 2016a). NOAA Fisheries lists this population as overfished; it is currently in year 11 of a 25-year rebuilding plan in the U.S. Caribbean (NOAA 2016a), but no formal stock assessment exists for these regions. Ault et al. (2015) estimated that biomass was at 11% of the target reference point (B/B_{MSY} = 0.11) in Puerto Rico for 2000–2002 in a data-limited assessment. Genetic studies indicate a single population in the northern Caribbean, with some possible barriers to gene flow that may structure the population at a finer scale; however, there is still debate surrounding geographic structure of this species (Jackson et al. 2014) (Federal Register 2016a).

Nassau grouper is widely distributed across the Caribbean and forms large spawning aggregations with thousands of individuals (Jackson et al. 2014), which partly led to its decline (Albins et al. 2009); trap fishing was also a large contributor to decline in biomass (Hawkins et al. 2007). More than one-third of known spawning aggregations have been extirpated throughout the Caribbean, including those in Puerto Rico and the U.S. Virgin Islands (Cornish and Eklund 2003) (Kadison et al. 2009), and adults are rare throughout much of the northern Caribbean (Munro and Blok 2005). Little recovery has been documented, except for the reformation of a small spawning aggregation in a protected site in the U.S. Virgin Islands (Kadison et al. 2009). The endangered status of Nassau grouper and its limited recovery in the Caribbean result in a rating of "high" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
NOAA Fisheries lists Nassau grouper as not currently subject to overfishing (NOAA 2016a). All harvest of Nassau grouper has been banned in the waters of Puerto Rico and the U.S. Virgin Islands since 2011 (NOAA and CFMC 2015). Prior to this, fishing mortality in Puerto Rico was estimated at more than three times the target reference point (F/F_{MSY} = 3.62; Ault et al. 2008). Juvenile Nassau grouper are subject to potential bycatch mortality in pot and trap fisheries (Hawkins et al. 2007) (Anh-Thu et al. 2014) as well as ghostfishing by derelict traps (Renchen et al. 2014). Nassau grouper has been commercially extinct in Puerto Rico, the U.S. Virgin Islands, and other Caribbean waters for several years, but there is concern over illegal fishing (Sadovy and Eklund 1999). Because of a moratorium on fishing but potential sources of mortality that include illegal harvest and ghostfishing, we have awarded a score of "moderate" concern.

LANE SNAPPER, UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
High Concern

Key relevant information:
The IUCN considers lane snapper *(Lutjanus synagris)* to be a "Near Threatened" species (Lindeman et al. 2016a). Lane snapper is managed by the Caribbean Fishery Management Council within the Caribbean "snapper complex" under Snapper Unit 3. No target abundance or reference points have been defined, and the overfished status for the U.S. Caribbean population is unknown (NOAA 2016a). But a previous data-limited study found that biomass in Puerto Rico was less than half the biomass at maximum sustainable yield for 2000–2002 (B/B_{MSY} = 0.43; Ault et al. 2008). Lane snapper is generally well studied in the Caribbean, West Indies, and Bermuda because of heavy exploitation and popularity in fisheries (Graham et al. 2008) (White 2015). It was heavily overfished in Cuba in the 1970s to 1980s (Claro 1991), and collapses in local populations in the region were likely due to targeted harvesting of spawning aggregations (Claro et al. 2009). Negligible regulations since then have not allowed lane snapper to rebound in that region. Because of unknown abundance in the U.S. Caribbean and

probable declines in abundance based on overfished status in surrounding regions, we have rated abundance of this species as “high” concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
High Concern

Key relevant information:
NOAA Fisheries lists Caribbean snapper as not experiencing overfishing (NOAA 2016a). But lane snapper is one of the most commonly caught species in Puerto Rican waters (Matos-Caraballo 2009), and a recent data-limited assessment estimated the fishing mortality of Puerto Rico lane snapper to be more than twice the fishing mortality at maximum sustainable yield from 2010 to 2013 (F/F_{MSY} = 2.64; Appendix B, Ault and Smith 2015). Fishing effort decreased in the 1990s to 2000s, likely due to problems with overfishing of reef fish (Matos-Caraballo 2008). Approximately 50% of the commercial annual catch limit for Snapper Unit 3 was landed in Puerto Rico between 2010 and 2012 (NOAA SERO 2016), but this includes species that occur less frequently in the commercial landings (TIP 2016). Seasonal closures exist for lane snapper to prevent targeting of spawning aggregations (NOAA and CFMC 2015). Because of clear overfishing for this species in Puerto Rico, we have awarded a “high” concern score.

PARROTFISH, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
The IUCN considers the three most-commonly landed species of parrotfish (queen, redtail, and stoplight parrotfish) in the Caribbean diving and pots and traps fisheries to be of “Least concern” (Rocha et al. 2012a) (Rocha et al. 2012b) (Rocha et al. 2012c). Ten parrotfish species are managed by the Caribbean Fishery Management Council under the Caribbean parrotfish complex. NOAA Fisheries lists Caribbean parrotfish biomass as not overfished but approaching overfished condition (NOAA 2016a). Redtail parrotfish is the only species to be assessed by the

Southeast Data, Assessment, and Review process, but abundance could not be determined due to data limitations (SEDAR 2011a).

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

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
NOAA Fisheries lists Caribbean parrotfish as not subject to overfishing (NOAA 2016a) since 2012 (NOAA 2012). An assessment of Caribbean redtail parrotfish determined there was insufficient evidence to suggest overfishing of this species (SEDAR 2011a). A more recent data-limited assessment of fishing mortality on parrotfish found that queen, redtail, and stoplight parrotfish were experiencing fishing mortality at levels greater than three times the fishing mortality at maximum sustainable yield in Puerto Rico (F/F_{MSY} = 3.41 to 4.34; Appendix B, Ault and Smith 2015). But the authors believed that these mortality estimates were "somewhat unrealistic" and based on inaccurate demographic parameters (p. 12, Ault and Smith 2015), and thus are unreliable.

Pot and trap fisheries target queen, redtail, and stoplight parrotfish in the U.S. Virgin Islands (SEDAR 2011a), while dive fisheries tend to target redtail and stoplight parrotfish (NOAA 2016b). Other species of parrotfish and undersized individuals may be caught in the pot and trap fisheries (Garrison et al. 1998) (Hawkins et al. 2007), and derelict fishing traps also catch parrotfish (Clark et al. 2012) (Renchen et al. 2014). Commercial landings have been well below the annual catch limit (ACL) for this complex since at least 2010 (NOAA SERO 2016a).

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

PORGY, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Porgy in the Caribbean are managed by the Caribbean Fishery Management Council under "scups and porgies" complexes for Puerto Rico, St. Croix, and St. Thomas/St. John. Abundance of the species in each complex is unknown relative to target abundance reference points (NOAA 2016a). Each complex includes jolthead, sheepshead, and pluma porgies, as well as sea bream. The IUCN lists all four species as "Least Concern" (IUCN 2016). We have therefore awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
NOAA fisheries lists each Caribbean complex that includes porgies as not experiencing overfishing (NOAA 2016a), although no assessment of porgy fishing mortality exists. Most landed porgies are categorized as ""porgy, unspecified," but saucereye porgy was the most commonly identified species in landings data (NOAA 2016b). Nearly 100% of the commercial annual catch limit (ACL) for porgies was landed in Puerto Rico in 2011–2012, but less than 19% of the commercial ACL was landed in the U.S. Virgin Islands for 2011–2013 (NOAA SERO 2016a). Porgies were one of the most frequently seen species in surveys of commercial fish traps in St. John, U.S. Virgin Islands (Garrison 1998). Porgy are also frequently caught in derelict pots and traps (Clark et al. 2012) (Renchen et al. 2014). Because of unknown fishing mortality of porgies, we have awarded a score of "moderate" concern.

RED GROUPER: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
The IUCN considers red grouper to be a "Near Threatened" species (Garcia-Moliner and Eklund 2004). Red grouper in the U.S. Southeast Atlantic is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery. The last stock assessment for red grouper in the Southeast Atlantic estimated abundance as of 2008 to be 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 2010). Because abundance was estimated to be below the limit reference point, the assessment concluded that red grouper in the Southeast Atlantic was overfished. Since then, the method for calculating MSST 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 2016a) (SAFMC 2011). Because red grouper is no longer considered overfished but abundance is below the target level, abundance is rated "low" concern.

Factor 2.2 Fishing Mortality

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
Red grouper in the Southeast Atlantic was experiencing overfishing in 2008, with fishing mortality well above the target level at maximum sustainable yield (F/F_{MSY} = 1.46; SEDAR 2010). But the overfishing concerns were addressed with the establishment of a rebuilding plan and annual catch limits for red grouper in 2012. NOAA Fisheries currently lists red grouper in the Southeast Atlantic as not subject to overfishing (NOAA 2016a), although there is no recent assessment report to back up this classification. Red grouper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. Landings for the Southeast Atlantic in 2014 were 71,576 lbs by the commercial fishery and 29,437 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because it is probable that fishing from all sources is at a sustainable level (NOAA 2016a), fishing mortality is rated as "low" concern.

RED HIND: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
Moderate Concern

Key relevant information:
The IUCN considers red hind to be a species of "Least Concern" (Sadovy et al. 2008). Red hind in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of the "Caribbean Groupers" complex (NOAA 2016a). This complex is considered to be one stock for Puerto Rico and the U.S. Virgin Islands. The most recent formal stock assessment was published in 2014; this assessment did not make any determination of biomass because of data limitations (SEDAR 2014b). NOAA Fisheries currently lists the biomass of the Caribbean Groupers complex as "unknown" (NOAA 2016a).

Previous studies found red hind biomass to be depleted in the U.S. Caribbean in the 1970s to 1980s (Sadovy et al. 1992). A more recent assessment of Puerto Rico red hind biomass demonstrated that biomass was 40% of the target abundance reference point from 2000 to 2002 (B/B_{MSY} = 0.40; Ault et al. 2008). The 2014 stock assessment notes several vulnerable life history characteristics of this species, such as slow growth, protogynous development, and spawning aggregations (SEDAR 2014b). The Productivity-Susceptibility Analysis suggests that this species has a medium inherent vulnerability (see Appendix A), and Nemeth (2005) indicates that red hind was overfished in the U.S. Virgin Islands but is recovering.

Based on the limited abundance information and this species' medium vulnerability, we have rated abundance "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
Moderate Concern

Key relevant information:
The Caribbean Groupers complex is currently listed as not subject to overfishing by NOAA Fisheries (NOAA 2016a). But the most recent formal stock assessment for Caribbean red hind suggests that overfishing could be occurring, but there were substantial disagreements in the review panel report (SEDAR 2014b). The probability of overfishing on red hind ranged from 25% to 40% in Puerto Rico, 42% to 57% in St. Thomas, and 54% to 66% in St. Croix. The review panel

concluded that these probabilities were high enough to suggest that this species is experiencing overfishing, especially in St. Thomas and St. Croix (SEDAR 2014b). A recent data-limited assessment for Puerto Rico red hind found that fishing pressure was right around the target fishing mortality benchmark (F/F_{MSY} = 0.95: Appendix B, Ault and Smith 2015), but that mortality has declined over time for this species and mortality rates were likely sustainable (Ault et al. 2015).

Commercial landings averaged below the annual catch limits for the Grouper complex between 2010 and 2013 (NOAA SERO 2016a). Because of conflicting data over fishing mortality, we have rated fishing mortality in Puerto Rico bottom longlines as "moderate" concern.

RED PORGY: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
High Concern

Key relevant information:
The IUCN considers red porgy to be a species of "Least Concern" globally (Russell et al. 2014). But a 2012 assessment of red porgy in the U.S. Southeast Atlantic determined that this population was overfished. The assessment estimated abundance to be 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 Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery, and is in year 16 of an 18-year rebuilding program (NOAA 2016a). There is a low probability (2%–18%) that the population will rebuild by the 2018 timeline (SEDAR 2012a). Because of this depleted status, red porgy abundance is a "high" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
Red porgy in the Southeast Atlantic is not experiencing overfishing (SEDAR 2012a). Fishing mortality over the years 2009–2011 was estimated to be 64% of the fishing mortality at maximum sustainable yield (F_{MSY}) (SEDAR 2012a) (NOAA 2016a). Red porgy is currently

recovering from a depleted state, but rebuilding has slowed in recent years despite the low fishing mortality (SEDAR 2012a). Red porgy is commonly targeted by commercial fishers, headboats, and private recreational boats using vertical lines. Landings for the Southeast Atlantic in 2014 were 149,599 lbs by the commercial fishery and 35,269 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because of the current lack of overfishing, we awarded a "low" concern for fishing mortality.

RED SNAPPER: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
High Concern

Key relevant information:
Red snapper in the U.S. Southeast Atlantic is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery, and the most recent stock assessment was published in 2016 (SEDAR 2016c). This assessment concluded that Southeast Atlantic red snapper is overfished, with spawning stock biomass in 2014 at only 22% of the limit reference point or minimum stock size threshold (SSB/MSST = 0.22; SEDAR 2016c). Red snapper is currently in year 6 of a 35-year rebuilding plan (NOAA 2016a). Because of this highly depleted status of Southeast Atlantic red snapper, we have awarded a "high" concern score.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
High Concern

Key relevant information:
NOAA Fisheries lists red snapper in the Southeast Atlantic as subject to overfishing (NOAA 2016a), with fishing mortality estimated to be two-and-a-half times the fishing mortality at maximum sustainable yield (F/F_{MSY} = 2.52) over the years 2012–2014 (SEDAR 2016c). Red snapper is commonly targeted by commercial fishers using vertical lines and longlines, and by headboat and private recreational fishers using vertical lines. Additionally, juvenile red snapper is caught as bycatch in the shrimp trawl fishery. Because red snapper are caught as part of multi-species fisheries, fishing mortality does not drop to zero during the closure (SEDAR 2016c). Landings for the Southeast Atlantic in 2014 were 59,625 lbs by the commercial fishery

and 1,052,099 lbs by the recreational fishery (NMFS 2016a,b). Because of this very high fishing mortality, we awarded a “high” concern rating.

SILK SNAPPER: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
Moderate Concern

Key relevant information:
The IUCN considers silk snapper to be a species of “Least Concern” (Lindeman et al. 2016b). Silk snapper in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of the “"Caribbean snappers” complex, snapper unit 1 (NOAA 2016a). The Caribbean snappers are considered to be one stock for Puerto Rico and the U.S. Virgin Islands. A formal stock assessment for silk snapper was published in 2011, but no specific biomass estimates were produced due to data limitations (SEDAR 2011b). In a previous data-limited assessment, Puerto Rico silk snapper biomass for 2000–2002 was estimated to be at 88% of the target abundance reference point (B/B_{MSY} = 0.88; Ault et al. 2008). The biomass of the Caribbean snappers complex is listed as “unknown” by NOAA Fisheries (NOAA 2016a). Based on unknown biomass and the IUCN “Least Concern” status, abundance is rated a “moderate” concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
Moderate Concern

Key relevant information:
A formal stock assessment of silk snapper in 2011 did not give a fishing mortality estimate because of data limitations, but the assessment did conclude that silk snapper in Puerto Rico was not subject to overfishing, based on persistence of larger individuals in size structure and length-frequency data (SEDAR 2011b). Silk snapper catch per unit effort (CPUE) for pots/traps decreased during 1993 to 2007 while CPUE for handlines increased during 2000 to 2008, and no clear trend in total fishing mortality was described (SEDAR 2011b). NOAA Fisheries currently lists the Caribbean snappers complex as not subject to overfishing (NOAA 2016a). But in a recent data-limited assessment of Puerto Rico reef fish, fishing mortality of silk snapper was estimated at one-and-a-half times the target reference point (F/F_{MSY} = 1.47; Ault & Smith 2015). Caribbean snapper complex unit 1 commercial landings averaged 197,598 lbs/year in Puerto

Rico during 2010 to 2012, which was well below (69%) the annual catch limit for this species (NOAA SERO 2016a). Based on limited and conflicting information regarding overfishing status, we have awarded a score of "moderate" concern.

SNAPPER, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
Snapper species that are commonly landed with queen triggerfish have assessments that range from "Least Concern" to "Near Threatened" by the IUCN (IUCN 2016). The four most common species include silk, lane, yellowtail, and vermilion snapper (NOAA landings). These species, along with several other species, are managed by the Caribbean Fishery Management Council under the Caribbean "snapper complex"; overfished status is listed as "unknown" (NOAA 2016a).

Fourteen species are currently managed under this complex, and four have been formally assessed by the Southeast Data, Assessment, and Review process: yellowtail, silk, mutton, and queen snapper. Because of data limitations, abundance for each of these species could not be determined relative to target and overfished abundance reference points (SEDAR 2005b) (SEDAR 2007b) (SEDAR 2011b) (SEDAR 2011c). An independent, data-limited assessment of Puerto Rico snapper found that biomass was below the target abundance reference point for 8 of the 10 species evaluated between 2000 and 2002 (B/B_{MSY} = 0.08 to 0.88; Ault et al. 2008). No additional information on USVI snapper abundance is available.

Given unknown current biomass but the "Near Threatened" status of at least one commonly landed species and indication of biomass below maximum sustainable yield, we have awarded a score of "high" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Diving
Virgin Islands, United States, Diving

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
NOAA Fisheries lists Caribbean snapper as not experiencing overfishing (NOAA 2016a), but previous stock assessments could not determine fishing mortality relative to target reference points (SEDAR 2005b) (SEDAR 2007b) (SEDAR 2011b) (SEDAR 2011c). A recent data-limited assessment of Puerto Rico snapper found that 9 of the 10 species assessed were potentially undergoing overfishing from 2010 to 2013 (F/F_{MSY} = 1.47 to 4.25; Ault & Smith 2015), although the authors state that the fishing mortality values >F/F_{MSY} = 3 were driven by inaccurate life-history information and are not conclusive.

Various species of snapper are targeted by the diver fishery, while the pot and trap fishery primarily lands silk, lane, yellowtail, and vermilion snapper (NOAA landings). Snapper are highly susceptible to the pot and trap fishery, especially as undersized juveniles (Hawkins et al. 2007) (Clark et al. 2012). Snapper were the top-ranked group found in fish traps in the U.S. Virgin Islands by biomass (Clark et al. 2012), and have been overfished in parts of the Caribbean because of their vulnerability to trap fishing (Hawkins et al. 2007). Commercial landings of snapper units in Puerto Rico from 2012 and 2014 were between 48% and 65% of the annual catch limits (ACLs), except for snapper unit 2, which exceeded the commercial ACL by 7% because of increased landing. USVI snapper landings averaged 35% to 57% of the commercial ACLs for that region (CFMC 2016).

Because of limited and conflicting information, fishing mortality is rated “moderate” concern.

SURGEONFISH, UNSPECIFIED: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Surgeonfish are a family of laterally compressed fish (in the family Acanthuridae) that feed almost exclusively on algae; they are commonly captured for the aquarium trade, although some species are prohibited (SEDAR 2013b). Species such as blue tang are sold locally as food fish, and many are fished for subsistence (Choat et al. 2012). The most frequently landed species in the Caribbean is the blue tang, but other members that are referred to as tangs and unicornfishes may also be landed (NOAA 2016b).

Surgeonfish in the U.S. Caribbean are managed by the Caribbean Fishery Management Council as part of the Caribbean surgeonfish complex. This complex is split into separate stocks for Puerto Rico, St. Croix, and St. Thomas/St. John (NOAA 2016a). There are no abundance conservation estimates for surgeonfish biomass, although they are generally listed by the IUCN as having stable populations and are species of "Least Concern" (IUCN 2016). We have therefore awarded a score of "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
NOAA Fisheries lists all three stocks of surgeonfish as not experiencing overfishing (NOAA 2016a). But the only formally assessed species is blue tang, and no estimates of fishing mortality were given due to data limitations (SEDAR 2013b).

Surgeonfish accounted for 23% to more than 25% of the catch (by number of individuals) in traps in the U.S. Virgin Islands (STFA 2008) (Clark et al. 2012). Because of their body shape, they are particularly susceptible to trap fisheries as juveniles (Hawkins et al. 2007), so they represent a large proportion of bycatch in this fishery. Landings of surgeonfish for 2011–2013 in St. Croix were 22,023 lbs/yr and in St. Thomas/St. John were 15,654 lbs/yr, which accounted for 66% and 55% of the commercial annual catch limits (ACLs), respectively (NOAA SERO 2016). Landings are limited in Puerto Rico (CFMC 2016), but surgeonfish are expected to be caught as bycatch in the pot and trap fisheries. Most landings are reported as "surgeonfish, unspecified," but doctorfish, blue tang, and ocean surgeonfish are the most commonly reported landings (NOAA 2016b). Because of limited information on fishing mortality, we have awarded "moderate" concern.

TURTLES, UNKNOWN: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
High Concern

Key relevant information:
Sea turtles are known to interact with bottom longline gear in the U.S. Virgin Islands and elsewhere in the Caribbean (Wallace et al. 2010), along with rope gear from fish traps (Bjorkland 2011); however, specific estimates are not available for these fisheries. Candidate species for interaction with longline gear used for reef fish include leatherback turtle (NMFS and USFWS 1992) (NOAA 2011), which is the most widespread species in the Caribbean (Bjorkland 2011). Other species may be susceptible in the region, including loggerhead turtle, which has been documented as bycatch mortality in Mexican and Venezuelan bottom longline fisheries; small hawksbill turtle, which may be captured in fish traps (Bjorkland 2011); and leatherback turtle, which may interact with both gear types in the Gulf of Mexico (NOAA SERO 2009). NOAA Fisheries notes that leatherback turtle is increasing its nesting in Puerto Rico and surrounding islands (NMFS 2016c). Because of the endangered or threatened status and high vulnerability of sea turtle populations to interactions with fisheries, sea turtles automatically receive a score of “high” concern (Seafood Watch 2016).

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
High Concern

Key relevant information:
The fishing impact on sea turtles by Caribbean benthic longline fisheries is rated as “high” concern, according to the Seafood Watch Unknown Bycatch Matrix (Seafood Watch 2016).

VERMILION SNAPPER: UNITED STATES SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
Vermilion snapper is considered "Vulnerable" by the IUCN (Lindeman et al. 2016c). Vermilion snapper in the U.S. Southeast Atlantic is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery, and was last assessed in 2012. The assessment indicates that the abundance of vermilion snapper has been declining since 1946 and was at its lowest level in 2011. The biomass of spawning fish was estimated to be slightly below the target level or the biomass at maximum sustainable yield (B/B_{MSY} of 0.98). But abundance was above the limit abundance 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, we have awarded a "low" concern score.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States Southeast Atlantic, Handline
Low Concern

Key relevant information:
NOAA Fisheries lists vermilion snapper along the Southeast Atlantic coast as not experiencing overfishing (NOAA 2016a), and the most recent stock assessment (SEDAR 2012b) estimates fishing mortality to be 67% of the target level or fishing mortality at maximum sustainable yield (F/F_{MSY} = 0.67; SEDAR 2012b) for the years 2009–2011. But the stock assessment also notes some 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 is commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the Southeast Atlantic in 2014 were 907,528 lbs by the commercial fishery and 259,146 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because the most recent assessment concluded that it is probable (> 50% chance) that overfishing is not occurring (SEDAR 2012b), we have awarded a "low" concern score.

WHITE GRUNT: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
The pot and trap fishery primarily targets white grunt, although other grunt species may be caught and landed or discarded (Clark et al. 2012). The IUCN considers white grunt to be a species of "Least Concern" (Lindeman et al. 2016d). White grunt in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of a mixed "grunts complex," which is subdivided into three stocks: Puerto Rico, St. Thomas/St. John, and St. Croix (NOAA 2016a). There is no formal stock assessment and there are no abundance conservation targets for white grunt or for the grunts complex for any of the three stocks (NOAA 2016a). White grunt abundance is rated "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
White grunt in the U.S. Caribbean is managed under the "grunts complex" in three separate stocks: Puerto Rico, St. Thomas/St. John, and St. Croix. Each of the grunts complex stocks is listed as not subject to overfishing (NOAA 2016a), although there is no formal stock assessment for this species or for the complexes. Commercial landings for the grunts complex between 2012 and 2014 averaged 2,493 lbs per year in Puerto Rico; 17,912 lbs per year in St. Croix; and 12,973 lbs per year in St. Thomas/St. John (CFMC 2016). All landings were 50% or less than the total allowable catches in each region (CFMC 2016). Recreational data were not available. Because of the lack of a stock assessment, we have rated the fishing mortality as "moderate" concern.

YELLOWTAIL SNAPPER: UNITED STATES CARIBBEAN

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

Puerto Rico, Bottom Longline
Moderate Concern

Key relevant information:
The IUCN considers yellowtail snapper to be a "Data Deficient" species (Lindeman et al. 2016e). Yellowtail snapper in the U.S. Caribbean is managed by the Caribbean Fishery Management Council as part of the "Caribbean snappers" complex (NOAA 2016a). This complex is considered to be one stock for Puerto Rico and the U.S. Virgin Islands. The Caribbean snappers are further sub-divided into four units; yellowtail snapper is the only species in "Snapper Unit 4" (NOAA SERO 2016a). The most recent formal stock assessment for Caribbean yellowtail snapper was published in 2005. This assessment produced widely variable model outputs and found the available data insufficient to make specific abundance estimates (SEDAR 2005b). Yellowtail snapper biomass in Puerto Rico was estimated at one-fourth of the target abundance reference point in the early 2000s (B/B_{MSY} = 0.26; Ault et al. 2008). In recent stock status updates, NOAA Fisheries lists the biomass of the Caribbean snappers complex as "unknown" (NOAA 2016a). The Productivity-Susceptibility Analysis indicates that this species has a medium vulnerability (see Appendix A). Based on the species' medium vulnerability and unknown biomass, abundance is rated "moderate" concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

Puerto Rico, Bottom Longline
Low Concern

Key relevant information:
Yellowtail snapper in the U.S. Caribbean is considered one stock for Puerto Rico and the U.S. Virgin Islands. The most recent formal stock assessment for Caribbean yellowtail snapper did not make any specific estimates of fishing mortality, based on data limitations and widely variable model results (SEDAR 2005b). Ault & Smith (2015) recently assessed fishing mortality for yellowtail snapper and found that it was below the fishing mortality at maximum sustainable yield (F/F_{MSY} = 0.86). The Caribbean snappers complex is currently listed as not subject to overfishing in NOAA Fisheries stock status updates (NOAA 2016a). Commercial landings for Snapper Unit 4 in Puerto Rico averaged 183,457 lbs/year from 2010 to 2012; this was only 49% of the annual catch limit (NOAA SERO 2016a). Because of its status as not

currently experiencing overfishing and the low fishing mortality estimate, we have awarded a score of “low” concern.

YELLOWTAIL SNAPPER: SOUTHEAST ATLANTIC

Factor 2.1 Abundance

Scoring Guidelines (same as Factor 1.1 above)

United States, Southeast Atlantic, Handline
Very Low Concern

Key relevant information:
The IUCN considers yellowtail snapper to be a “Data Deficient” species (Lindeman et al. 2016e). Yellowtail snapper in the U.S. Southeast Atlantic is managed by the South Atlantic Fishery Management Council (SAFMC), and the most recent stock assessment (O’Hop et al. 2012) treats this species as a single population that ranges into both Southeast Atlantic and Gulf of Mexico management zones. This assessment rated the stock status as not overfished, with spawning stock biomass more than three times the target level of biomass at maximum sustainable yield (B/B_{MSY} = 3.36; O’Hop et al. 2012). Because of the high biomass, we have rated the abundance as “very low” concern.

Factor 2.2 Fishing Mortality

Scoring Guidelines (same as Factor 1.2 above)

United States, Southeast Atlantic, Handline
Low Concern

Key relevant information:
The National Marine Fisheries Service lists yellowtail snapper in the Gulf of Mexico and Southeast Atlantic regions as not subject to overfishing (NOAA 2016a). 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; O’Hop et al. 2012). This ratio was based on an F_{MSY} that would yield a spawning potential ratio (SPR) of 30%. Yellowtail snapper is commonly targeted by commercial fishers using vertical lines, and by headboat and private recreational fishers using vertical lines. Landings for the Southeast Atlantic in 2014 were 89,303 lbs by the commercial fishery and 395,124 lbs by the recreational fishery (NMFS 2016a) (NMFS 2016b). Because of the very low overall fishing mortality, we have awarded a rating of “low” concern.

Factor 2.3 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
<100%	1
≥100	0.75

Puerto Rico, Bottom Longline
>100 %

Key relevant information:
Discards in the Puerto Rico longline fishery are likely to be high. Although there are no estimates for discard mortality from this region and fishery, discard/landings ratios are generally greater than 100% in similar fisheries (Scot-Denton et al. 2011) (Scott-Denton and Williams 2013). Given what is known about this fishery in other regions, this factor is conservatively rated at >100%.

Puerto Rico, Diving
Virgin Islands, United States, Diving
<100%

Key relevant information:
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).

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
>100%

Key relevant information:
Discards and bait use are high in pot and trap fisheries. One study in Florida found that 49% of all fish caught were discarded (Harper et al. 1990), most often due to undersized or non-commercial species, or threat of ciguatera in some reef fish (Johnson 2010). Additionally, approximately 10%–20% of pots and traps are lost in a given year in the U.S. Virgin Islands (Clark et al. 2012), which increases bycatch mortality significantly through ghostfishing. Additionally, some traps are baited with undersized reef fish (Wolf and Chislett 1974). Together, these suggest that discards and bait use is greater than 100%.

United States, Southeast Atlantic, Handline
<100%

Key relevant information:
Commercial discards in the snapper-grouper fishery in the U.S. Southeast Atlantic are moderate. The total discards/landings ratio for the fishery was 23.2% between 2007 and 2011 (GSAFFI 2013). A large proportion (36% to 98%, depending on the species) of the most commonly discarded species in the fishery (red snapper, scamp, red porgy, and vermilion snapper) are undersized discards (GSAFFI 2008), or they may be discarded out of season. Discard/landings ratios of some commonly discarded species in a pilot observer program in the commercial fishery were: vermillion snapper 17%, red snapper 45%, and red grouper 250% (GSAFFI 2010); together, the total discards/landings ratio for this fishery is < 100%.

Criterion 3: Management Effectiveness

Five subfactors are evaluated: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final criterion 3 score is determined as follows:

- *5 (Very Low Concern)—Meets the standards of 'highly effective' for all five subfactors considered.*
- *4 (Low Concern)—Meets the standards of 'highly effective' for management strategy and implementation and at least 'moderately effective' for all other subfactors.*
- *3 (Moderate Concern)—Meets the standards for at least 'moderately effective' for all five subfactors.*
- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other subfactor is rated 'ineffective.'*
- *1 (Very High Concern)— Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical)—Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

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

Rating is Critical if Management Strategy and Implementation is Critical.

Criterion 3 Summary

Fishery	3.1 Mgmt strategy and implement.	3.2 Bycatch Strategy	3.3 Scientific research and monitoring	3.4 Enforcement	3.5 Stakeholder Inclusion	**Management Effectiveness Category (Score)**	**C3 Rating**
U.S. Southeast Atlantic, Handline	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow

Puerto Rico, Pots and Traps	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow
U.S. Virgin Islands, Pots and Traps	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow
Puerto Rico, Diving	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow
U.S. Virgin Islands, Diving	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow
Puerto Rico, Bottom Longline	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderate (3)	Yellow

Criterion 3 Assessment

Factor 3.1 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? Do managers follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderately Effective

Key relevant information:
Queen triggerfish is managed in the U.S. Caribbean by the Caribbean Fishery Management Council in federal waters under three triggerfish and filefish complexes: Puerto Rico, St. Croix, and St. Thomas/St. John. Most other reef fish species are also managed under complexes. Annual catch limits (ACLs) are in place for species complexes in this region, but they are based on average annual landings rather than maximum sustainable catch (CFMC 2016); however, some efforts are underway to improve the way annual catch limits and overfishing limits are determined (NOAA 2016f). There are limited other regulations in place specific to species in these complexes (e.g., bag limits, size limits; SEDAR 2013a). There are a few seasonal closures, particularly on spawning grounds of species such as red hind and mutton snapper (NOAA and

CFMC 2015) that are designed to reduce fishing on spawning aggregations. There are also several small, no-take marine protected areas (Hernandez-Delgado 2014). The Puerto Rico Department of Natural and Environmental Resources oversees fishing activity within state waters (DRNA 2010) and regulates fishing activity through commercial permitting, some minimum size requirements, and seasonal closures (DNER 2004). The Department of Planning and Natural Resources (DPNR) manages fisheries in U.S. Virgin Island waters, and regulations in these waters include some minimum sizes, gear restrictions, and seasonal or spatial closures (DPNR 2009). Regulations that affect mesh size in the pot and trap fishery and seasonal closures on species caught with triggerfish may positively affect triggerfish, although data are needed to substantiate this point (SEDAR 2013a).

The status of queen triggerfish in the U.S. Caribbean remains uncertain, but it is likely depleted throughout the region and undergoing overfishing in Puerto Rico. Many of the species that are commonly landed with queen triggerfish have not yet been assessed, or assessments could not estimate abundance or fishing morality, or the stocks have a high probability of being overfished. Data-limited assessments suggest that most common reef-associated fish in the fishery in Puerto Rico are severely depleted and undergoing overfishing (Ault et al. 2008) (Ault and Smith 2015).

Reef fish are currently managed by ACLs, but data suggest that several of the species in these fisheries are overfished or experiencing overfishing. Thus, a score of “moderately effective” is awarded.

United States Southeast Atlantic, Handline
Moderately Effective

Key relevant information:
Queen triggerfish was removed from federal management in the snapper grouper fishery in 2012 because commercial landings are low and it is primarily caught on trips that target other species (Federal Register 2012). It is not regulated by any Southeast Atlantic state in state waters. Queen triggerfish in this region also has not been assessed for measures of abundance or fishing mortality.

Species caught along with queen triggerfish include vermilion snapper, yellowtail snapper, red snapper, red grouper, gag, greater amberjack, and red porgy (Stephen and Harris 2010) (Shertzer and Williams 2008) (ACCSP 2016). These species are managed through federal and state bag, size, and catch limits (SAFMC 2015). Concern exists over the abundance of red snapper, red porgy, and gray triggerfish, and fishing mortality remains high for red snapper (NOAA 2016a). Other species are abundant, suggesting effective management for some but not all species.

Because queen triggerfish is not managed and management of other species caught in the fishery is mixed, a score of “moderately effective” is awarded.

Factor 3.2 Bycatch Strategy
Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Puerto Rico, Bottom Longline
Moderately Effective

Key relevant information:
The most frequently captured species with queen triggerfish include snapper (yellowtail, lane, and silk snapper) and grouper (primarily red hind) (NOAA 2016b), but interactions with sea turtles are possible (NOAA 2011b). The National Marine Fisheries Service requires several restrictions on bottom longlines to reduce or mitigate bycatch, including corrodible (non-stainless steel) hooks; possession and use of sea turtle release gear; immediate release of sawfish, sea turtles, and marine mammals; reporting of marine mammal entanglements; and use of vessel monitoring systems (VMS) (NOAA and CFMC 2015). NMFS further prohibits the use of bottom longlines in several spawning areas for species of concern in the Caribbean. Circle hook requirements to minimize longline bycatch have been debated for the Caribbean region, but no circle hook requirements have been implemented yet (NOAA and CFMC 2015). Based on these measures, bycatch strategy is rated "moderately effective."

Puerto Rico, Diving
Virgin Islands, United States, Diving
Highly Effective

Key relevant information:
The diver fishery has very minimal bycatch (< 5%; Frisch et al. 2008), so a score of "highly effective" is awarded.

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderately Effective

Key relevant information:
A minimum mesh size is in place to reduce bycatch of undersized individuals (NOAA and CFMC 2015). Approximately 10% of fish traps are estimated to be lost yearly in the U.S. Virgin Islands, which leads to ghostfishing and further bycatch mortality (Clark et al. 2012). Because of this, mesh panels (escape vents) with degradable twine are required in fish and lobster traps used in

the Caribbean Exclusive Economic Zone and territorial waters (Clark et al. 2012) (NOAA and CFMC 2015). Based on these measures, bycatch strategy is rated “moderately effective.”

Detailed Rationale:
Bycatch in the trap and pot fisheries in the region frequently includes angelfish, boxfish, mixed invertebrates, and undersized snapper and grouper, which are often returned. Snappers, groupers, and triggerfish are often the target species of trap and pot fisheries, but fish traps in Curacao were found to catch 42%–64% bycatch by weight, mostly small parrotfish and surgeonfish (Johnson 2010). Another study in the U.S. Virgin Islands found that 19% of the biomass caught in traps comprised non-commercial species such as boxfish and angelfish (Clark et al. 2012). These fisheries are highly unselective, but discard mortality may be low due to fishing at relatively shallow depths and improvements in release techniques (Uhlmann and Broadhurst 2015). In other studies, the most commonly captured bycatch species in St. Thomas demonstrated a range of mortality from 0% to 79%, with relatively high mortality for some snapper species that were captured out of season (Olsen and Hill 2012).

United States Southeast Atlantic, Handline
Moderately Effective

Key relevant information:
All vessels in the federal commercial fishery are required to use non-stainless steel circle hooks and have de-hooking tools aboard to minimize bycatch mortality (SAFMC 2015), but not in state waters of eastern Florida (FWCC 2013). 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 co-landed species, but other studies have been inconclusive (Wilson and Diaz 2012) (Sauls and Ayala 2012) (Garner et al. 2014). Evidence from the Gulf of Mexico suggests reduced catchability of gray triggerfish using circle hooks (SEDAR 2015), which will apply to queen triggerfish as well. Overall, bycatch management is considered “moderately effective.”

Detailed Rationale:
The most frequently discarded species in the South Atlantic snapper-grouper fishery include red snapper, red porgy, and vermillion snapper (which are commonly caught with queen triggerfish), along with scamp and Atlantic sharpnose shark (ACCSP 2016) (GSAFFI 2013). Queen triggerfish is a relatively rare species in the commercial fishery (GSAFFI 2010) (GSAFFI 2013), representing about 2% of the number of fish caught; discards were zero from one field study spanning 2007–2011 (GSAFFI 2013). The handline fishery is not expected to contribute to significant mortality of any threatened or endangered species. Annual expected mortality of sea turtles is expected to be less than 30 individuals, and no mortality is expected for smalltooth sawfish (SAFMC 2014).

Factor 3.3 Scientific Research and Monitoring
Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderately Effective

Key relevant information:
Information on Puerto Rico and U.S. Virgin Islands fisheries comes from dealer self-reporting of landings in paper logbooks, but more than 50% of landings are unreported. Dockside and phone interviews are also conducted, but these do not confirm landings data provided by fishers (Trumble 2011). Additionally, little information about life history is collected, including length-weight data and other characteristics. A Digital Deck Electronic Reporting trial is underway in Puerto Rico to assess the feasibility of electronic reporting to provide timely data for annual catch limit monitoring (NOAA 2015). The Puerto Rico Department of Natural and Environmental Resources has applied for an exempted fishing permit to gather information about abundance, distribution and other information for help in assessing the status of populations in that region (Federal Register 2016b). A few stock assessments have been carried out, primarily for Puerto Rico stocks, but there is generally too little information to make definitive assessment of abundance or fishing mortality (Trumble 2011). Recently, a SEDAR data-limited assessment of six Caribbean species was completed with the goal of identifying the best methods to set annual catch limits (ACLs) and overfishing limits (SEDAR 2016a). Very little bycatch information exists; what is available comes from a few studies on pot and trap bycatch. Because of limited collection of data in this fishery but efforts toward gathering more data and a few bycatch studies, we have awarded a score of "moderately effective."

United States Southeast Atlantic, Handline
Moderately Effective

Key relevant information:
Available data for queen triggerfish come from commercial dealer reports, dockside interviews of fishers (Trip Interview Program, TIP), and visual surveys (NMFS 2015a) (SEDAR 2016a). Queen triggerfish in the U.S. Southeast Atlantic has not been formally assessed. One study by Kellison et al. (2012) found that queen triggerfish had declined significantly in Biscayne Bay (eastern Florida) between 1977 to 1981 and 2006 to 2007. Some species that are commonly caught with queen triggerfish (e.g., gag, vermilion snapper, red snapper, and red porgy) were recently

assessed (2012–2016), but others were assessed more than 5 years ago (red grouper and greater amberjack). Bycatch/discard data for this fishery come from a limited number of preliminary observer studies (GSAFFI 2008) (GSAFFI 2010) (GSAFFI 2013), but no observer program currently exists (NOAA 2015).

Recent assessment of some targeted species in the fishery but the lack of any assessment for queen triggerfish and the lack of an observer program result in a "moderately effective" rating.

Factor 3.4 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.

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderately Effective

Key relevant information:
Commercial annual catch limits (ACLs) in Puerto Rico and the U.S. Virgin Islands are monitored through paper logbooks only (NOAA 2015); there is no observer program, so landings are consistently underreported (Trumble 2011). Further, the lag in receipt of accurate landings logbook data prevents effective management of commercial ACL monitoring (Trumble 2011), although there have been recent improvements to commercial reporting in both regions (CFMC 2016). An electronic reporting pilot study is currently underway for the Caribbean (NOAA 2015). Landings of triggerfish in the U.S. Virgin Islands are generally not exceeded, but were recently exceeded in Puerto Rico. ACLs of other species including angelfish, snappers, and wrasses have also been exceeded (NOAA SERO 2016a). In Puerto Rico, ACL overages have largely been attributed to increased landings; in the U.S. Virgin Islands, they are attributed to improvements in catch reporting (CFMC 2016). There are also reports of illegal fishing in Puerto Rico (Munoz et al. 2013) and the U.S. Virgin Islands (pers. comm., Gore 2016).

Enforcement capacity by the main agencies in Puerto Rico (Department of Natural and Environmental Resources (DNER)) and the U.S. Virgin Islands (Department of Planning and Natural Resources (VI-DPNR)) in local waters is minimal, although both regions are exploring community-based enforcement options to reduce illegal fishing (Pittman et al. 2014) (Schaerer-Umpiere et al. 2014). Both regions are limited by number of personnel, and coordination is difficult among the stakeholder groups (e.g., local agencies, U.S. Coast Guard, National Parks Service) that are involved in enforcement among marine parks, protected areas, and waters open to fishers (Schaerer-Umpiere et al. 2014). In the U.S. Virgin Islands, National Parks Service

agents regularly patrol to create a presence, but it is clear that illegal fishing still occurs (Pittman et al. 2014). Enforcement is therefore rated as "moderately effective."

United States Southeast Atlantic, Handline
Moderately Effective

Key relevant information:
Commercial annual catch limits (ACLs) in the Southeast Atlantic are monitored through paper logbooks and electronic reporting (NOAA 2015), but no Vessel Monitoring System (VMS) or observer program currently exists (SAFMC 2014). ACLs for some species (e.g., gag grouper, vermilion snapper, and red snapper) were exceeded in the past; however, in the most recent years, ACLs for other species in the fishery have not been met or exceeded. An improved dealer reporting amendment was implemented in 2014 (SAFMC 2014), and a pilot study is underway to assess the feasibility of the use of e-logbooks (NOAA 2015).

The South Atlantic Fishery Management Council (SAFMC) Law Enforcement Advisory Panel develops a set of recommendations for law enforcement agencies to protect habitat and reduce illegal fishing (SAFMC 2016). States manage enforcement of rules in their respective local waters in coordination with NOAA's Office of Law Enforcement; in federal waters, rules are enforced by the NOAA Office for Law Enforcement and the U.S. Coast Guard (NOAA 2016h). Enforcement is rated as "moderately effective."

Factor 3.5 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, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Highly Effective

Key relevant information:
The Caribbean Fishery Management Council 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

Key relevant information:
The South Atlantic Fishery Management Council 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.”

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 and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

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

Criterion 4 Summary

Fishery	**4.1a Gear type and substrate** Score	**4.1b Mitigation of gear impacts** Score	**4.2 EBFM** Category (Score)	**Criterion 4** Rating Score
U.S. Southeast Atlantic, Handline	4	0	Moderate (3)	Green 3.46
Puerto Rico, Pots and Traps	2	0	Moderate (3)	Yellow 2.45
U.S. Virgin Islands, Pots and Traps	2	0	Moderate (3)	Yellow 2.45
Puerto Rico, Diving	4	0	Moderate (3)	Green 3.46
U.S. Virgin Islands, Diving	4	0	Moderate (3)	Green 3.46
Puerto Rico, Bottom Longline	2	0	Moderate (3)	Yellow 2.45

Criterion 4 Assessment

Factor 4.1a Physical 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. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 (High)—Hydraulic clam dredge. Or 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.

Puerto Rico, Bottom Longline
2

Key relevant information:
Bottom longlines may be fished in sensitive coral reef habitat (Garcia-Sais et al. 2005) and may cause a moderate impact on those habitats by snagging coral substrate (Cooke and Suski 2004). Because of the potential for gear interactions with corals, we have awarded a score of 2.

Puerto Rico, Diver
Virgin Islands, United States, Diver
4

Key relevant information:
Diver-based fishing (spearfishing) may result in some incidental contact with the reef, but has little expected or observable impacts on benthic coral habitat (Frisch et al. 2012). This results in a score of 4.

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
2

Key relevant information:
Pots and traps are frequently used in areas of sensitive coral habitat (Clark et al. 2012) and trap movement caused by wave action can damage coral and sessile invertebrates (Lewis et al. 2009). Further damage is caused by lost traps (Clark et al. 2012) (Renchen et al. 2014). Lost traps are moved by wind and currents and by major storm events such as hurricanes; trap movement can dislodge epifauna including sponges and hard and soft corals, damaging important structural habitat (Lewis et al. 2009) (Clark et al. 2012). This results in a score of 2.

United States Southeast Atlantic, Handline
4

Key relevant information:
Handlines used for reef-associated species are in limited contact with the substrate. Lost hook and line gear in the Florida Keys does impact coral, sponges, and other benthic habitat, but in one study in the Florida Keys, less than 1% of the studied coral demonstrated abrasion by this gear (Chiappone et al. 2005). For this reason, the impact on the habitat scores a 4.

Factor 4.1b Modifying factor: Mitigation of gear impacts

Scoring Guidelines

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

Puerto Rico, Bottom Longline
No Mitigation (0)

Key relevant information:
Very little gear mitigation is in place for the Puerto Rico bottom longline fishery. There are seasonal closures for bottom longlining for snappers and groupers (NOAA and CFMC 2015), and five year-round, no-take marine protected areas. But less than 5% of the area around Puerto Rico is currently set aside as no-take areas (Hernandez-Delgado 2014). Circle hooks, which are typically used in other U.S. bottom longline fisheries and may reduce the likelihood of snagging the benthos (Cooke & Suski 2004), are not required in this fishery (NOAA 2015). Therefore, no points have been awarded for gear mitigation.

Puerto Rico, Diver
Virgin Islands, United States, Diver
Not Applicable (0)

Key relevant information:
Diver-based fishing (spearfishing) may result in some incidental contact with the reef, but has little expected or observable impacts on benthic coral habitat (Frisch et al. 2012).

Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
No Mitigation (0)

Key relevant information:
Less than 5% of Puerto Rico and U.S. Virgin Island waters are no-take marine reserves, but there are several areas in each region that are closed to fishing to protect spawning aggregations (NOAA and CFMC 2015). Because a substantial portion of the waters are not closed to pots and traps, no points are awarded for gear mitigation.

United States Southeast Atlantic, Handline
No Mitigation (0)

Key relevant information:
Circle hooks are required for use by all federal reef fish fishery vessels in both the reef fish and snapper grouper fisheries (Sauls and Ayala 2012) (SAFMC 2015), but not in the state fisheries (FFWC 2013). Circle hooks are expected to be less likely to snag the substrate (Cooke and Suski 2004), though limited data exist to substantiate this point. There are eight federal marine protected areas (MPAs) in the Southeast Atlantic where fishing activity is prohibited, and many smaller MPAs in the Florida Keys National Marine sanctuary; some of these MPAs protect triggerfish spawning habitat (SAFMC 2007) (NOAA 2016g). Contact between handline gear and

the environment is minimal, and the gear type is suggested to minimize impact; however, less than 20% of queen triggerfish habitat is protected from fishing. Because of these factors, no additional points are awarded for gear mitigation.

Factor 4.2 Ecosystem-based Fisheries Management

Scoring Guidelines

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

Puerto Rico, Bottom Longline
Puerto Rico, Diving
Virgin Islands, United States, Diving
Puerto Rico, Pots and Traps
Virgin Islands, United States, Pots and Traps
Moderate Concern

Key relevant information:
Ecosystem-based management has lagged behind in the Caribbean because fisheries management has focused on traditional single-species yields and not ecosystem or habitat protection (Stump 2007) (Hernandez-Delgado et al. 2014). But some marine sanctuaries to protect reef habitat and sea turtle nesting have been established in Puerto Rico and the U.S. Virgin Islands (NOAA 2016e). There is a Protected Caribbean Corals Recovery Plan (NMFS 2015b), but this plan is not yet integrated with fishery management, and implementation of this plan is not clear. Two habitat reserves have been established in Puerto Rico (Northeast

Reserve and Culebra Island) to protect coral reef habitats, seagrass beds, mangroves, and sea turtle nesting beaches (NOAA 2016e). Several locations on both islands are closed seasonally to all fishing activity, in part to protect spawning aggregations of grouper and snapper species (NOAA and CFMC 2015).

There are numerous marine protected areas (MPAs) to protect coral reef habitat in the U.S. Virgin Islands, although the jurisdiction, purpose, and enforcement of regulations vary across these areas (Pittman et al. 2014). An assessment of three U.S. Virgin Island MPAs under federal jurisdiction found that these areas were not effective at preventing loss of fish biomass or coral cover; this failure was attributed to illegal fishing, lack of enforcement/regulation, and island-wide declines in coral habitat (Pittman et al. 2014).

The extent to which the removal of queen triggerfish or most other species in the fisheries of Puerto Rico or the U.S. Virgin Islands would result in detrimental food web impacts is currently unknown. But species such as parrotfish are important herbivores that actively maintain coral habitat. Declines in these herbivores has contributed to major shifts in community composition in other Caribbean reef systems in tandem with overfishing of snapper and grouper species (Mumby et al. 2012), suggesting that these potential food web impacts should be incorporated into current management.

Because of this mixed record of implementation and lack of coordinated effort to implement ecosystem-based management, we have awarded a score of “moderate” concern.

United States Southeast Atlantic, Handline
Moderate Concern

Key relevant information:
The South Atlantic Fishery Management Council is working toward adopting an ecosystem-based approach to management through a Fishery Ecosystem Plan. The plan addresses five key areas needed to implement this ecosystem approach: 1) an overview of the South Atlantic system; 2) species, habitats, and essential fish habitat; 3) information on coastal fishing communities; 4) threats to the system and recommendations; and 5) research and data needs (SAFMC 2009). The most recent adoption 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 2011a).

The extent to which the removal of queen triggerfish or most other species in the fisheries of the Southeast Atlantic would result in detrimental food web impacts is unknown. But red grouper *(Epinephelus morio)* may serve as a habitat modifier, potentially increasing biodiversity and abundance of economically and ecologically important species, such as spiny lobster, sponges, and corals (Coleman et al. 2010). The South Atlantic Fishery Management Council has implemented few policies to account for species’ ecological roles. This results in a score of “moderate” concern.

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Appendix A: Custom Appendix

Productivity-Susceptibility Analysis for Criterion 1 and 2 species

Scoring Guidelines

1.) Productivity score (P) = average of the productivity attribute scores (p1, p2, p3, p4 (finfish only), p5 (finfish only), p6, p7, and p8 (invertebrates only))

2.) Susceptibility score (S) = product of the susceptibility attribute scores (s1, s2, s3, s4), rescaled as follows: $S = [(s1 * s2 * s3 * s4) - 1/40] + 1$.

3.) Vulnerability score (V) = the Euclidean distance of P and S using the following formula: $V = \sqrt{(P^2 + S^2)}$

Vulnerability Score Range

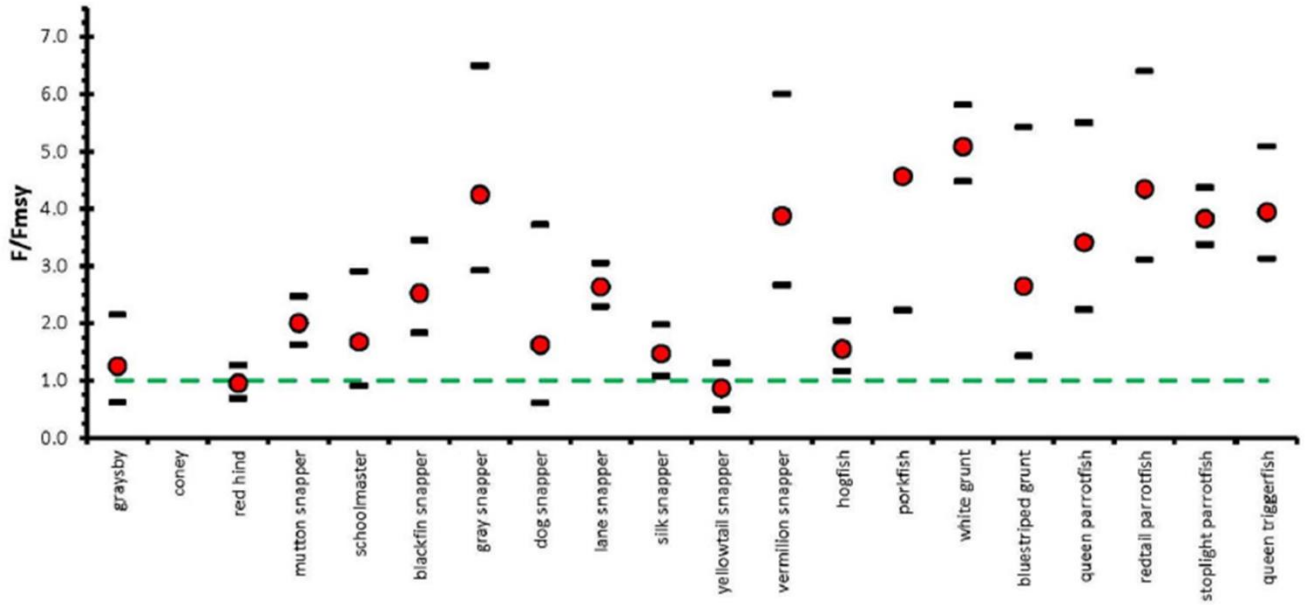
- *< 2.64 = Low vulnerability*
- *≥ 2.64 and ≤ 3.18 = Medium vulnerability*
- *> 3.18 = High vulnerability*

For details on the PSA method and scoring, please see the Seafood Watch Criteria.

	Productivity attributes								Susceptibility attributes/scores					
Common Name	Avg age at maturity	Average maximum age	Fecundity (eggs/year)	Average maximum size	Average size at maturity	Reproductive Strategy	Trophic Level	Density dependence (invertebrates)	Areal overlap	Vertical overlap	Selectivity	Post-capture Mortality	PSA Score	PSA Category
Caribbean spiny lobster	2.5 years	20 years	300,000	N/A	N/A	Brooder	3	None	High overlap	High overlap	Targeted	Retained		
score	*1*	*2*	*1*			*2*	*2*	*2*	*3*	*3*	*2*	*3*	***2.86***	***Medium***
Coney	5 years	17 years	200,000	70 cm	19 cm	Broadcast spawner	4.1	NA	High overlap	High overlap	Targeted	Retained		
score	*1*	*2*	*1*	*1*	*1*	*1*	*3*		*3*	*3*	*2*	*3*	***2.86***	***Medium***
Gray triggerfish	1.5 years	10 years	8,000,000	60 cm	17 cm	Demersal egg layer	4.1	N/A	High overlap	High overlap	Targeted	Retained		
score	*1*	*2*	*1*	*1*	*1*	*2*	*3*		*3*	*3*	*2*	*3*	***2.81***	***Medium***
Red hind	3 years	18 years	89,000	76 cm	22 cm	Broadcast spawner	3.8	N/A	High overlap	High overlap	Targeted	Retained		
score	*1*	*2*	*1*	*1*	*1*	*1*	*3*		*3*	*3*	*2*	*3*	***2.73***	***Medium***
Yellowtail snapper	3 years	23 years	150,000	86 cm	24 cm	Broadcast spawner	4	N/A	High overlap	High overlap	Targeted	Retained		
score	*1*	*2*	*1*	*1*	*1*	*1*	*3*		*3*	*3*	*2*	*3*	***2.73***	***Medium***

**Data from Appendix A: spiny lobster: (Ehrhardt and Fitchett 2010) (SEDAR 2016a) (Behringer and Butler 2006a) (Behringer and Butler 2006b) (Maxwell et al. 2007); coney: (Ault et al. 2008) (Froese and Pauly 2016) (Ferreira et al. 2008); gray triggerfish: (Lombardi et al. 2015) (Lang and Fitzhugh 2015) (Fitzhugh et al. 2015) (Froese and Pauly 2016); red hind: (Ault et al. 2008) (Froese and Pauly 2016) (Sadovy et al. 2008); yellowtail snapper: (Manooch and Drennon 1987) (SEDAR 2005) (O'Hop et al. 2012) (Garcia and Ramirez 2016) (Froese and Pauly 2016).*

Appendix B: Custom Appendix



Appendix B. *Sustainability status for commonly landed Puerto Rico reef fishes (from Ault and Smith 2015). Values greater than F/F_{MSY} = 1.0 were experiencing overfishing during the period 2010 through 2013.*

Appendix C: Review Schedule

Caribbean spiny lobster will be assessed and released in January 2018; no other Caribbean species listed on the SEDAR southeast review schedule. In the Southeast Atlantic, red grouper review is to be released in January 2017 and vermilion snapper will be released in April 2018. No additional information available on stock assessment plans for other Southeast Atlantic species in this report.