

Seafood Watch

Seafood Report



MONTEREY BAY AQUARIUM*

Commercially Important Groupers of the Gulf of Mexico & South Atlantic Regions

Red grouper (*Epinephelus morio*)

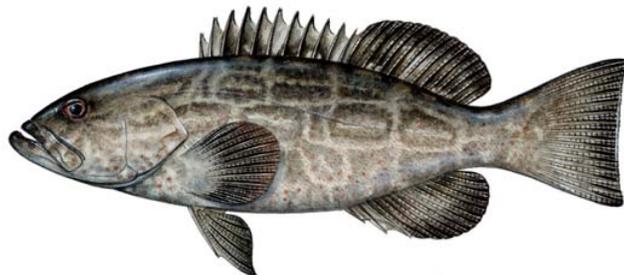
Gag (*Mycteroperca microlepis*)

Yellowedge grouper (*Epinephelus flavolimbatus*)

Black grouper (*Mycteroperca bonaci*)

Snowy grouper (*Epinephelus niveatus*)

Warsaw grouper (*Epinephelus nigritus*)



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About Seafood Watch® and the Seafood Reports

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® 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.

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Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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I. Executive Summary

Groupers are an important species in tropical and subtropical marine ecosystems throughout the world. A highly desirable food fish, groupers are sought by artisanal, recreational, and commercial fisheries throughout their range. Twelve grouper stocks are commercially exploited in the southeastern United States. These stocks are divided into two groups based on their depth distributions—shallow water and deep water—and are fished for using different methods and gear accordingly. Groupers possess a suite of life history characteristics, such as a long life span (12-41 years), high site fidelity, dense spawning aggregations, and protogyny that makes them highly susceptible to overfishing.

In the Atlantic shallow-water complex, red grouper is a critical conservation concern because it is overfished and experiencing overfishing. The gag grouper stock status would normally be classified as poor according to Seafood Watch® because overfishing is occurring, distribution parameters are skewed, and the stock is likely approaching an overfished condition. In addition, the black grouper stock would normally be classified as a low conservation concern according to Seafood Watch® because the stock is not overfished, overfishing is not occurring, and the stock uncertainty is not high. However, in the Atlantic, red, black, and gag grouper are targeted and caught together in a multi-species fishery and are managed under an aggregate quota, with gag and red grouper contributing the majority of the landings of the shallow-water aggregation. As such, any landed black grouper and gag were most likely targeted and caught with red grouper, which has a critical stock status, and the fisheries landing black grouper and gag add to the unsustainable fishing pressure on red grouper. Therefore, Seafood Watch® ranks the stocks of the Atlantic shallow-water complex as an aggregation rather than on a single species basis, and considers the stock status of the shallow-water aggregation including red, gag, and black grouper from the Atlantic to be a critical conservation concern.

In the Gulf of Mexico shallow-water complex, the gag grouper stock is a critical conservation concern because it is overfished and experiencing overfishing. The red and black grouper stocks are each classified as low conservation concerns according to Seafood Watch® because the stocks are not overfished, overfishing is not occurring, and the stock uncertainty is not high. In the Gulf of Mexico, as in the Atlantic, these three species are closely associated and are landed together. However, in the Gulf of Mexico, management has implemented a strict quota for gag to allow the stocks to rebuild, effectively closing directed fishing for gag and allowing fishermen to land only a very limited quantity of incidentally caught gag before the fishery is closed. Because fisheries cannot target gag under current strict quotas, gag landings are considered bycatch, and the stocks of the three shallow-water complex grouper species in the Gulf of Mexico are considered separately. (The conservation concern associated with unavoidable incidental catch of gag in the Gulf of Mexico shallow-water grouper fishery is considered under Seafood Watch® Criterion 3: Nature and Extent of Bycatch). Seafood Watch® considers the stocks of red and black grouper from the Gulf of Mexico to be low conservation concerns, while the stock status of gag from the Gulf of Mexico is a critical conservation concern.

The deep-water complex includes snowy, Warsaw, and yellowedge grouper. Snowy grouper and yellowedge grouper are listed as Vulnerable species (“facing a high risk of extinction in the wild”) according to the IUCN. Warsaw grouper are listed as Critically Endangered (“facing an

extremely high risk of extinction in the wild”) by the IUCN. Vulnerable and Critically Endangered species are both considered “threatened” under the IUCN due to the high to extremely high risk of extinction. In addition, in the Atlantic, snowy and Warsaw are undergoing overfishing, and snowy is overfished while the overfished status of Warsaw and yellowedge is unknown. In the Gulf of Mexico, the overfished and overfishing status of all three species is unknown because there is no stock assessment, a serious concern considering the threatened status of these three species. Seafood Watch® deems the status of snowy grouper, Warsaw grouper, and yellowedge grouper in the Atlantic and the Gulf of Mexico to be critical because they are all considered threatened by the IUCN.

Bycatch in the snapper/grouper fishery is moderate and includes undersized individuals (regulatory discards), protected grouper species such as Nassau and goliath grouper, grouper species undergoing overfishing (e.g., gag), and occasional incidental catches of sea turtles. Several types of gear are used in capturing grouper, including hand lines, power assisted lines, fish traps, and bottom longlines. Given their roles as ecosystem engineers and top predators, it is possible that reduced biomass of groupers is having direct and indirect effects on the marine ecosystems in which they live. U.S. grouper fisheries in the Atlantic and the Gulf of Mexico are regulated by their respective management councils through fishery management plans (FMPs) that are amended as needed to increase protection for the stocks. Despite FMP requirements for regular stock assessments, a comprehensive stock analysis has only been completed on red grouper, black grouper, gag and yellowedge grouper from the Gulf of Mexico, and only recently has management been able to stop overfishing in some overfished stocks. As a result, management is considered to be moderately effective.

Red, gag and black grouper from the Atlantic, gag from the Gulf of Mexico, and snowy, Warsaw and yellowedge grouper from both the Gulf of Mexico and the Atlantic are given an overall seafood recommendation of Avoid due to their critical stock status. Red and black grouper from the Gulf of Mexico are all given an overall seafood recommendation of Good Alternative due to high inherent vulnerability, healthy stocks, and moderate concerns for bycatch, habitat and ecosystem effects and management effectiveness.

This report was updated on January 13, 2011. For a summary of changes made at this time, please see Appendix 1.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability			√	
Status of Stocks	√ Red and black grouper (Gulf of Mexico)			√ Red and Black Grouper (Atlantic); Gag, Snowy, Warsaw, and Yellowedge (Gulf of Mexico and Atlantic)
Nature of Bycatch		√		
Habitat & Ecosystem Effects		√		
Management Effectiveness		√		

About the Overall Seafood Recommendation:

- A seafood product is ranked “**Best Choice**” if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.
- A seafood product is ranked “**Good Alternative**” if the five criteria “average” to yellow (Moderate Conservation Concern) OR if the “Status of Stocks” and “Management Effectiveness” criteria are both of Moderate Conservation Concern.
- A seafood product is ranked “**Avoid**” if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.

Overall Seafood Recommendation:**Red grouper; black grouper (Gulf of Mexico):**Best Choice Good Alternative Avoid 

Gag, Warsaw grouper, Snowy grouper, and Yellowedge grouper (Gulf of Mexico and Atlantic); Red grouper, black grouper (Atlantic):Best Choice Good Alternative **Avoid** **Market Availability****Product Sources:**

Grouper enters the U.S. marketplace from both domestic and international sources. Domestic catch of grouper is separated by species common name, while imported grouper is only classified as “grouper.” In 2007, the U.S. landed 4,206.5 metric tons (mt) of grouper (Figure 1), the majority consisting of red, gag, and yellowedge grouper (Figure 2) (NMFS 2003). In 2007, the U.S. imported 4,846.3 mt (Figure 3), most of which entered the U.S. from Mexico, followed by Panama and Brazil respectively (Figure 4) (NMFS 2003).

Product Forms:

Grouper are sold both as whole fish and fillets in fresh and frozen forms.

Market Names:

Grouper can be found in markets and restaurants throughout the U.S. and Mexico. Grouper market names include grouper and sea bass. In Mexico, grouper are called mero (Seijo G. 1986).

Seasonal Availability:

Grouper are available year-round. Peak catch in the Southeast Atlantic and Gulf of Mexico fisheries occurs during the summer and fall months (LaVecchia 2001). During winter and spring, most grouper landings are along the Atlantic coast of South America (LaVecchia 2001).

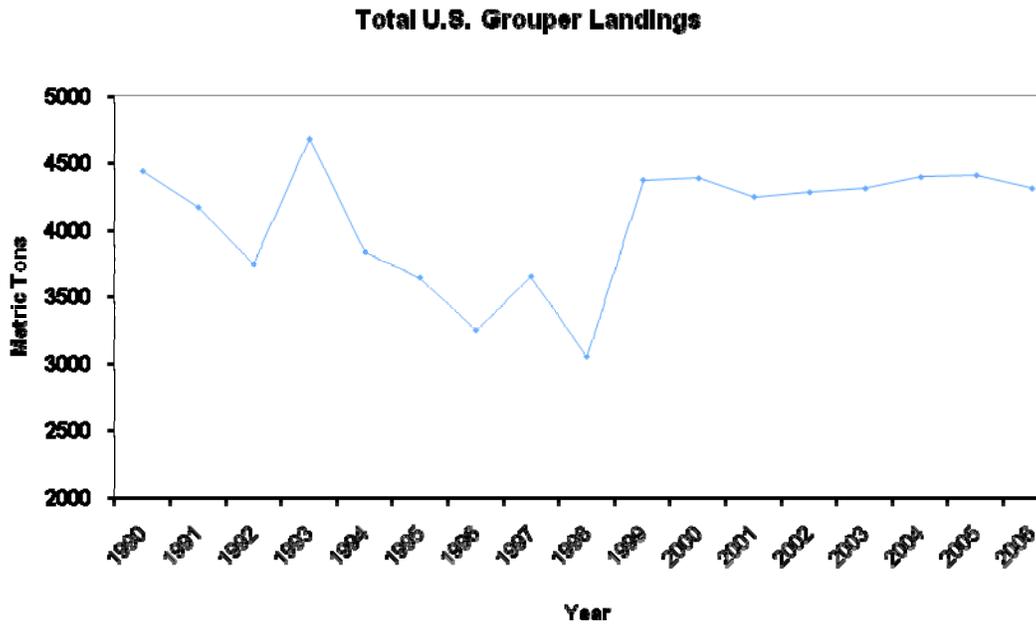


Figure 1. Total grouper landings have remained relatively steady in the U.S., despite recent catch restrictions on a number of species (NMFS 2003).

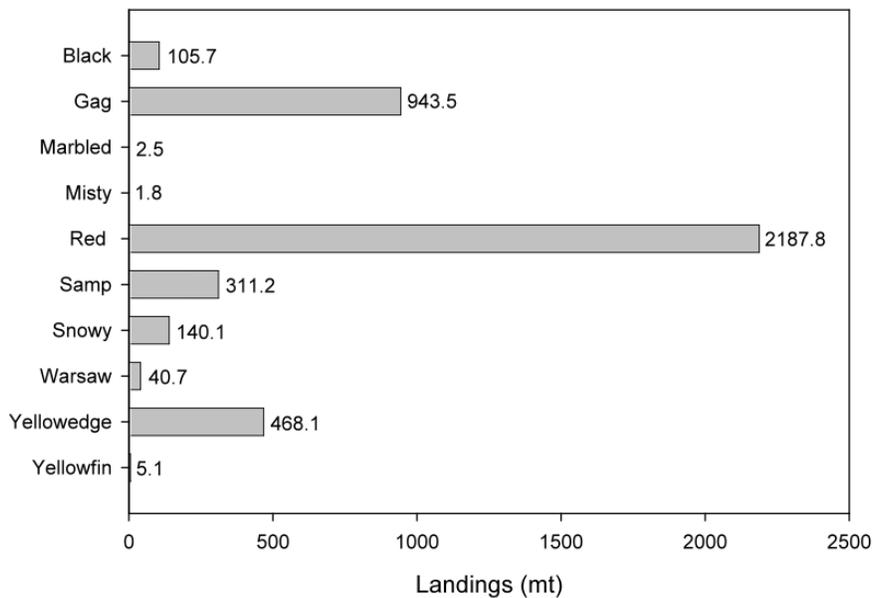


Figure 2. U.S. grouper catch in the South Atlantic and Gulf of Mexico, 2007 (NMFS 2003).

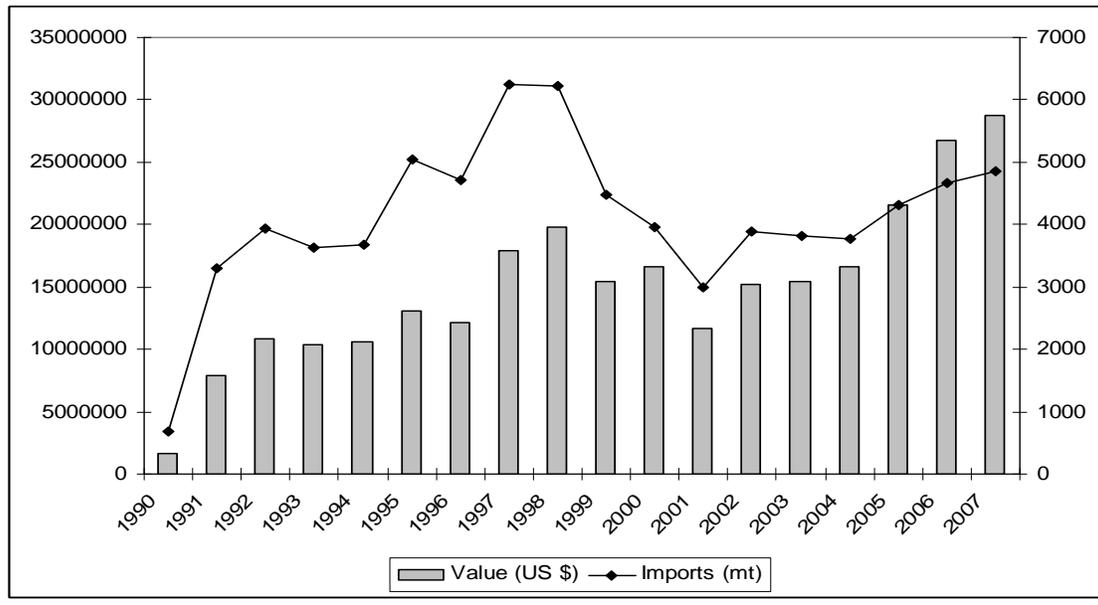


Figure 3. Tonnage (mt) and value (US\$) of US imports of grouper, 1990-2007 (NMFS 2003).

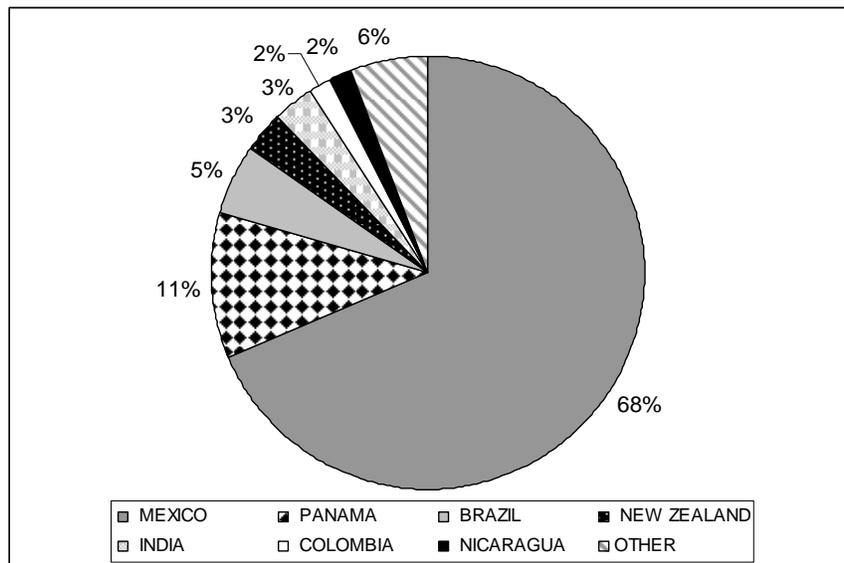


Figure 4. Relative proportions of grouper imports from foreign countries (mt) (NMFS 2003).

II. Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species

Criterion 1: Inherent Vulnerability to Fishing Pressure

Grouper are generally long-lived, protogynous (individuals function first as females then some portion of the population transforms into males), and reach sexual maturity between three and nine years of age (Robins and Ray 1986; Froese and Pauly 2003). Though fecundity is unknown for most grouper species, studies have shown some species are prolific spawners, producing over one million eggs per spawn (Heemstra and Randall 1993; Brule, Deniel et al. 1999; Froese and Pauly 2003). Heemstra and Randall (Heemstra and Randall 1993) found, however, that many grouper species have a slow population doubling time, ranging from 4.5-14 years. Furthermore, many grouper species are relatively sedentary, making seasonal migrations to specific spawning sites, where they form spawning aggregations (Shapiro 1987; NMFS 2002), increasing significantly their susceptibility to fishing pressure. Most grouper species spawn during spring and summer months (Figure 5) (NMFS 2002a).

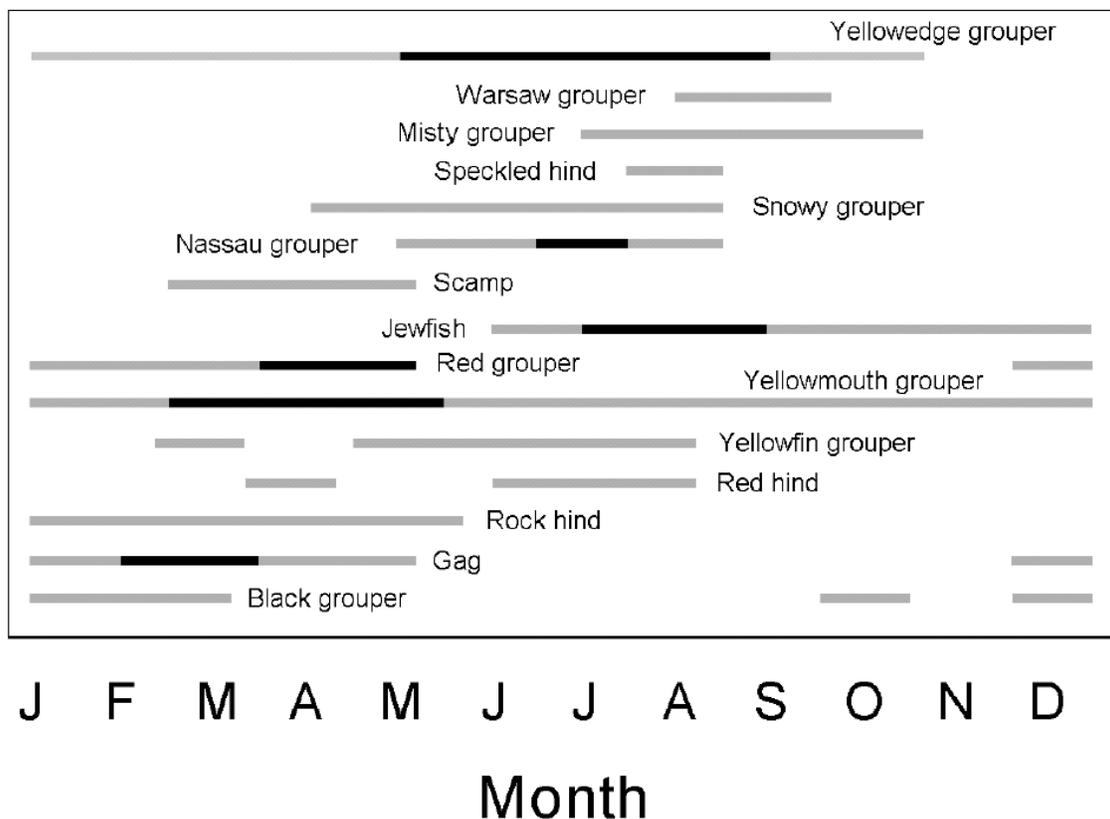


Figure 5. Spawning seasons of grouper species caught in the Gulf of Mexico. Gray lines represent when spawning is occurring and black lines represent peak spawning (NMFS 2002).

Shallow water fishery

Red grouper

Red grouper are found exclusively in the western Atlantic, and range from Massachusetts to southern Brazil (Richardson and Gold 1997), including the Gulf of Mexico, Caribbean Sea, and around Bermuda (Froese and Pauly 2003). They are most abundant along the West Florida Shelf and the north coast of the Yucatan Peninsula, Mexico (Smith 1961; Richardson and Gold 1997). They are found mainly over rocky or muddy bottoms and coral reefs, and usually rest on or near the bottom (Seijo G. 1986; Richardson and Gold 1997; Koenig, Chapman et al. 1999; FishBase 2002; Froese and Pauly 2003).

Red grouper are protogynous (Coleman, Koenig et al. 1996; Brule, Deniel et al. 1999; Koenig, Chapman et al. 1999; NMFS 1999) and spend their first 4-5 years nearshore. After reaching sexual maturity, they migrate offshore into deeper water (Moe 1969; NMFS 1999). The red grouper stock exhibits a female-biased sex ratio that has changed little over the past 25-30 years (Coleman, Koenig et al. 1996). Red grouper tend to be sedentary (Gold and Richardson 1998), and tagged specimens are usually found around the same locations (Marrufo, Brule et al. 1998; NMFS 1999).

Red grouper are primarily harvested along the West Florida Shelf (NMFS 2002), but are also taken in the South Atlantic. They recruit to the fishery by 5-7 years of age and become rare by age 12 (Lombardi-Carlson, Fitzhugh et al. 2002). Maximum age for the species is thought to be 18 years (Burgos, Harris et al. 2000).

Red grouper spawn multiple times per year (Moe 1969; Coleman, Koenig et al. 1996; NMFS 1999), in waters deeper than 25 meters (Coleman, Koenig et al. 1996). Annual fecundity ranges from 631,400 to 17,141,170 eggs per female individual (Figure 6) (Collins, Fitzhugh et al. 2002).

There are conflicting reports whether red grouper aggregate to spawn. According to Coleman et al. (Coleman, Koenig et al. 1996), red grouper are one of the few grouper species that do not aggregate to spawn. However, Arreguín-Sánchez et al. (Arreguin-Sanchez and Pitcher 1999) argue that red grouper do aggregate to spawn, and they point out this behavior is a key aspect for management of this resource. It is unclear which of these statements is most accurate.

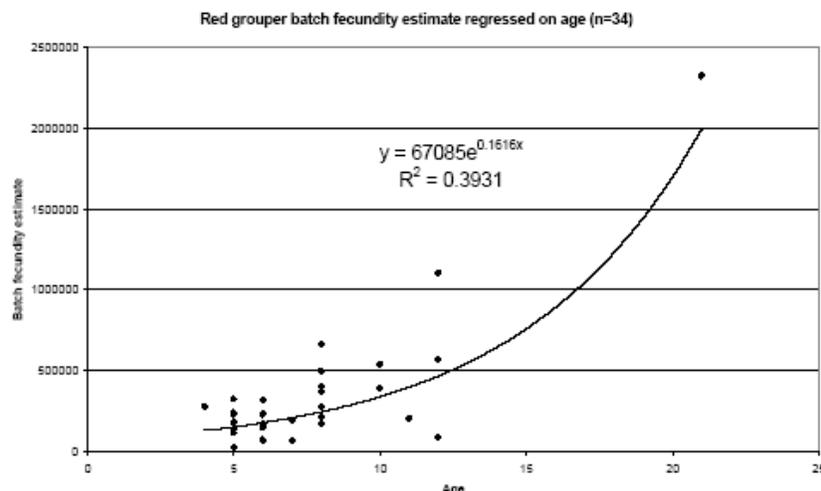


Figure 6. Red grouper batch fecundity estimate as a function of age (n=34) Figure courtesy of NMFS (Collins, Fitzhugh et al. 2002).

Gag

Gag are found in the western Atlantic, ranging from North Carolina to the Yucatan Peninsula, and throughout the Gulf of Mexico. Juveniles are sometimes found as far north as Massachusetts (Heemstra and Randall 1993; Froese and Pauly 2003). Gag live at depths of 40-152 m (Heemstra and Randall 1993; Froese and Pauly 2003) and prefer inshore-reef and shelf-break habitats (Hood and Schlieder 1992). Gag move from shallow water to deeper water reefs to spawn and show a gradual shift toward deeper water with increased age (NMFS 2002).

Gag have a minimum population doubling time of 4.5 years (Heemstra and Randall 1993) and can live for at least 26 years (Harris and Collins 2000). They are protogynous and all individuals examined in the South Atlantic smaller than 87.5 cm TL were females, while almost all fish greater than 120 cm TL were males (McGovern, Wyanski et al. 1998). Gag reach maturity in as little as 2 years; 50% of a spawned stock will be mature at 3 years of age, and 100% will be mature at 5-7 years of age (Harris and Collins 2000, Hood and Schlieder (Hood and Schlieder 1992).

Off the Southeastern United States, gag spawn from December through May, exhibiting a peak spawning period during February and March in the Gulf of Mexico (Coleman and Koenig) and during March and April in the South Atlantic (McGovern, Wyanski et al. 1998). Gag appear to form loose spawning aggregations of 10s to 100s of individuals (Coleman, Koenig et al. 1996). Annual fecundity ranges from 60,000 to 1,700,000 eggs per female individual (Collins, Fitzhugh et al. 2002).

Black grouper

Little is known about the life history characteristics of black grouper. In a study conducted off the coast of Florida, Crabtree and Bullock (Crabtree and Bullock 1998) found that 50 percent of female black grouper 84 cm TL in length were mature. Another study showed that adult black grouper range from near-shore shallow waters to depths of 150 m and are associated with wrecks

and rocky coral reefs (GMFMC 1999). Age at sexual maturity is thought to be five years and maximum age is thought to be 30 years for black grouper (GMFMC 1999).

Deep water complex

Snowy grouper

Snowy grouper are found in the eastern Pacific and western Atlantic. In the Atlantic, the species ranges from Massachusetts to southeastern Brazil, including the northern Gulf of Mexico (Robins and Ray 1986). They are found at depths of 30-525 meters (NMFS 2002). Adults inhabit offshore rocky bottom habitats (NMFS 2002) and juveniles are often observed inshore (Heemstra and Randall 1993; Froese and Pauly 2003).

Snowy grouper have a minimum population doubling time of 4.5 years (Heemstra and Randall 1993; Froese and Pauly 2003). They are protogynous, and females typically change sex by age 8 (Wyanski et al. (Wyanski, White et al. 2000). Size and age at 50% maturity for females are around 54.1 cm TL and 5 years, respectively (Wyanski et al 2000). Snowy grouper can reach sizes as great as 122 cm TL and 30 kg, and lives up to 27 years (Heemstra and Randall 1993; Froese and Pauly 2003). Information is lacking on fecundity in snowy grouper.

Yellowedge grouper

Yellowedge grouper are found in the western Atlantic, ranging from North Carolina to southern Brazil, including the Gulf of Mexico (NMFS 2002). A solitary, demersal, deep-water species, yellowedge grouper inhabit rocky areas and sandy mud bottoms at depths ranging from 64-275 m (NMFS 2002). On soft bottom habitats, this fish is often seen in or near trenches or burrow-like excavations usually associated with tilefish (Heemstra and Randall 1993; Froese and Pauly 2003).

Yellowedge grouper are protogynous (Bollock, Godcharles et al. 1996) and have a minimum population doubling time of 4.5 years (Heemstra and Randall 1993; Froese and Pauly 2003). The estimated size and age at maturity is 51 cm TL and 6 years, respectively (Froese and Pauly 2003). The maximum reported age for yellowedge grouper is 32 years (Heemstra and Randall 1993; Froese and Pauly 2003). Information is lacking on fecundity in yellowedge grouper.

Warsaw grouper

Warsaw grouper are found in the western Atlantic, ranging from Massachusetts to southeastern Brazil (Robins and Ray 1986), and in the Gulf of Mexico (NMFS 2002). They are a solitary species (Heemstra and Randall 1993; Froese and Pauly 2003), usually found on rocky ledges and seamounts (Robins and Ray 1986), at depths from 55-525 m (Heemstra and Randall 1993; Froese and Pauly 2003). Juveniles are sometimes observed in inshore waters (Robins and Ray 1986) on jetties and shallow reefs (Heemstra and Randall 1993; Froese and Pauly 2003).

Warsaw grouper have a minimum population doubling time of 4.5 years (Heemstra and Randall 1993; Froese and Pauly 2003). Maximum reported size for warsaw grouper is 230 cm TL (Heemstra and Randall 1993; Froese and Pauly 2003) and 263 kg (Robins and Ray 1986). Age at sexual maturity is nine years and warsaw grouper can reach a maximum age of 41 years (Brule, Deniel et al. 1999). Information is lacking on fecundity in warsaw grouper.

Table 1. Life history parameters for commercially important grouper species in the southeastern U.S.

Species Name	Species Range	Intrinsic Rate of Increase (r)	Age at Sexual Maturity (years)	Longevity (years)	Special Behaviors	Fecundity	Source
Red grouper <i>Epinephelus morio</i>	Western Atlantic, Gulf of Mexico, Caribbean, Bermuda	Unknown	5-7	12-14	Protogyny, sedentary	631,400 to 17,141,170 eggs	(Moe 1969; Collins, Fitzhugh et al. 2002; Lombardi-Carlson, Fitzhugh et al. 2002)
Gag <i>Micropoperca microlepis</i>	Western Atlantic, Gulf of Mexico	Unknown	2-7	26	Protogyny, aggregate to spawn	60,000 to 1,700,000 eggs	Collins et al. 1998; (Koenig, Chapman et al. 1999; NMFS 2003); SEDAR 2006b (NMFS 2003)
Yellowedge grouper <i>Epinephelus flavolimbatus</i>	Western Atlantic, Gulf of Mexico	Unknown	6	32	Protogyny, sedentary, aggregate to spawn	Unknown	(NMFS 2003)
Black grouper <i>Mycteroperca bonaci</i>	Western Atlantic, Gulf of Mexico	Unknown	5	30	Protogyny, sedentary, aggregate to spawn	Unknown	(Crabtree and Bullock 1998)
Snowy grouper <i>Epinephelus niveatus</i>	Eastern Pacific, Western Atlantic, Gulf of Mexico	Unknown	5	27	Protogyny, sedentary, aggregate to spawn	Unknown	(NMFS 2003)
Warsaw grouper <i>Epinephelus nigritus</i>	Western Atlantic, Gulf of Mexico	Unknown	9	41	Protogyny, sedentary, aggregate to spawn	Unknown	(Parker and Mays 1998; NMFS 2003)

Synthesis

Grouper are thought to be prolific spawners, though little information on fecundity is available for most species. They tend to be long-lived, have a long population doubling time, are protogynous, sedentary, and aggregate to spawn. All of these characteristics make grouper species in the southeastern U.S. region highly vulnerable to fishing pressure.

Inherent Vulnerability Rank:

Resilient Moderately Vulnerable **Highly Vulnerable** 

Criterion 2: Status of Wild Stocks

Twelve grouper stocks are landed commercially and listed in the 2010 NOAA Fisheries Second Quarter Report to Congress (Table 2) (NMFS 2003). In 2007, 85% (3,308 mt) of commercial grouper landings were from the Gulf of Mexico, while 15% (578 mt) were from the Atlantic (NMFS 2008c).

Shallow water complex

Red grouper

The red grouper is the dominant species landed in the shallow water grouper fishery and is managed as two separate stocks, one from the Gulf of Mexico and one from the Atlantic coast. In 2008, almost 90% of commercial landings came from the Gulf of Mexico, and most of that from the West Florida Shelf (NMFS 2003a; NMFS 2009a). Landings from the Atlantic, which account for approximately 10% of commercial landings, are caught mainly off Florida's east coast, North Carolina, and the northern part of South Carolina (Figure 7) (NMFS 2009a; SEDAR 2010a). While red grouper supports the bulk of the grouper harvest in the U.S., it received little attention in the form of research or management prior to 1991 (Goodyear and Schirripa 1991; Goodyear and Schirripa 1993; Goodyear and Schirripa 1999).

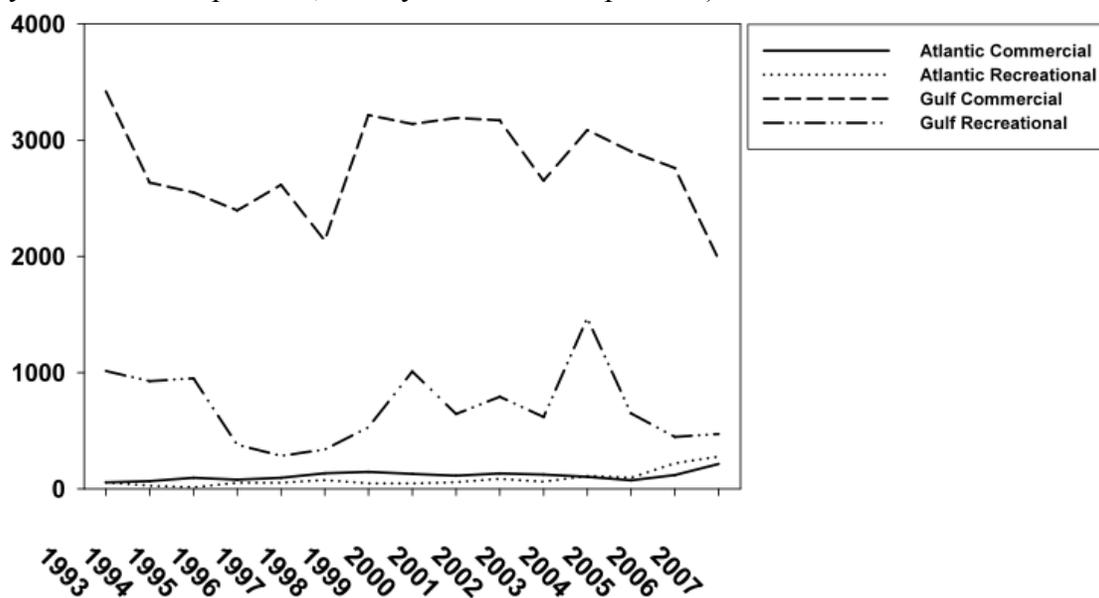


Figure 7. Red grouper landings for commercial and recreational fisheries by region and year (Figure from NMFS 2008c).

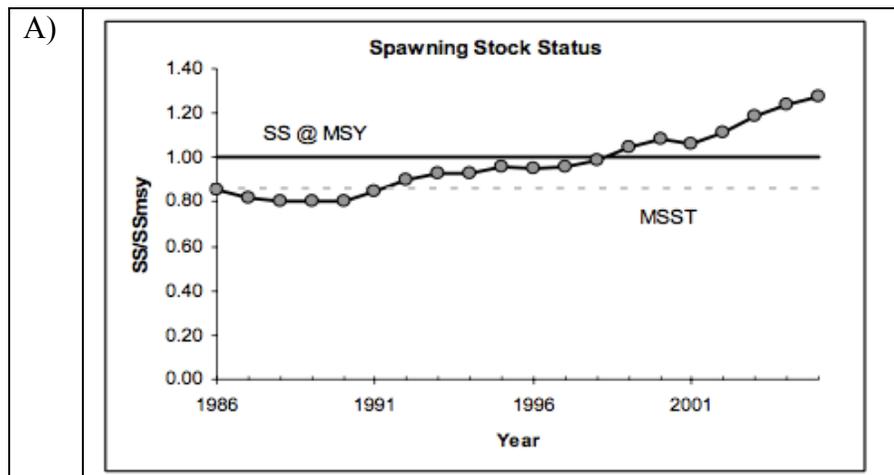
Gulf of Mexico Red Grouper Stock

Throughout the 1990s, it was believed that the Gulf of Mexico red grouper stock was overfished, with overfishing occurring. However, due to lack of information regarding age and growth, fecundity, and catch-age allocations, these results were continually questioned by the review panel in subsequent years. In 2002, new life history information became available, and the stock status was re-assessed. The assessment team found that the stock was showing signs of recovery and was no longer overfished. This biomass increase was attributed to recent improvements in recruitment success (SEDAR 2007).

The Gulf of Mexico red grouper stock status was again re-evaluated in 2006 (SEDAR 2007). This assessment was considered a large improvement over previous assessments due to the availability of longer time-series catch indices, direct age composition data, and more accurate estimates of natural mortality levels (SEDAR 2007).

The 2006 assessment used SPR proxies such as spawning stock reproductive potential (SS), which measures the stock's potential quantity of eggs per spawning event (mt of female gonads) (NMFS 2002b; SEDAR 2007), as well as acceptable biological reference points, such as B_{MSY} and F_{MSY} . B/B_{MSY} for red grouper in the Gulf of Mexico was estimated at 1.27, and SS was estimated at 752 mt of female gonads, which is 7% above spawning stock at optimum yield (SS_{OY}). The spawning stock reproductive potential appears to be increasing, when compared to the previous stock assessment (SEDAR 2007). Relative fishing mortality (F_{2005}/F_{MSY}) for red grouper in the Gulf of Mexico was estimated at 0.73, also a lower value than observed in previous years (SEDAR 2007) (Figure 8). These results suggest that the stock is not overfished, and overfishing is not occurring.

The assessment also concluded that the stock has not been overfished since 1992, conflicting with the questionable results of the late 1990s. According to the 2006 assessment, in 1992, the spawning stock exceeded the maximum spawning stock threshold (MSST), which is defined as $(1-M)*B_{MSY}$, where M is the natural mortality rate. Furthermore, the stock was recovered as of 1997, when the spawning stock exceeded the maximum sustainable yield (MSY) (Figure 8) (SEDAR 2007). Both long and short-term trends in spawning stock biomass are increasing. These results led NMFS to declare the stock as rebuilt (NMFS 2009). In addition, research shows that the stock consists of a wide age distribution, with an increasing number of adults and continued recruitment (SEDAR 2007), although sex and size distributions are unknown.



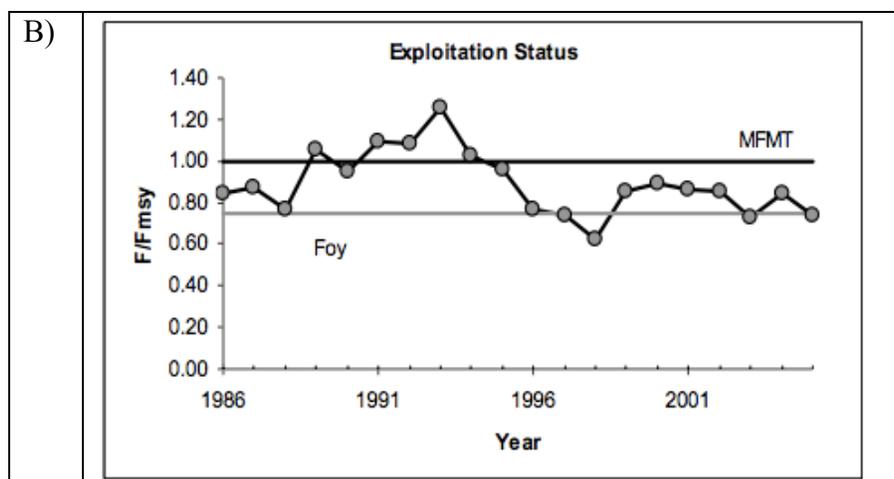


Figure 8. Gulf of Mexico red grouper stock and fishery status (1986-2005) A) Spawning stock biomass relative to the minimum stock size threshold (MSST) and MSY, B) Exploitation rate relative to F_{oy} and MFMT (F_{MSY}) (Figure from SEDAR 2007)

The Gulf of Mexico red grouper stock is considered healthy because the stock is above B_{MSY} , overfishing is not occurring, and the stock uncertainty is not high.

Red grouper are caught together with both black grouper and gag, and gag in the Gulf of Mexico have a critical stock status (see “*Gulf of Mexico Gag Grouper Stock*,” below). However, the Gulf of Mexico Fisheries Management Council has recently limited gag catch to very low levels in order to prevent directed fishing, while allowing for the landing of small amounts of gag caught incidentally in the fishery targeting red and black grouper (see “Criterion 5: Effectiveness of the Management Regime”). As such, the conservation impact of gag catch in the Gulf of Mexico fishery for both red and black grouper is evaluated under “Criterion 3: Nature and Extent of Bycatch,” and the stocks of these species are evaluated separately. Therefore, the Gulf of Mexico red grouper stock is considered a low conservation concern.

South Atlantic Red Grouper Stock

Prior to 2010, there had been no formal stock assessment conducted for South Atlantic red grouper. However, in 2000, NMFS declared the Atlantic red grouper overfished, with overfishing occurring based on declining CPUE trends (SEDAR 2010a).

A complete stock assessment for the Atlantic red grouper was conducted in April 2010. This assessment used widely accepted reference points for the stock and fishing status, including spawning stock biomass (SSB), the minimum stock size threshold (MSST), and fishing mortality (F). The MSST value is defined as $(1-M) \cdot B_{MSY}$, where M is the natural mortality rate. Based on the assessment results, the stock is not overfished if the SSB exceeds MSST, the stock is recovered if SSB exceeds SSB_{MSY} , and overfishing is not occurring if current fishing mortality is less than F_{MSY} (SEDAR 2010a).

The 2010 Atlantic red grouper assessment determined that the stock is overfished ($SSB_{2008}/MSST = 0.79$) and overfishing is occurring ($F_{2008}/F_{MSY} = 1.46$) (Table 2) (Figure 9, Figure 10). Sensitivity analyses suggest that the stock status results contain some uncertainty (SEDAR 2010a). Projections of future stock were also included in the stock assessment. It was

predicted that in a scenario with no fishing ($F=0$), there is a 50% chance that the stock could be fully rebuilt by 2028 (SEDAR 2010a). The South Atlantic Fishery Management Council has two years from the date grouper was declared overfished (June 2010) to develop a rebuilding plan (NOAA 2010).

Table 2. Estimated status indicators, benchmarks, and related quantities from the Beaufort catch-age model, conditional on estimated current selectivities averaged across fisheries. Precision is represented by standard errors (SE) approximated from Monte Carlo/Bootstrap analysis. Estimates of yield do not include discards; D_{MSY} represents discard mortalities expected when fishing at F_{MSY} . Rate estimates (F) are in units of y^{-1} ; status indicators are dimensionless; and biomass estimates are in units of metric tons or pounds, as indicated. Symbols, abbreviations, and acronyms are listed in Appendix A (Table from SEDAR 2010a).

Quantity	Units	Estimate	SE
F_{MSY}	y^{-1}	0.212	0.027
$85\%F_{MSY}$	y^{-1}	0.180	0.023
$75\%F_{MSY}$	y^{-1}	0.159	0.020
$65\%F_{MSY}$	y^{-1}	0.138	0.018
$F_{30\%}$	y^{-1}	0.178	0.024
$F_{40\%}$	y^{-1}	0.121	0.016
$F_{50\%}$	y^{-1}	0.084	0.011
B_{MSY}	mt	3622	530
SSB_{MSY}	mt	2545	488
MSST	mt	2189	459
MSY	1000 lb	1117	86
D_{MSY}	1000 fish	26	7
R_{MSY}	1000 age-1 fish	406	50
Y at $85\%F_{MSY}$	1000 lb	1110	85
Y at $75\%F_{MSY}$	1000 lb	1095	83
Y at $65\%F_{MSY}$	1000 lb	1069	81
F_{2008}/F_{MSY}	—	1.46	0.27
$SSB_{2008}/MSST$	—	0.79	0.22

A look at historical trends in the Atlantic red grouper suggests that the long and short-term trends in spawning stock and overall biomass are fluctuating (Figure 9). The increase in biomass between the early 1990s and the mid-2000s corresponds with an overall decrease in fishing pressure due to more stringent fishing regulations implemented in 1992. In recent years however, there has been an increase in fishing pressure, which is attributed to new regulations on other species in the region, and biomass has begun declining. It is also important to note that a majority of landings occur in the recreational sector, and thus the recreational fishery has a large impact on the overall health of the stock (Figure 10) (SEDAR 2010a).

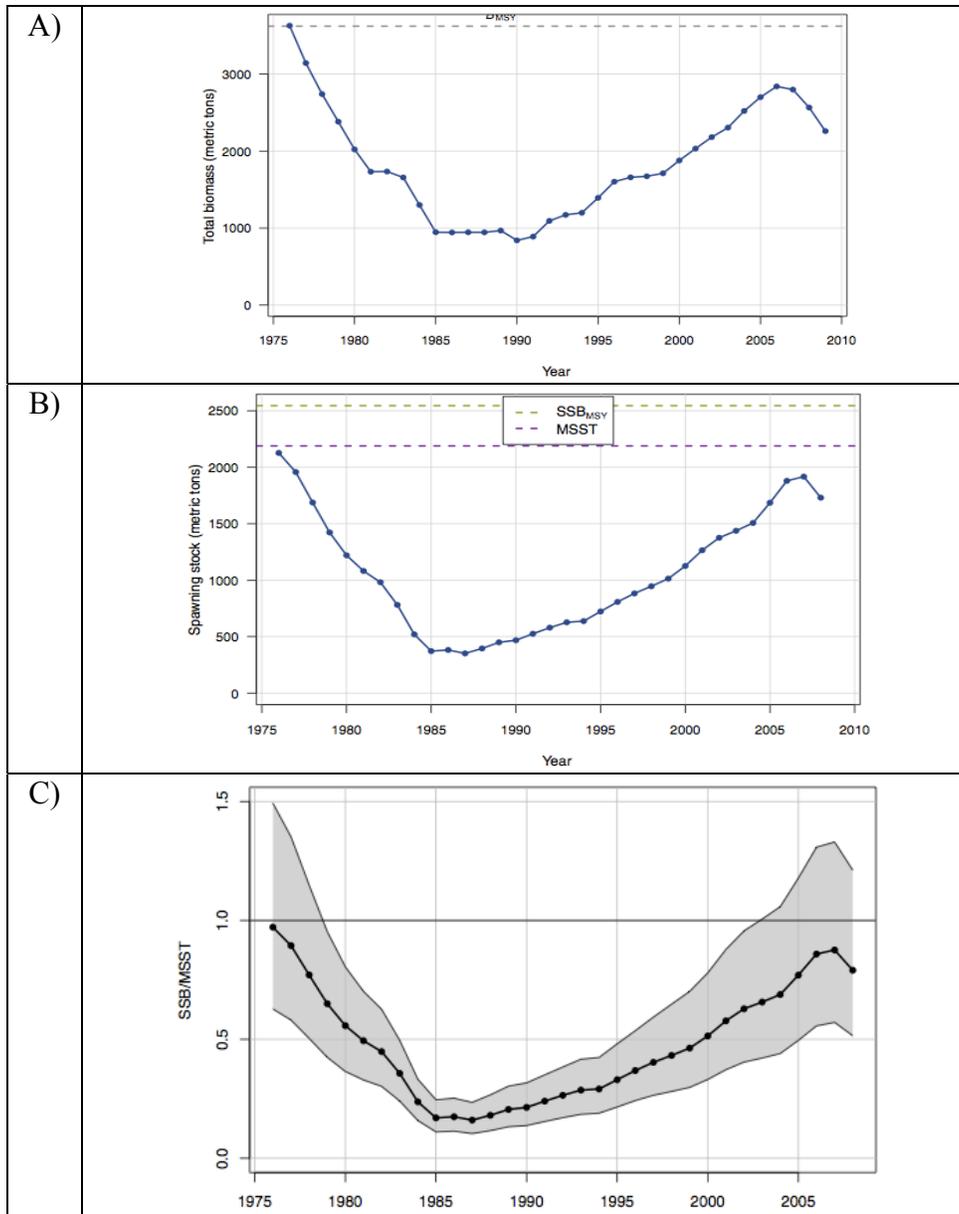
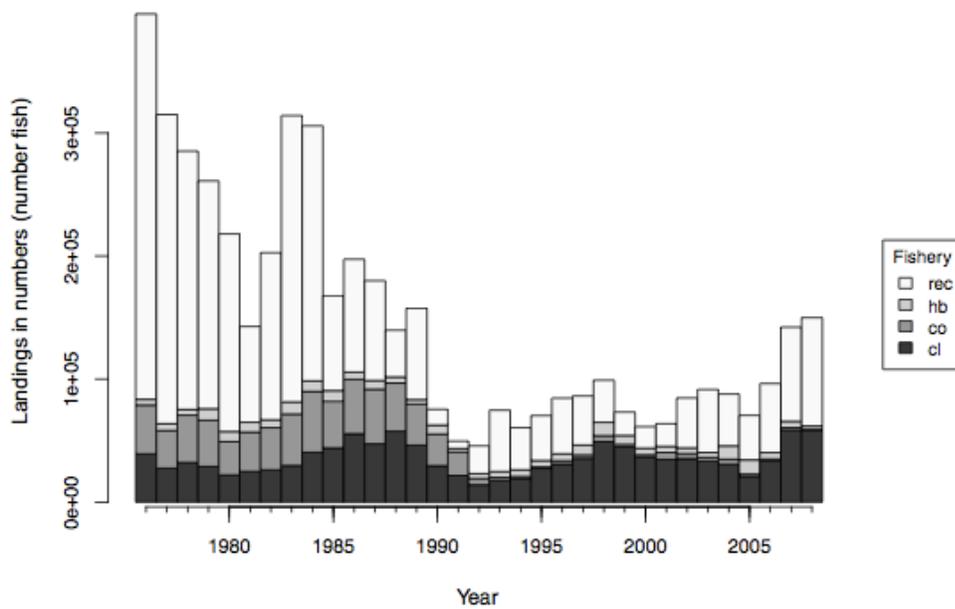


Figure 9. Atlantic red grouper stock status (1976-present) A) Estimated total biomass, dashed line represents B_{MSY} ; B) Estimated spawning (mature) biomass at time of peak spawning; C) Spawning stock biomass relative to the minimum stock size threshold (MSST). Gray error bands indicate 5th and 95th percentiles (Figure from SEDAR 2010a)

A)



B)

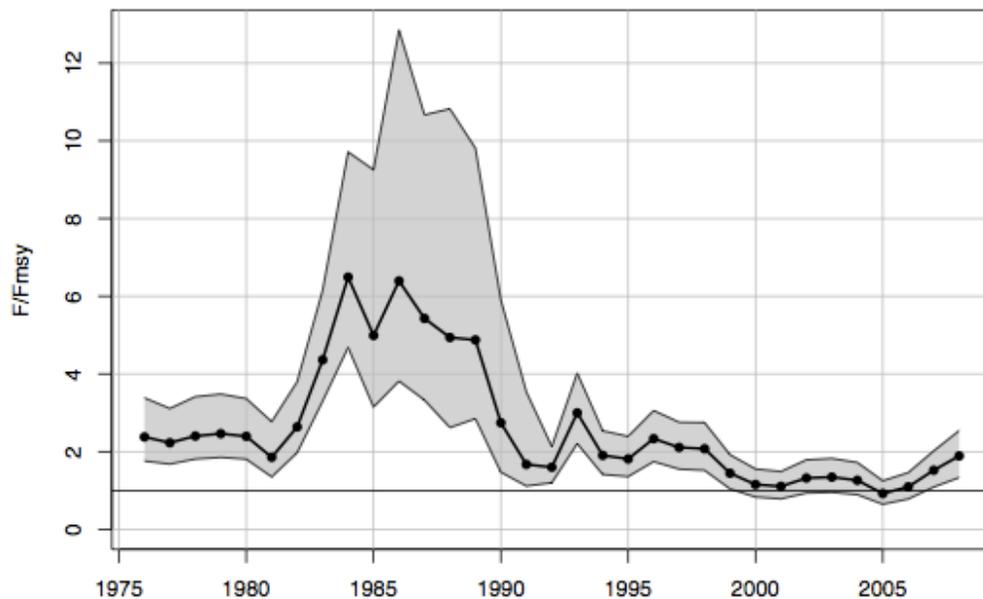


Figure 10. Atlantic red grouper fishery status A) Estimated landings by fishery (cl=commercial lines, co=commercial other, hb=headboat, rec=general recreational) B) Fishing mortality relative to F_{MSY} (horizontal line). Gray error bands indicate 5th and 95th percentiles (Figure from SEDAR 2010a)

Age distribution parameters also appear to be skewed. Abundance of older fish have decreased relative to natural conditions, and older fish are predominately male. Because the species is protogynous, it is unclear whether this male to female sex ratio is normal or skewed (SEDAR 2007). Size distribution is unknown.

Seafood Watch® considers the South Atlantic red grouper stock to be a critical conservation concern because the stock is overfished and overfishing is occurring.

Gag Grouper

Historically, gag has been the second most dominant species in the shallow-water grouper fishery (NMFS 2002). In most years, between 60-85% of commercial landings of gag are caught in the Gulf of Mexico (mean₁₉₉₃₋₂₀₀₇ = 74%), primarily off the West Florida Shelf, compared to that caught in the Atlantic off Florida's east coast (Figure 11) (NMFS 2008c).

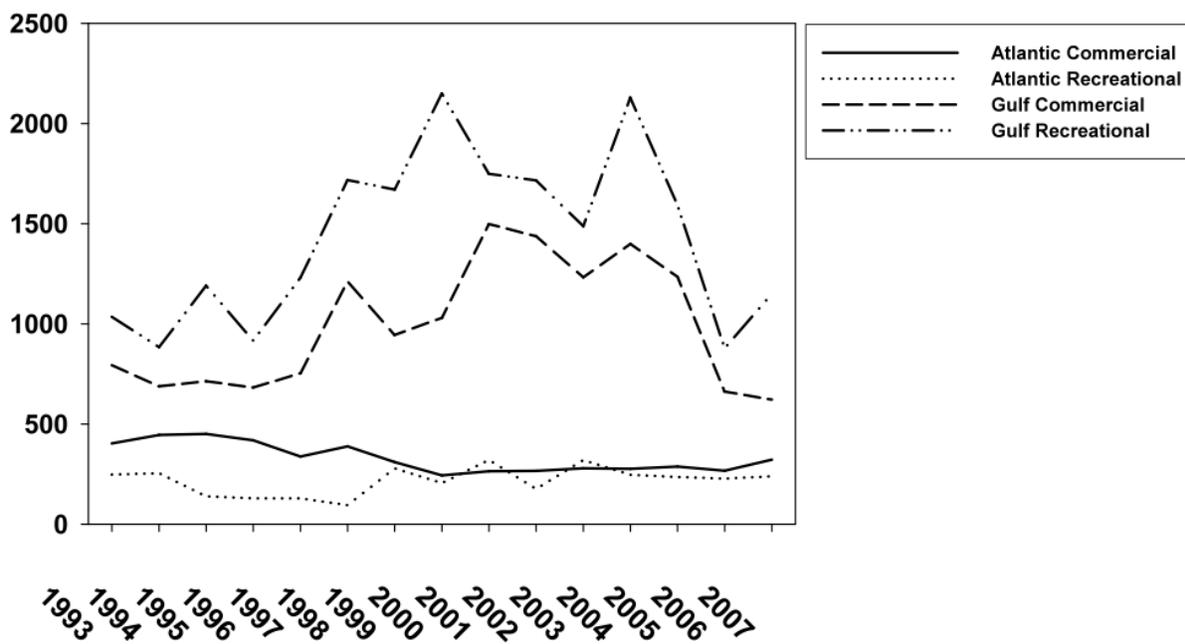


Figure 11. Gag landings for commercial and recreational fisheries by region and year (Figure from NMFS 2008c).

Atlantic Gag Grouper Stock

In 2010, NOAA Fisheries' Second Quarter Report to Congress (NMFS 2010) reported that the Atlantic stock of gag grouper is not overfished ($B/B_{MSY} = 0.94$) but overfishing is occurring ($F_{2004}/F_{MSY} = 1.3$) (SEDAR 2006a). While the stock is not currently overfished, it has been overfished in the past, particularly in the 1980s. Furthermore, the most recent stock assessment conducted in 2006 indicates that with the current level of fishing, the stock is most likely approaching an overfished condition. The long-term trend in Atlantic gag grouper biomass is down, while the short-term trend appears to be variable (Figure 12) (SEDAR 2006a). The assessment also reports that size at maturity seems to have slightly decreased relative to previous reports, and the sex ratio of males to females has drastically decreased. This could potentially result in failed recruitment due to lack of adequate sperm supply (SEDAR 2006a).

Seafood Watch® would normally consider the Atlantic gag grouper stock to be poor because while the stock is not overfished, it is likely approaching an overfished condition, overfishing is occurring, and distribution parameters are skewed. However, Atlantic gag grouper, Atlantic black grouper, and Atlantic red grouper are all caught together in a multispecies fishery and managed together under a single quota. A large proportion of the catch of this complex (the Atlantic shallow-water grouper complex) is made up of Atlantic red grouper, which has a critical stock status (see "Atlantic Red Grouper Stock" above). As such, any gag or black grouper caught in this fishery were most likely caught and targeted together with red grouper, and the fisheries landing black grouper and gag add to the unsustainable fishing pressure on red grouper.

Therefore, Seafood Watch® assesses these three stocks in aggregate, and considers the stock status of Atlantic gag grouper to be a critical conservation concern as well.

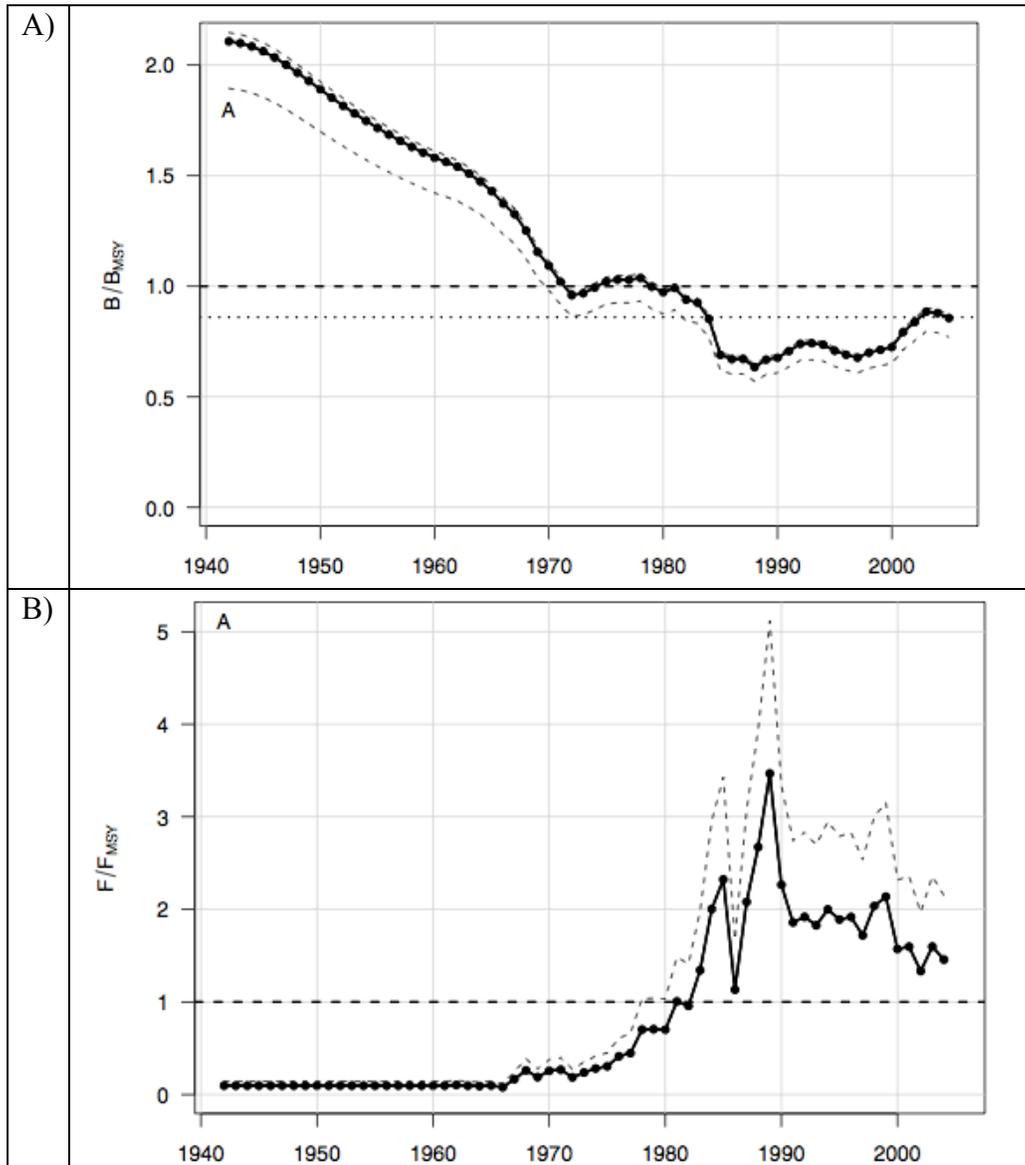


Figure 12. Atlantic gag grouper stock and fishery status (1942-2005) A) Estimated biomass relative to B_{MSY} ; B) Fishing mortality rate relative to F_{MSY} (Figure from SEDAR 2006a).

Gulf of Mexico Gag Grouper Stock

For the Gulf of Mexico gag grouper stock, the stock status was unknown until 2009, when the most recent stock assessment was conducted. In the past, the status of the gag stock has been a topic of substantial debate in the Gulf Council and in the scientific community (Aparicio, Horn et al. 1999; Koenig, Chapman et al. 1999; Lessard 1999; Maumus F. Claverie and Jernigan 1999; Kenchington 2001; Coleman, Koenig et al. 2002; Collins, Fitzhugh et al. 2002). Different analyses have resulted in a wide range of fishing-mortality rates and associated abundances (NMFS 2002), and therefore different classifications of stock status. In the 2001 stock

assessment Turner et al. (2001) concluded that estimated spawning-stock size was below the minimum stock size threshold (MSST). They also showed that recruitment levels estimated for the mid- to late-1990s were unusual, and harvest rates occurring before 2001 were unsustainable. The 2004 stock assessment results were consistent with the 2001 conclusion that overfishing was occurring.

Fishing mortality rates for Gulf of Mexico gag grouper have generally increased since the 1960s, and have increased every year since 2000 (Figure 13). The most recent 2009 stock assessment estimated the fishing mortality rate to be extremely high ($F_{2007}/F_{MSY}=2.20-2.47$), indicating that the Gulf of Mexico gag grouper is experiencing overfishing (SEDAR 2009). The stock assessment also suggests that the stock is overfished, with the spawning stock biomass less than half of the minimum stock size threshold ($SSB_{2008}/MSST = 0.47-0.54$) (Figure 14). Here, the MSST value is defined as $(1-M)*SSB_{MAX}$, where M is the natural mortality rate and SSB_{MAX} is the equilibrium spawning stock at the F_{MSY} , also referred to as F_{MAX} (SEDAR 2009). Trends in size, sex, and age distribution parameters are unknown.

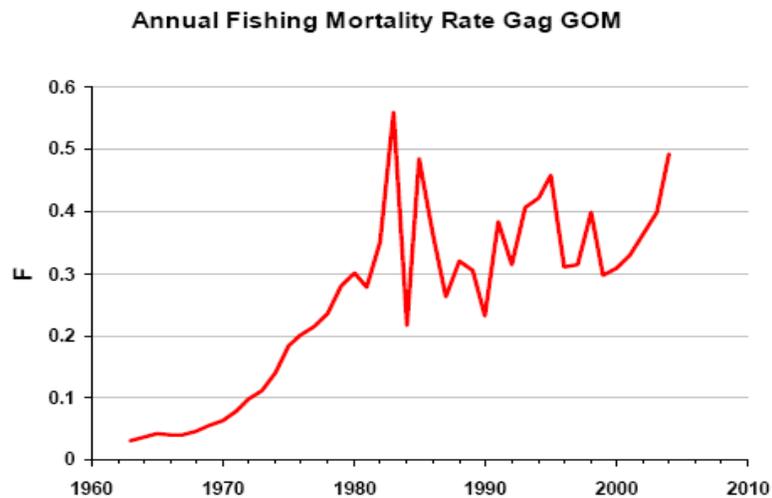


Figure 13. Estimated annual fishing mortality rate on Gulf of Mexico gag (Figure from SEDAR 2006b).

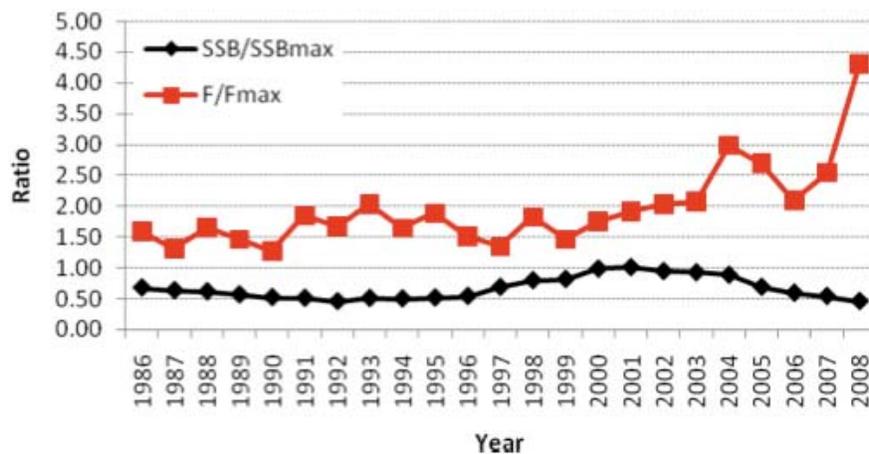


Figure 14. Gulf of Mexico gag grouper stock and fishery status. $F_{MAX} = F_{MSY}$ (SEDAR 2009).

While fishing pressure for Gulf of Mexico gag grouper has generally increased over time, the long and short-term trends in biomass are variable (SEDAR 2009). Estimated spawning stock biomass declined in the 1960's and 1970's, remained stable through the 1980s and early 1990s, then increased from 1997 to 2001. Since 2001, spawning stock and total biomass have declined to levels seen in the 1980s (Figure 15) (SEDAR 2006b).

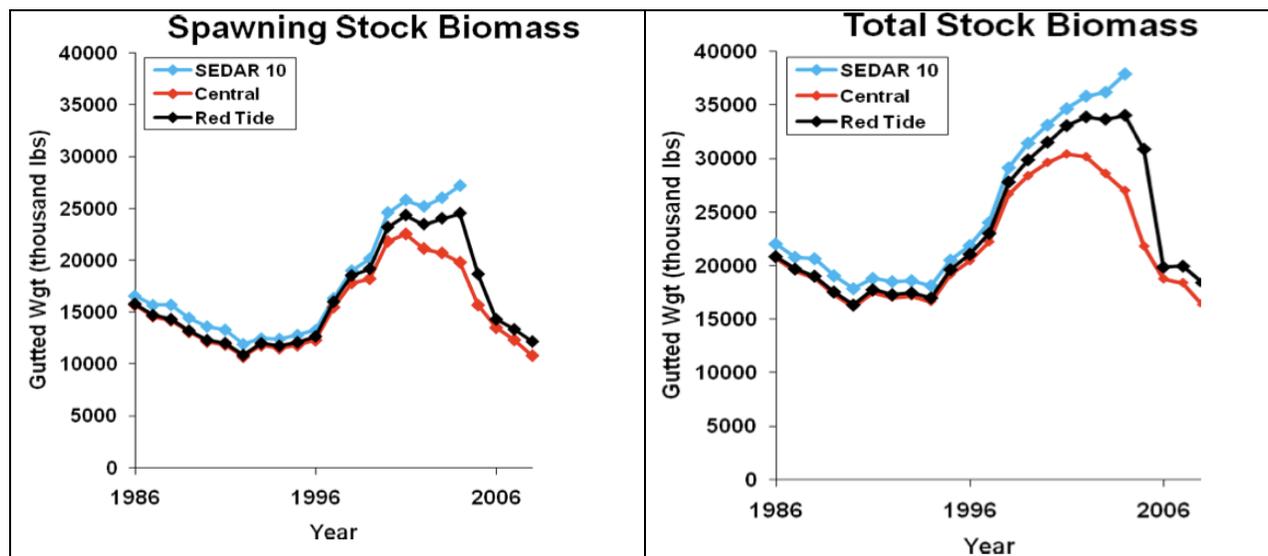


Figure 15. Estimated biomass of Gulf of Mexico gag grouper spawning stock biomass (SSB, mature female) and total biomass in gutted weight. The blue line represents results from the previous 2004 stock assessment; the red (central) line represents the results from the primary model used in the 2009 stock assessment; the black (red tide) line represents results from the secondary model which assumed natural mortality peaks in red tide years (Figure from SEDAR 2006b).

Seafood Watch® considers the Gulf of Mexico gag grouper stock to be a critical conservation concern because the stock is overfished and overfishing is occurring.

Black grouper

The first formal stock assessment for black grouper was conducted in 2010. Black grouper, found in the shallow-water grouper fishery, are predominately caught in the Gulf of Mexico (Figure 16) south of 25° N. latitude (Florida Keys). They are also occasionally caught further north, as far as the Florida Panhandle, and found at depths of 37 to 100 meters (Crabtree and Bullock 1998).

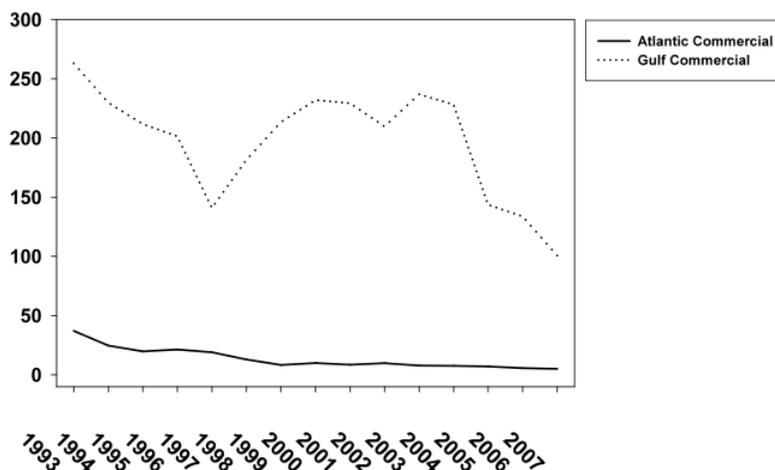


Figure 16. Black grouper landings for commercial fisheries by region and year (Figure from NMFS 2008c).

Traditionally, black groupers have been managed as two separate stocks, one from the South Atlantic and the other from the Gulf of Mexico. However, the 2010 Stock Assessment Committee determined it is more appropriate to evaluate the two groups as a single stock, particularly since a majority of landings occur in the Florida Keys, right near the boundary that traditionally separates the Atlantic and Gulf of Mexico groups. In addition, Zatcoff (2001) conducted genetic studies on black groupers and found that black grouper from the Florida Keys are genetically identical to black grouper found elsewhere in the Gulf of Mexico. Therefore, a single stock assessment was conducted for both groups.

Up until the recent 2010 stock assessment, it was assumed that overfishing was occurring in the Atlantic, and the status of both groups was uncertain (NMFS 2008b). The 2010 model incorporated life history information with both fishery-dependent and independent data to form a robust prediction of stock status and fishing mortality rates. This assessment determined that the stock is in fact not overfished ($SSB_{2008}/SSB_{MSY}=1.40$), nor is overfishing occurring ($F_{2008}/F_{MSY}=0.50$) (SEDAR 2010b). These results were widely accepted by the review panel (SEDAR 2010b).

The historical trend of the black grouper stock is only known from 1986 onward, as the species was not separated statistically from other groupers until 1986. From 1986 to 1991, biomass was stable at around 8.7 million pounds. Throughout the 1990s and 2000s, biomass continued to increase, peaking at 17 million pounds in 2008. Likewise, recruitment has increased over time, peaking in 2008 (Figure 18) (SEDAR 2010b). Trends in sex, size, and age distribution parameters are unknown, although there seems to be a healthy proportion of adults, as seen in Figure 17.

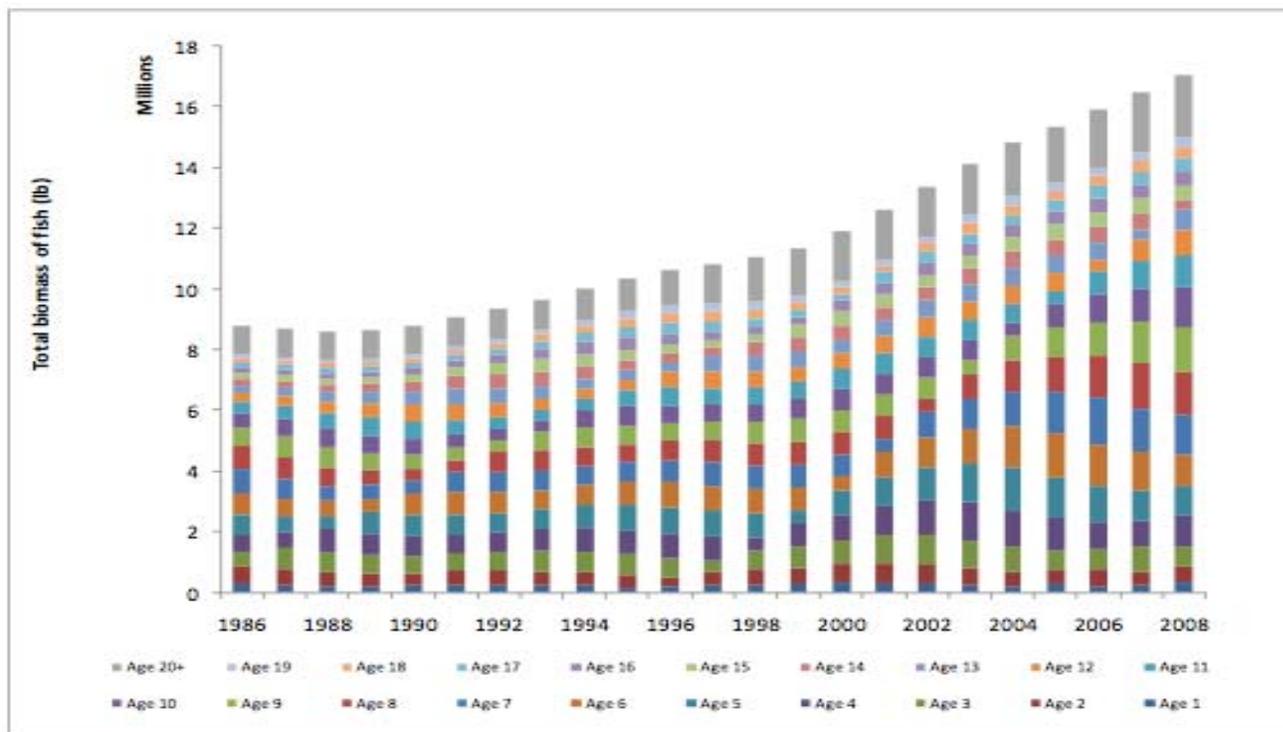


Figure 17. Total black grouper biomass by age (1986-2008) (Figure from SEDAR 2010b).

Although the stock status of the black grouper appears to be healthy, a moderate degree of uncertainty in the stock status exists. First, there is no accurate information regarding the life history and distribution of young juvenile black grouper. Second, the stock assessment incorporated limited fishery independent data that failed to cover the entire geographic range of the species. Finally, information on fecundity and location of spawning aggregations and movements is very poor. A final point of concern, is that the gag grouper, a critical conservation concern, looks very similar to the black grouper and is often landed in black grouper fisheries (SEDAR 2010b).

Seafood Watch® would normally consider the Gulf of Mexico and Atlantic black grouper stocks to be healthy because the stock is not overfished, overfishing is occurring, and uncertainty is not high. However, Atlantic gag grouper, Atlantic black grouper, and Atlantic red grouper are all caught together in a multispecies fishery and managed together under a single quota. A large proportion of the catch of this complex (the Atlantic shallow-water grouper complex) is made up of Atlantic red grouper, which has a critical stock status (see “*Atlantic Red Grouper Stock*” above). As such, any gag or black grouper caught in this fishery were most likely caught and targeted together with red grouper, and the fisheries landing black grouper and gag add to the unsustainable fishing pressure on red grouper. Therefore, Seafood Watch® assesses these three stocks in aggregate, and considers the stock status of Atlantic black grouper to be a critical conservation concern as well.

Black grouper, red grouper, and gag are also caught together in the Gulf of Mexico, and gag in the Gulf of Mexico have a critical stock status (see “*Gulf of Mexico Gag Grouper Stock*,” above). However, the Gulf of Mexico Fisheries Management Council has recently limited gag catch to

very low levels in order to prevent directed fishing, while allowing for the landing of small amounts of gag caught incidentally in the fishery targeting red and black grouper (see “Criterion 5: Effectiveness of the Management Regime”). As such, the conservation impact of gag catch in the Gulf of Mexico fishery for both red and black grouper is evaluated under “Criterion 3: Nature and Extent of Bycatch,” and the stocks of these species are evaluated separately. Black grouper stock is therefore ranked as a low conservation concern in the Gulf of Mexico.

Deep water fishery

Snowy grouper

Snowy grouper is the dominant species in the deep-water grouper fishery (NMFS 2003d). In recent years, about 51% of commercial landings of snowy grouper were caught in the Atlantic, while 49% were caught in the Gulf of Mexico (Figure 18) (NMFS 2003). In the Atlantic, snowy grouper are caught from North Carolina south to the Florida Keys. In the Gulf of Mexico, snowy grouper are caught primarily off Southwest Florida, near the Florida Keys.

Snowy grouper are listed as Vulnerable according to the IUCN Red List, based on an assessment conducted in 2008 (Thierry et al. 2008). The “Vulnerable” category on the IUCN Red List is a sub-category of “threatened” and is defined as “facing a high risk of extinction in the wild” (IUCN 2001). Seafood Watch® considers any stock that is “listed as a ‘threatened species’ or similar proxy by national or international bodies” to be a critical conservation concern.

According to NOAA Fisheries’ 2010 Second Quarter Report to Congress (NMFS 2010), the South Atlantic stock of snowy grouper is considered overfished ($B/B_{MSY} = 0.18$) with overfishing occurring. The status of the Gulf of Mexico stock is unknown. The only study conducted on the stock status of snowy grouper was in the Atlantic, and shows an SPR ranging from 5% to 15% (Wyanski, White et al. 2000). Long-term and short-term trends in biomass are unknown. However, landings in the Atlantic have exhibited declining long-term and short-term trends, and in the Gulf, landings have exhibited an increasing long-term trend and a stable short-term trend (Figure 18) (NMFS 2008c). Additional studies indicate that the distribution parameters for Atlantic snowy grouper are skewed. Wyanski et al. (2000) studied the Atlantic stock and found that the proportion of males has significantly decreased, with males only comprising 1% of the surveyed population in the 1990s. Authors also found that the mean length of landed fish has decreased from 65 to 80 cm in the early 1980s to 50-60 cm in the mid 1990s (Wyanski et al. 2000). Trends in sex, age, and size distribution for the Gulf of Mexico stock are unknown.

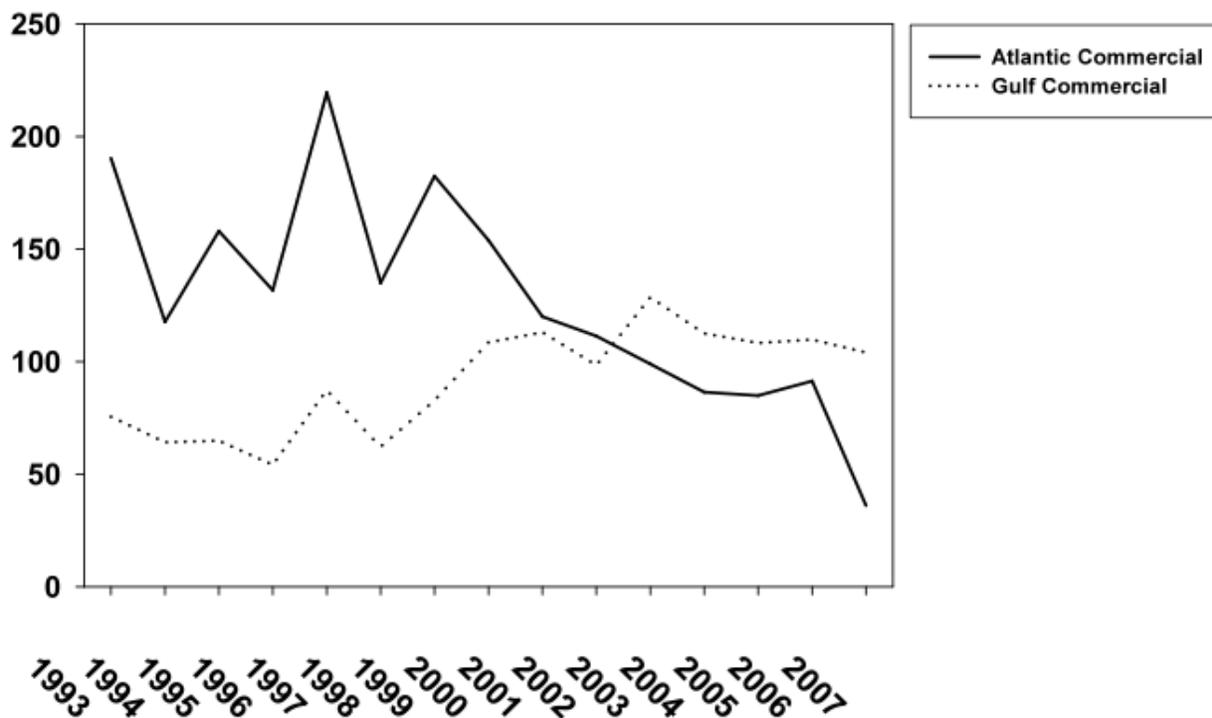


Figure 18. Snowy grouper landings for commercial fisheries by region and year (Figure from NMFS 2008c).

In summary, Seafood Watch® considers both Gulf of Mexico and Atlantic snowy grouper stocks to be a critical conservation concern because the species is listed as Vulnerable according to the IUCN. In addition, the South Atlantic stock is overfished and overfishing is occurring.

Yellowedge grouper

In the U.S., more than 98% of yellowedge grouper are caught in the Gulf of Mexico (Figure 19) (Cass-Calay and Bahnick 2002; NMFS 2003). Landings off the West Florida Shelf account for about 67% of Gulf of Mexico landings, while landings off Louisiana and Texas account for 20% and 10%, respectively. Landings in Mississippi and Alabama account for a combined 1% of the total catch in the Gulf of Mexico (Cass-Calay and Bahnick 2002).

Yellowedge grouper are listed as Vulnerable according to the IUCN Red List, based on an assessment conducted in 2008 (Ferreira and Peres 2008). The “Vulnerable” category on the IUCN Red List is a sub-category of “threatened” and is defined as “facing a high risk of extinction in the wild” (IUCN 2001). Seafood Watch® considers any stock that is “listed as a ‘threatened species’ or similar proxy by national or international bodies” to be a critical conservation concern.

According to NOAA Fisheries’ 2010 Second Quarter Report to Congress (NMFS 2010), yellowedge grouper in the Atlantic are not experiencing overfishing and their overfished status is unknown, while in the Gulf of Mexico, their overfished and overfishing status is unknown.

The single stock assessment that was conducted for yellowedge grouper—covering the Gulf of Mexico stock—was inconclusive relevant to the status of the stock. It analyzed the data in a variety of ways, some of which indicated that the stock was overfished, that overfishing was occurring (Figure 21), and that biomass was low (at approximately 25% of B_{MSY}), while others indicated that the stock was in good condition with current biomass at approximately 160% of B_{MSY} (Cass-Calay and Bahnick 2002; NMFS 2002). All of the models suggested that fishing mortality for yellowedge grouper is low (Cass-Calay and Bahnick 2002; NMFS 2002).

MSY estimates ranged from 230 to 630 mt (NMFS 2002). These values are similar in magnitude to present commercial yield (NMFS 2002). During 1986-2001, average yield of yellowedge grouper was 381 mt, and maximum yield was 642 mt (NMFS 2002). With only an inconclusive stock assessment available for yellowedge grouper, long-term and short-term biomass trends are unknown. However, landings in the Atlantic have exhibited stable long-term and short-term trends, and in the Gulf, landings have exhibited a variable long-term trend and an increasing short-term trend (Figure 20) (NMFS 2008c).

Evidence exists for skewed distribution parameters for the Gulf of Mexico stock. In the Gulf of Mexico bottom longline fishery, the mean size of landings was largest from 1977-1980, with the average size of landings decreasing since. Additionally, the sex ratio is representative of an exploited population, with almost 2 females for every male. This is concerning because yellowedge grouper start life as females and then transform to a males as size and age increase. Therefore, the proportion of males is less than ideal for continued successful reproduction (Cass-Calay and Bahnick 2002). Trends in size, age, and sex distribution for the Atlantic stock are unknown.

Seafood Watch® considers the Gulf of Mexico and Atlantic yellowedge grouper stocks to be a critical conservation concern because the species is listed as Vulnerable according to the IUCN.

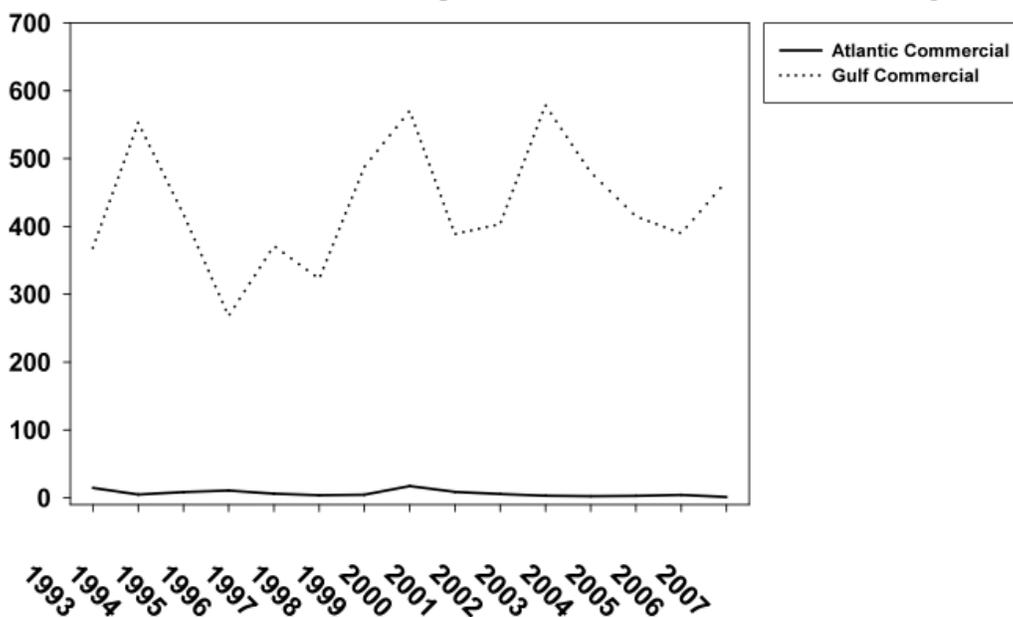


Figure 19. Yellowedge grouper landings for commercial fisheries by region and year (Figure from NMFS 2008c).

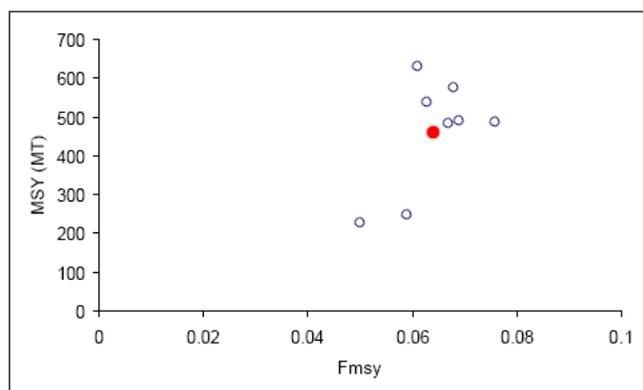


Figure 20. Distribution of estimates of F_{MSY} and MSY from the suite of models applied to the yellowedge grouper catch and effort data. Each open circle is the paired estimates from one of the other eight models. The solid circle represents the average estimate of MSY and F_{MSY} across the eight models (Figure from NMFS 2002c).

Warsaw grouper

About 99% of warsaw grouper are caught in the Gulf of Mexico (Figure 21) (NMFS 2003).

Warsaw grouper are listed as “Critically Endangered” (“facing an extremely high risk of extinction in the wild”) according to the IUCN (IUCN 2001; Chuen & Huntsman 2006). Seafood Watch® considers any stock that is listed as a “threatened species” or similar proxy to be a critical conservation concern.

According to the NOAA Fisheries’ 2010 Second Quarter Report to Congress (NMFS 2010), the status of the Gulf of Mexico stock is unknown. In the Atlantic, overfishing is occurring, but it is unknown whether the stock is overfished. Although data are limited on the status of the Atlantic stock (Prager 2004), SPR for warsaw grouper in the Atlantic has been estimated at 6-14% (NMFS 2003). Long-term and short-term biomass trends for warsaw grouper are unknown. However, landings in the Atlantic have exhibited a declining long-term trend and a stable short-term trend, and in the Gulf, landings have exhibited a variable long-term trend and a declining short-term trend (Figure 21) (NMFS 2008c). The species has also demonstrated signs of skewed distribution parameters. From 1998 to 1990, the mean weight of landed fish was below the minimum weight required for Warsaw grouper to be considered adults. This indicates that the species has experienced declines in the average size (NMFS 2009b). Age and sex distribution parameters for both Gulf of Mexico and Atlantic stocks are unknown.

Seafood Watch® considers the Atlantic and Gulf of Mexico Warsaw grouper stocks to be a critical conservation concern because the species is listed as “Critically Endangered” according to the IUCN.

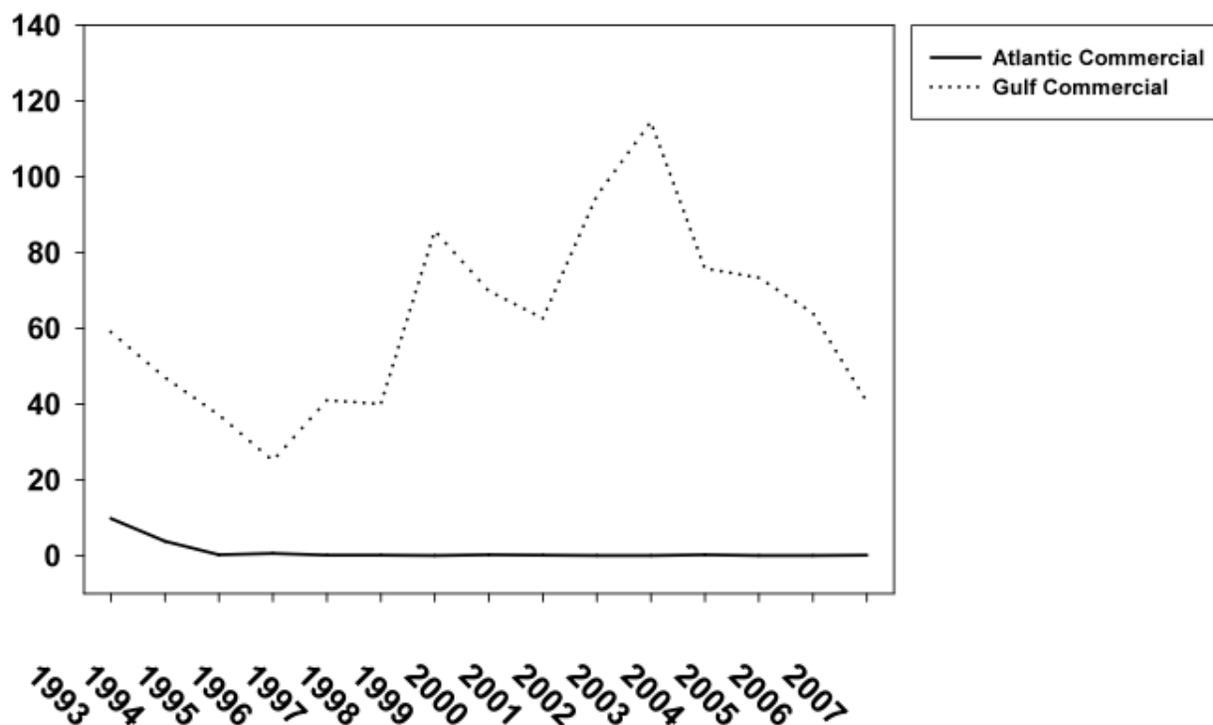


Figure 21. Warsaw grouper landings for commercial fisheries by region and year (Figure from NMFS 2008c).

Synthesis

Twelve grouper stocks are commercially exploited in the Southeast region of the United States. These stocks are broken into two groups based on their shallow-water or deep-water habitats. The shallow-water complex includes red, gag and black grouper.

In the Atlantic shallow-water complex, red grouper is a critical conservation concern because it is overfished and experiencing overfishing. The gag grouper stock status would normally be classified as poor according to Seafood Watch® because overfishing is occurring, distribution parameters are skewed, and the stock is likely approaching an overfished condition. In addition, the black grouper stock would normally be classified as a low conservation concern according to Seafood Watch® because the stock is not overfished, overfishing is not occurring, and the stock uncertainty is not high. However, in the Atlantic, gag and black groupers are caught with red grouper, which has a critical stock status. These three species are targeted together and red grouper makes up a large component of the landings of the aggregation, such that the fisheries landing gag and black grouper are contributing to the overfishing of red grouper. Therefore, Seafood Watch® considers the stocks of red, gag, and black grouper from the Atlantic to be critical conservation concerns.

In the Gulf of Mexico shallow-water complex, the gag grouper stock is a critical conservation concern because it is overfished and experiencing overfishing. The red and black grouper stocks are low conservation concerns according to Seafood Watch® because the stocks are not overfished, overfishing is not occurring, and the stock uncertainty is not high. Although in the Gulf of Mexico, red and black groupers are caught with gag grouper, management has recently

implemented strict quotas which effectively restrict the catch of gag grouper to incidental catch only. Therefore, Seafood Watch® considers the stocks of red, gag, and black grouper from the Gulf of Mexico independently, and considers the impact of incidental catch of gag grouper under Criterion 3: Nature and Extent of Bycatch. Stock status of gag grouper in the Gulf of Mexico is considered a critical conservation concern, while stock status of red and black grouper in the Gulf of Mexico is a low conservation concern.

The deep-water complex includes snowy, Warsaw, and yellowedge grouper. In the Atlantic, snowy and Warsaw are undergoing overfishing, and snowy is overfished while the overfished status of Warsaw and yellowedge is unknown. In addition, all three species are listed on the IUCN Red List – yellowedge grouper and snowy grouper as Vulnerable, and Warsaw grouper as Critically Endangered. As such, stock status of these three species is considered a critical conservation concern, both in the Gulf of Mexico and the Atlantic.

All of these rankings are summarized in Table 3.

Table 3. Stock and abundance classifications of grouper from the Southeast Region.

Species/ Region	Classification Status	B/B _{MSY}	Occurrence of Overfishing	Abundance Trends/CPUE	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Red grouper – Atlantic	Over- fished	SSB ₂₀₀₈ / MSST = 0.79	Overfishing; F ₂₀₀₈ /F _{MSY} = 1.46	Spawning stock biomass: longterm and short term variable	Age distribution skewed; size/sex distribution unknown	Mod- erate	NMFS 1999; SEDAR 2007; NOAA 2008b; SEDAR 2010a	Critical
Red grouper – Gulf of Mexico	Under- utilized	B ₂₀₀₅ / B _{MSY} =1.27	No Overfishing; F ₂₀₀₅ /F _{MSY} = 0.73	Spawning stock biomass: long-term increasing; short-term increasing	Unknown	Low	NMFS 1999; SEDAR 2007; NOAA 2008b; SEDAR 2010a	Low
Gag grouper – Atlantic	Fully fished; but caught together with red grouper which is over- fished	B ₂₀₀₈ /B _{MSY} = 0.94	Overfishing; F ₂₀₀₄ /F _{MSY} = 1.3	Biomass: long-term declining short-term variable	Size/sex/ag e distribution skewed	High	GMFMC 1999; Coleman et al. 2002; NMFS 2003d; NMFS 2006; SEDAR 2006B; NOAA 2008b	Critical

Species/ Region	Classification Status	B/B _{MSY}	Occurrence of Overfishing	Abundance Trends/CPUE	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Gag grouper – Gulf of Mexico	Over- fished	SSB ₂₀₀₈ / MSST = 0.47-0.54	Overfishing; F ₂₀₀₇ /F _{MSY} =2 .20-2.47	Spawning stock biomass: long term variable, short term declining	Unknown	High	GMFMC 1999; Coleman et al. 2002; NMFS 2003d; NMFS 2006; SEDAR 2006B; NOAA 2008b	Critical
Black grouper – Atlantic	Under- utilized; but caught together with red grouper, which is over- fished	SSB ₂₀₀₈ / SS _{BMSY} = 1.40	No Overfishing; F ₂₀₀₈ /F _{MSY} =0 .50; but caught together with red grouper which is undergoing overfishing	Biomass: long-term increasing; short-term increasing	Unknown	Mod- erate	NMFS 2008b; NMFS 2008c; Crabtree and Bullock 1998; SEDAR 2010b	Critical
Black grouper – Gulf of Mexico	Under- utilized	SSB ₂₀₀₈ / SS _{BMSY} = 1.40	No Overfishing; F ₂₀₀₈ /F _{MSY} =0 .50	Biomass: long-term increasing; short-term increasing	Unknown	Mod- erate	NMFS 2008b; NMFS 2008c; Crabtree and Bullock 1998; SEDAR 2010b	Low
Snowy grouper – Atlantic	Overfish ed; Vulnerab le (IUCN)	B/B _{MSY} = 0.18	Overfishing	Unknown Landings: long-term declining; short-term declining.	Size/sex distribution skewed; age distribution unknown	High	Wyanski et al. 2000; NMFS 2003c; NMFS 2003d; NOAA 2008b; Thierry et al. 2008	Critical
Snowy grouper – Gulf of Mexico	Vulnerab le (IUCN)	Unknow n	Unknown	Unknown Landings: long-term up; short- term flat	Unknown	High	Wyanski et al. 2000; NMFS 2003c; NMFS 2003d; NOAA 2008b; Thierry et al. 2008	Critical
Warsaw grouper – Atlantic	Critically Endange red (IUCN)	Unknow n	Overfishing	Unknown Landings: long-term declining; short-term stable	Size distribution skewed; age/sex distribution unknown	High	NMFS 2003c; NMFS 2003d; NOAA 2008b; NMFS 2009b; Chuen & Huntsman 2006	Critical

Species/ Region	Classification Status	B/B _{MSY}	Occurrence of Overfishing	Abundance Trends/CPUE	Age/Size/Sex Distribution	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Warsaw grouper – Gulf of Mexico	Critically Endange red (IUCN)	Unknow n	Unknown	Unknown Landings: long-term variable; short-term declining	Size distribution skewed; age/sex distribution unknown	High	NMFS 2003c; NMFS 2003d; NOAA 2008b; NMFS 2009b; Chuen & Huntsman 2006	Critical
Yellowedg e grouper – Atlantic	Vulnerab le (IUCN)	Unknow n	No overfishing	Unknown Landings: long-term flat; short- term flat	Unknown	High	Cass-Calay and Bahnick 2002; NMFS 2003c; NMFS 2003d; NOAA 2008b); Ferreira and Peres 2008	Critical
Yellowedg e grouper – Gulf of Mexico	Vulnerab le (IUCN)	Unknow n	Unknown	Unknown Landings: long-term variable; short-term increasing	Size/sex distribution skewed; age distribution unknown	High	(Cass-Calay and Bahnick 2002; NMFS 2003c; NMFS 2003d; NOAA 2008b; Ferreira and Peres 2008	Critical

Status of Wild Stocks Rank:

Red grouper, black grouper (Gulf of Mexico):



Gag grouper (Atlantic and Gulf of Mexico), Red grouper (Atlantic), Black grouper (Atlantic), Warsaw grouper (Atlantic and Gulf of Mexico), Snowy grouper (Atlantic and Gulf of Mexico), and Yellowedge grouper (Atlantic and Gulf of Mexico):



Criterion 3: Nature of Bycatch

Bycatch in the snapper/grouper fishery is substantial and includes undersized individuals and protected grouper species such as Nassau and goliath grouper (NMFS 2002), as well as grouper species undergoing overfishing (e.g., gag). In the Gulf of Mexico bottom longline (allowable

outside of 20 fathoms in the eastern GOM and 50 fathoms in the western GOM) and South Atlantic snapper/grouper longline (allowable outside of 50 fathoms) fisheries there is a high potential for fish bycatch, a moderate potential for sea turtle bycatch, and a low potential for marine mammal bycatch (NMFS 2003c; GMFMC 2008; SAFMC 2008). Beginning in 2001, the Southeast Fisheries Science Center (SEFSC) collected data, using a supplemental discard form, in the Gulf of Mexico reef fish, South Atlantic snapper/grouper, king and Spanish mackerel, and shark fisheries (Poffenberger 2004). Bottom longline data were collected from 51 vessels in the Gulf of Mexico and 16 vessels in the South Atlantic from August 1, 2001 to July 31, 2003 (Poffenberger 2004). In the South Atlantic, 449 animals were discarded in the bottom longline fishery; the species with the highest quantity of discards were spiny dogfish sharks (195 during 2 trips), unclassified red porgies (57 during 7 trips), and lesser amberjacks (48 during 3 trips) (Poffenberger 2004). In the Gulf of Mexico, 33,519 animals were discarded in the bottom longline fishery; the species with the highest quantity of discards were red grouper (23,305 during 121 trips), unclassified sharks (3,009 during 78 trips), and red snapper (1,612 during 58 trips) (Poffenberger 2004). A leatherback sea turtle was discarded during one trip in the South Atlantic, while one loggerhead, one green turtle, and three unclassified sea turtles were discarded during five trips in the Gulf of Mexico (Poffenberger 2004). In regards to marine mammal bycatch, NMFS states that this fishery has only “a remote likelihood of, or no known incidental mortality and serious injury of marine mammals”. This statement defines a Category III fishery. In order to reduce bycatch, trawl gear and fish traps are not allowed inside of 50 fathoms in the South Atlantic (SAFMC 2008) and are prohibited in the Gulf of Mexico (GMFMC 2008).

A study on post-release mortality of red grouper shows mortality rates between 18-100%, depending on depth of capture (Figure 22) (Wilson and Burns 1996; NMFS 2002). The GMFMC and SAFMC take estimated bycatch and mortality into account in setting quotas for shallow and deep-water grouper species (GMFMC 2002; NMFS 2003).

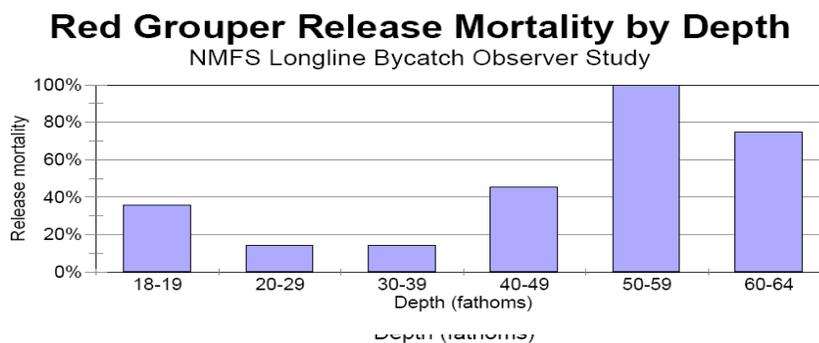


Figure 22. Red grouper release mortality by depth in the NMFS bycatch observer study (NMFS 2002).

Table 4. Bycatch classifications of commercially important Atlantic and Gulf of Mexico groupers.

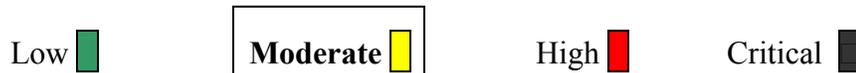
Gear Type	Composition of Bycatch	Population Consequences	Quantity of Bycatch	Short and Long Term Trends	Source
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Gear Type	Composition of Bycatch	Population Consequences	Quantity of Bycatch	Short and Long Term Trends	Source
Hook and Line	Undersized individuals, protected grouper species	Unknown	Moderate	Unknown	(NMFS 2002)
Bottom Longline	Undersized individuals, protected grouper species; Some sea turtles, sharks, marine mammals	Unknown	Moderate	Unknown	(NMFS 2002)
Powerhead (spearfishing)	Undersized individuals, protected grouper species	Unknown	Moderate	Unknown	(NMFS 2002)
Diving (spearfishing)	None	Unknown	Moderate	Unknown	(NMFS 2002)
Pot (trap)	Undersized individuals, protected grouper species	Unknown	Moderate	Unknown	(NMFS 2002)

In addition to the non-target species discussed above, incidental catch of gag grouper in the Gulf of Mexico is considered as bycatch in this assessment. Because gag stocks are currently a critical conservation concern, they are considered a species of special concern according to Seafood Watch®. Although gag is historically one of the major targeted species in the shallow water grouper fishery in the Gulf of Mexico, the catch of gag is currently strictly restricted to a temporary quota of just 100,000 lbs until the Council develops a rebuilding plan for gag as Amendment 32 to the Reef Fish FMP (see Criterion 5: Effectiveness of the Management Regime). Initial estimates of needed catch reductions to allow rebuilding were between 70 and 74%, and the Science and Statistical Committee found that a recommended quota of 390,000 lbs (reduced 73% from the previous quota of 1.49 million lbs) would have a less than 50% chance of overfishing and a greater than 50% chance of rebuilding the stock. However, due to uncertainties in the estimates of dead discards, the GMFMC set the quota at 100,000 pounds as a precautionary measure, to keep gag catch to a minimum while allowing fishermen to land incidental catch that occurs when targeting other grouper, as the fishery tends to operate in water deep enough to cause barotrauma to incidentally caught fish, limiting post-release survival (NMFS 2010). Because the catch rate of gag is currently restricted to levels below the rate that was determined necessary to allow rebuilding of the stock, incidental catch of gag while targeting red and black grouper in the Gulf of Mexico is most likely not substantially impacting the gag population, causing declines or limiting its recovery. As such, bycatch of gag is a moderate conservation concern.

Synthesis

Seafood Watch® concludes bycatch is of moderate conservation concern for groupers of the southeast region of the U.S.

Nature of Bycatch Rank:**Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems**

Within the commercial grouper fishery in the Southeastern U.S., there are four legal methods of harvest. Species can be harvested by black sea bass pot, vertical line (handline, hydraulic, or electric), bottom longline, and spear fishing (NMFS 2003d).

The vertical line sector of the commercial fishery, which predominantly targets shallow-water grouper species, operates from the North Carolina/Virginia border to the Atlantic side of Key West and throughout the Gulf of Mexico (NMFS 2003d). According to NMFS Logbook data there were 15,302 vertical line trips reported in 2001. Vertical line typically involves fishing at depths of 24-201 m during both daytime and nighttime hours.

Black sea bass pots are allowed north of Cape Canaveral, Florida, although the majority of these traps are set off North Carolina and the northern coasts of South Carolina. According to NMFS Logbook data there were 1,054 trips in 2001 using black sea bass pots.

Bottom longlining is conducted in waters 91 m in depth or more, north of St. Lucie Inlet, Florida, on the Atlantic coast and in the Gulf of Mexico. According to NMFS Logbook data there were 714 bottom longline trips in 2001. Effort is mostly off Florida and the Carolinas and most fishing occurs outside of the 100-fathom contour (183 meters).

Recreational fishing for species in the snapper/grouper fishery occurs throughout the Southeastern United States. Generally, recreational fishing for grouper is done with vertical hook and line, with either electric or manually operated reels.

In a review of the fishing gear used in the Southeastern U.S., Barnette (2001) concluded that the weights and lines associated with these gears could damage coral habitat by “breaking or abrading delicate coral (gorgonian) structures and fouling of discarded/lost fishing line, which accretes coralline algae and eventually overgrows the coral.” It is possible that with the kind of commercial and recreational effort observed for the grouper fisheries, damage to and fouling of coral structure do occur. The extent of these effects however, is unknown at this time.

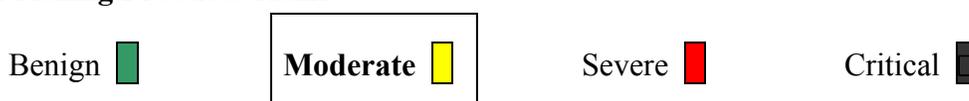
Although the ecosystem-level effects of reduced grouper biomass remain somewhat uncertain, a few studies provide evidence that reductions can have important direct and indirect impacts. Several groupers, including red and yellowedge, function as “ecosystem engineers” by burrowing and excavating bottom substrate. These excavations support increased abundances of

fishes and invertebrates including commercially-important black and snowy groupers, vermilion snapper, and spiny lobster (Jones et al. 1989; Coleman and Williams 2002). Reductions in the biomass of these ecosystem engineers will possibly have direct and indirect effects on the biodiversity and biogeochemistry of their local systems. Groupers also function as top predators. Stallings (2008) experimentally demonstrated that reduced abundances of the intensively-fished Nassau grouper resulted in a strong trophic cascade, with drastic negative effects on entire communities and populations of reef fishes. Given their roles as ecosystem engineers and top predators, it is possible that reduced biomass of groupers could have substantial impacts on the marine systems in which they live.

Synthesis

Bottom longlines are known to cause moderate damage to habitats. The grouper fisheries occur at a moderate spatial scale and in habitats that have low resilience to disturbance from fishing gear. The ecosystem-level effects of reduced grouper biomass remain somewhat uncertain; however, given their roles as ecosystem engineers and top predators, it is possible that reduced biomass of groupers could have substantial impacts on the marine systems in which they live. Given this information, Seafood Watch® deems the effect of grouper fishing practices on habitats and ecosystems to be a moderate conservation concern.

Effect of Fishing Practices Rank:



Criterion 5: Effectiveness of the Management Regime

Gulf of Mexico

The Gulf of Mexico grouper stocks in federal waters (3-200 miles offshore) are managed by the GMFMC under the Reef Fish Fishery Management Plan (FMP) (GMFMC 1984). The FMP was established in 1984 and is amended as needed to protect grouper stocks. Twelve species in the snapper/grouper fishery are covered by the FMP (GMFMC 1984). The original plan was designed to rebuild already declining reef fish stocks and included inshore prohibitions on the use of fish traps, roller trawls, and powerhead-equipped spear guns (GMFMC 1984).

There have been 31 Amendments to the original FMP, which have mostly attempted to address continued overfishing of grouper, including enacting limited access permits, catch quotas, commercial trip limits, closed seasons, and recreational bag limits (GMFMC 2010).

Despite these amendments, the stock status of gag is critical. The GMFMC is developing a rebuilding plan for gag in Amendment 32 to the Reef Fish FMP. Initial estimates of needed catch reductions were between 70 and 74%; however, the exact amount of catch reductions has not yet been determined due to inconsistencies in estimates of dead discard (preliminary estimates of dead discards were much greater when estimated using reef fish observer data versus logbook based methods). Until the dead discards issue is resolved, the GMFMC has asked for temporary measures to reduce the gag catch to allow the gag stock to begin to rebuild.

As such, the commercial quota has been reduced from 1.49 million pounds to 100,000 pounds as a precautionary measure until a better estimate of the needed catch reductions is available (NMFS 2010).

The GMFMC's Scientific and Statistical Committee recommended the total allowable catch for red grouper be adjusted from the existing 7.57 million pounds to 5.68 million pounds. Based on the 76:24 ratio for the commercial and recreational allocation, respectively, the 2011 commercial quota for red grouper has been reduced from 5.75 million pounds to 4.32 million pounds (NMFS 2010).

Current commercial grouper regulations for the Gulf of Mexico include (GMFMC 2003; GMFMC 2010):

- Red grouper – 18" TL minimum size limit (Amendment 30B); red grouper quota of 4.32 million pounds (gutted weight); seasonal closure of commercial harvest from February 15th to March 15th.
- Gag – 24" TL minimum size limit; hard quota of 100,000 pounds quota; seasonal closure of commercial harvest from February 15th to March 15th.
- Black grouper – 24" TL minimum size limit; shallow-water grouper quota share of 410,000 pounds (gutted weight) ; seasonal closure of commercial harvest from February 15th to March 15th.
- Snowy grouper – no minimum size; 1.02 million pounds (gutted weight) overall deep-water grouper quota.
- Warsaw grouper – no minimum size; 1.02 million pounds (gutted weight) overall deep-water grouper quota.
- Yellowedge grouper – no minimum size; 1.02 million pounds (gutted weight) overall deep-water grouper quota.
- 6,000 pound (gutted weight) aggregate deep-water and shallow-water grouper trip limit.
- 2011 shallow-water quota has been reduced from 7.65 million pounds to 4.83 million pounds.
- Shallow-water grouper quota closure occurs when either the shallow-water grouper or red grouper quota is reached, whichever occurs first.
- Bottom longline gear has been banned shoreward of 50 fathoms across the Gulf, except the Florida peninsula. New bottom longline regulations to address interactions with loggerheads off the Florida coast include the following:
 - Prohibited shoreward of 35 fathoms (Amendment 31)
 - Prohibited from June through August (Amendment 31)
 - Restricted by a longline endorsement for reef fish permits with minimum annual average reef fish landings of 40,000 pounds per permit during the 1999-2007

period. In addition, a few vessels that were using bottom longlines converted to vertical line gear (Amendment 31).

- Boats with longline gear are limited to a maximum of 750 baited hooks on board as well (Amendment 31).

Southern Atlantic

The Atlantic grouper stocks in federal waters (3-200 miles offshore) are managed by the SAFMC under the Snapper Grouper Fishery Management Plan (SAFMC 1983). The FMP was established in 1983 and is amended as needed to protect grouper stocks (SAFMC 1983). Twelve grouper stocks are covered in this FMP. The original plan established a 12" total length minimum size for red and Nassau grouper (SAFMC 1983). Also, harvest limitations on the use of certain gear, including poisons, explosives, fish traps, and trawls were included (SAFMC 1983).

The original FMP also contained a management measure that provided for designation of modified habitats or artificial reefs as special management zones (SMZs) (SAFMC 1983). Through a Regulatory Amendment to the Snapper/Grouper FMP, the Council prohibited fishing in these areas except with hand-held vertical line gear (including manual, electric, or hydraulic rod and reel) and spearfishing gear (including powerheads and spear guns). The harvest of goliath grouper also was prohibited within these SMZs.

The management measures enacted since 1991, have mostly attempted to address overfishing (NMFS 2002). Limited access permits, catch quotas, commercial trip limits, closed seasons, and recreational bag limits have been enacted through 17 amendments to the FMP (SAFMC 2011a). Gear restrictions include depth limitations on bottom longlining (only allowed in depths 50 fathoms or more and only north of St. Lucie Inlet, Florida) and longline vessel limits (vessels with longline gear onboard may only possess snowy grouper, one warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish and sand tilefish) (NMFS 2002). Also, under Amendment 6, the Gulf Council created the Oculina Experimental Closed Area, to protect spawning aggregations of grouper (NMFS 2003); Amendment 13 extended the regulation prohibiting fishing for and retention of snapper grouper species within the Oculina Experimental Closed Area.

Current commercial grouper regulations for the U.S. south Atlantic include (SAFMC 2003; SAFMC 2011b, c, d, e):

- Red grouper – 20" TL minimum size limit.
- Gag – 24" TL minimum size limit; fish must be landed with heads and fins attached; harvest and possession during March and April is limited to the recreational bag limit (2 black grouper and/or gag, individually or in combination), and sale and purchase during this period is prohibited. Effective January 31, 2011, in addition to the current commercial harvest quota, or "Annual Catch Limit" of 352,940 pounds (gw) for gag, there is an *aggregate* commercial Annual Catch Limit (quota) for gag, black grouper, and red grouper of 662,403 pounds. If either of these Annual Catch Limits is met or projected to be met, the commercial possession of shallow-water groupers (gag, black

grouper, red grouper, scamp, red hind, yellowmouth grouper, tiger grouper, yellow fin grouper, graysby and coney) is prohibited.

- Black grouper – 24" TL minimum size limit; fish must be landed with heads and fins attached; harvest and possession during March and April is limited to the recreational bag limit (2 black grouper and/or gag, individually or in combination), and sale and purchase during this period is prohibited. Effective January 31, 2011, there will be an *aggregate* commercial Annual Catch Limit (quota) for gag, black grouper, and red grouper of 662,403 pounds. If either the aggregate Annual Catch Limit or the Annual Catch Limit for gag is met or projected to be met, the commercial possession of shallow-water groupers (gag, black grouper, red grouper, scamp, red hind, yellowmouth grouper, tiger grouper, yellow fin grouper, graysby and coney) is prohibited.

- Snowy grouper – no size limit; As of October 2006, management reduced the annual commercial quota from 151,000 pounds gutted weight (gw) in 2006 to 118,000 pounds gw in 2007, and 84,000 pounds gw in 2008. They also reduced the commercial trip limit from 275 pounds gw in 2006 to 175 pounds gw in 2007, and 100 pounds gw in 2008. Effective January 31, 2011, there is a prohibition on harvest and retention of snowy grouper, blueline tilefish, yellowedge grouper, misty grouper, queen snapper, and silk snapper, beyond 240 feet (73 m) in federal waters in the South Atlantic.

- Warsaw grouper – 1 per vessel per trip; may not be sold or traded; no transfer at sea. Beginning January 31, 2011, a prohibition on the harvest and retention of speckled hind and warsaw grouper begins in federal waters in the South Atlantic.

Despite these regulations, stock status of red grouper and snowy grouper is critical, the stock status of gag is poor, and Warsaw grouper remain listed as Critically Endangered.

Synthesis

U.S. grouper fisheries in the Gulf of Mexico and the Atlantic are regulated by their respective management councils through fishery management plans (FMPs), which are amended as needed to further protect the stock. Despite the fact that each FMP calls for regular stock assessments, a comprehensive stock analysis has only been completed on red grouper, black grouper, gag, and yellowedge grouper from the Gulf of Mexico. Also, several grouper species from shallow-water and deep-water fisheries are considered either overfished or their stock status is unknown, and deepwater grouper species are listed as vulnerable or critically endangered by the IUCN. Only recently has management been able to stop overfishing in some overfished stocks. Seafood Watch® concludes that management of grouper stocks in the southern Atlantic and Gulf of Mexico is of moderate conservation concern.

Effectiveness of Management Rank:

Highly Effective 

Moderately Effective 

Ineffective 

Critical 

III. Overall Evaluation and Seafood Recommendation

Grouper possess a suite of life history characteristics, such as a long life span (12-41 years), high site fidelity, dense spawning aggregations, and protogyny that makes them highly susceptible to overfishing. Seafood Watch® deems the stock status of gag grouper in the Gulf of Mexico, red, black and gag grouper in the Atlantic, and snowy, Warsaw and yellowedge grouper from both the Gulf of Mexico and the Atlantic to be critical. Seafood Watch® deems the stock status of red and black grouper in the Gulf of Mexico to be healthy.

Bycatch in the snapper/grouper fishery is moderate and includes undersized individuals (regulatory discards), protected grouper species such as Nassau and goliath grouper, overfished gag, and occasional incidental catches of sea turtles. Given their roles as ecosystem engineers and top predators, it is possible that reduced biomass of groupers is having direct and indirect effects on the marine ecosystems in which they live. U.S. grouper fisheries in the Atlantic and the Gulf of Mexico are regulated by their respective management councils through fishery management plans (FMPs) that are amended as needed to increase protection for the stocks. Despite FMP requirements for regular stock assessments, a comprehensive stock analysis has only been completed on red grouper, black grouper, gag and yellowedge grouper from the Gulf of Mexico, and only recently has management been able to stop overfishing in some overfished stocks.

Red, gag and black grouper from the Atlantic, gag from the Gulf of Mexico, and snowy, Warsaw and yellowedge grouper from both the Gulf of Mexico and the Atlantic are given an overall seafood recommendation of Avoid due to their critical stock status. Red and black grouper from the Gulf of Mexico are all given an overall seafood recommendation of Good Alternative due to high inherent vulnerability, healthy stocks, and moderate concerns for bycatch, habitat and ecosystem effects and management effectiveness.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability			√	
Status of Stocks	√ Red and black grouper (Gulf of Mexico)			√ Red and Black Grouper (Atlantic); Gag, Snowy, Warsaw, and Yellowedge (Gulf of Mexico and Atlantic)
Nature of Bycatch		√		
Habitat & Ecosystem Effects		√		
Management Effectiveness		√		

About the Overall Seafood Recommendation:

- A seafood product is ranked “**Best Choice**” if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.
- A seafood product is ranked “**Good Alternative**” if the five criteria “average” to yellow (Moderate Conservation Concern) OR if the “Status of Stocks” and “Management Effectiveness” criteria are both of Moderate Conservation Concern.
- A seafood product is ranked “**Avoid**” if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.

Overall Seafood Recommendation:**Red grouper; black grouper (Gulf of Mexico):**Best Choice Good Alternative Avoid 

Gag, Warsaw grouper, Snowy grouper, and Yellowedge grouper (Gulf of Mexico and Atlantic); Red grouper, black grouper (Atlantic):

Best Choice 

Good Alternative 

Avoid 

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V. Appendices

Appendix I. Updates made in October 2010

Prior to the 2010 stock assessment, the status of Atlantic red grouper was unknown, and overfishing was believed to be occurring. The 2010 Atlantic red grouper assessment determined that the stock is overfished ($SSB_{2008}/MSST = 0.79$) and overfishing is occurring ($F_{2008}/F_{MSY} = 1.46$). A moderate degree of uncertainty still exists in the stock status results. As such, this stock is a “critical” concern and the overall recommendation remains “Avoid.”

Historically, the status of Gulf of Mexico gag grouper has been debated and was considered unknown, and it was believed that overfishing was occurring. The most recent 2009 stock assessment indicated that the stock is experiencing extreme overfishing ($F_{2007}/F_{MSY}=2.20-2.47$) and the stock is severely overfished ($SSB_{2008}/MSST = 0.47-0.54$). For this reason, stock status declined from “poor” in the last report to “critical,” and the overall recommendation remains “Avoid.”

For black grouper, the first stock assessment was conducted in 2010. Prior to this, it was assumed that overfishing was occurring in the Atlantic, and the status of both groups was uncertain. The 2010 Stock Assessment Committee decided that the Atlantic and Gulf of Mexico groups should be assessed as a single stock. The assessment determined that the stock is in fact not overfished ($SSB_{2008}/SSB_{MSY}=1.40$), nor is overfishing occurring ($F_{2008}/F_{MSY}=0.50$). However, because black grouper is caught together with red grouper in the Atlantic, a critical conservation concern, the stock status of black grouper in the Atlantic is also considered critical and the overall recommendation remains “Avoid”. Similarly, the stock status of gag grouper from the Atlantic is considered critical because it is caught with red grouper, and the recommendation remains Avoid.

Although red grouper and black grouper from the Gulf of Mexico are both caught together with gag, which is now a critical concern, management recently addressed overfishing of gag with a strict temporary quota that allows for only low levels of incidental catch of gag, below the levels needed to allow rebuilding of the stock. As the very low quota effectively ends targeted fishing for gag, gag is currently considered as a bycatch species in the Gulf of Mexico, and therefore stocks of the three shallow water species are assessed separately. Red and black grouper stocks are now considered a low conservation concern in the Gulf of Mexico. As a result, the recommendation for both red grouper and black grouper from the Gulf of Mexico changed from Avoid to Good Alternative.

In the previous report, Yellowedge from the Atlantic and Gulf of Mexico, Warsaw from the Gulf of Mexico, and Snowy from the Gulf of Mexico were considered high conservation concerns. Because each of these three species is listed as either vulnerable or critically endangered (both subcategories of threatened) by the IUCN, they are now considered critical conservation concerns, and the recommendation for these three species remains Avoid. We have also included more recent Amendments to the fishery management plans for South Atlantic and Gulf of Mexico grouper. All groupers still receive a moderately effective ranking for management.

Appendix 2**Capture Fisheries Evaluation**

Species: *South Atlantic/GOM Grouper* Region: *Southeast*

**Analyst: *Robert Mazurek* Date: *October 2010*
& *Stephanie Bradley***

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

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

- have a low vulnerability to fishing pressure, and hence a low probability of being overfished, because of their inherent life history characteristics;
- have stock structure and abundance sufficient to maintain or enhance long-term fishery productivity;
- are captured using techniques that minimize the catch of unwanted and/or unmarketable species;
- are captured in ways that maintain natural functional relationships among species in the ecosystem, conserves the diversity and productivity of the surrounding ecosystem, and do not result in irreversible ecosystem state changes; and
- have a management regime that implements and enforces all local, national and international laws and utilizes a precautionary approach to ensure the long-term productivity of the resource and integrity of the ecosystem.

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

1. Inherent vulnerability to fishing pressure
2. Status of wild stocks
3. Nature and extent of discarded bycatch
4. Effect of fishing practices on habitats and ecosystems
5. Effectiveness of the management regime

Each criterion includes:

- Primary factors to evaluate and rank
- Secondary factors to evaluate and rank
- Evaluation guidelines² to synthesize these factors
- A resulting rank for that criterion

¹ “Fish” is used throughout this document to refer to finfish, shellfish and other wild-caught invertebrates.

² Evaluation Guidelines throughout this document reflect common combinations of primary and secondary factors that result in a given level of conservation concern. Not all possible combinations are shown – other combinations should be matched as closely as possible to the existing guidelines.

Once a rank has been assigned to each criterion, an overall seafood recommendation for the species in question is developed based on additional evaluation guidelines. The ranks for each criterion, and the resulting overall seafood recommendation, are summarized in a table. Criterion ranks and the overall seafood recommendation are color-coded to correspond to the categories of the Seafood Watch pocket guide:

Best Choices/Green: Consumers are strongly encouraged to purchase seafood in this category. The wild-caught species is sustainable as defined by Seafood Watch.

Good Alternatives/Yellow: Consumers are encouraged to purchase seafood in this category, as they are better choices than seafood in the Avoid category. However there are some concerns with how this species is fished and thus it does not demonstrate all of the qualities of a sustainable fishery as defined by Seafood Watch.

Avoid/Red: Consumers are encouraged to avoid seafood in this category, at least for now. Species in this category do not demonstrate enough qualities to be defined as sustainable by Seafood Watch.

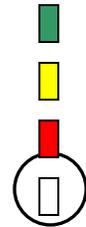
CRITERION 1: INHERENT VULNERABILITY TO FISHING PRESSURE

Guiding Principle: Sustainable wild-caught species have a low vulnerability to fishing pressure, and hence a low probability of being overfished, because of their inherent life history characteristics.

Primary Factors³ to evaluate

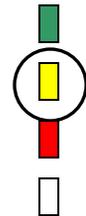
Intrinsic rate of increase ('r')

- High (> 0.16)
- Medium (0.05 - 0.16)
- Low (< 0.05)
- Unavailable/Unknown



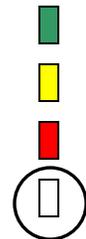
Age at 1st maturity

- Low (< 5 years)
- Medium (5 - 10 years)
- High (> 10 years)
- Unavailable/Unknown



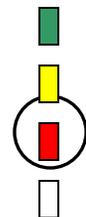
Von Bertalanffy growth coefficient ('k')

- High (> 0.16)
- Medium (0.05 - 0.15)
- Low (< 0.05)
- Unavailable/Unknown



Maximum age

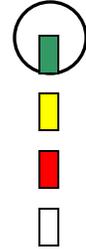
- Low (< 11 years)
- Medium (11 - 30 years)
- High (> 30 years)
- Unavailable/Unknown



³ These primary factors and evaluation guidelines follow the recommendations of Musick et al. (2000). Marine, estuarine, and diadromous fish stocks at risk of extinction in North America (exclusive of Pacific salmonids). Fisheries 25:6-30.

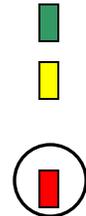
Reproductive potential (fecundity)

- High (> 100 inds./year)
- Moderate (10 – 100 inds./year)
- Low (< 10 inds./year)
- Unavailable/Unknown

***Secondary Factors to evaluate***

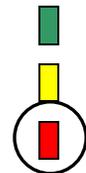
Species range

- Broad (e.g. species exists in multiple ocean basins, has multiple intermixing stocks or is highly migratory)
- Limited (e.g. species exists in one ocean basin)
- Narrow (e.g. endemism or numerous evolutionary significant units or restricted to one coastline)



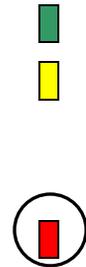
Special Behaviors or Requirements: Existence of special behaviors that increase ease or population consequences of capture (e.g. migratory bottlenecks, spawning aggregations, site fidelity, unusual attraction to gear, sequential hermaphrodites, segregation by sex, etc., OR specific and limited habitat requirements within the species' range).

- No known behaviors or requirements OR behaviors that decrease vulnerability (e.g. widely dispersed during spawning)
- Some (i.e. 1 - 2) behaviors or requirements
- Many (i.e. > 2) behaviors or requirements



Quality of Habitat: Degradation from non-fishery impacts

- Habitat is robust
- Habitat has been moderately altered by non-fishery impacts
- Habitat has been substantially compromised from non-fishery impacts and thus has reduced capacity to support this species (e.g. from dams, pollution, or coastal development)

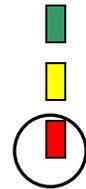


Evaluation Guidelines

- 1) Primary Factors
 - a) If 'r' is known, use it as the basis for the rank of the Primary Factors.
 - b) If 'r' is unknown, then the rank from the remaining Primary Factors (in order of importance, as listed) is the basis for the rank.
- 2) Secondary Factors
 - a) If a majority (2 out of 3) of the Secondary Factors rank as Red, reclassify the species into the next lower rank (i.e. Green becomes Yellow, Yellow becomes Red). No other combination of Secondary Factors can modify the rank from the Primary Factors.
 - b) No combination of primary and secondary factors can result in a Critical Conservation Concern for this criterion.

Conservation Concern: Inherent Vulnerability

- Low (Inherently Resilient)
- Moderate (Moderately Vulnerable)
- High (Highly Vulnerable)



CRITERION 2: STATUS OF WILD STOCKS

Guiding Principle: Sustainable wild-caught species have stock structure and abundance sufficient to maintain or enhance long-term fishery productivity.

Primary Factors to evaluate

Management classification status

- Underutilized OR close to virgin biomass **Red (Gulf), Black (Atlantic and Gulf)**



- Fully fished OR recovering from overfished OR unknown

Gag (Atlantic)



Recruitment or growth overfished, overexploited, depleted or “threatened”

Snowy, Warsaw and Yellowedge (Gulf & Atlantic), Red (Atlantic), Gag (Gulf)

Current population abundance relative to B_{MSY}

- At or above B_{MSY} (> 100%) **Red (Gulf), Black (Atlantic and Gulf)**



- Moderately Below B_{MSY} (50 – 100%) OR unknown

Gag (Atlantic), Snowy (Gulf), Yellowedge, Warsaw (Atlantic and Gulf)



- Substantially below B_{MSY} (< 50%) **Red (Atlantic), Gag (Gulf), Snowy (Atlantic)**



Occurrence of overfishing (current level of fishing mortality relative to overfishing threshold)

- Overfishing not occurring ($F_{curr}/F_{msy} < 1.0$)

Red (Gulf), Yellowedge (Atlantic), Black (Atlantic and Gulf)



- Overfishing is likely/probable OR fishing effort is increasing with poor understanding of stock status OR **Unknown**

Snowy, Warsaw, Yellowedge (Gulf)



- Overfishing occurring ($F_{curr}/F_{msy} > 1.0$)

Gag, Red, Snowy, Warsaw (Atlantic), Gag (Gulf)



Overall degree of uncertainty in status of stock

- Low (i.e. current stock assessment and other fishery-independent data are robust OR reliable long-term fishery-dependent data available) **Red (Gulf)**



- Medium (i.e. only limited, fishery-dependent data on stock status are available)

Red (Atlantic), Black (Atlantic and Gulf)



- High (i.e. little or no current fishery-dependent or independent information on stock status OR models/estimates broadly disputed or otherwise out-of-date) **(all others)**



Long-term trend (relative to species' generation time) in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up **Red (Gulf) and Black (Atlantic and Gulf)** 
- Trend is flat or variable (among areas, over time or among methods) OR Unknown **Red (Atlantic), Gag (Gulf) – variable; all others (unknown)** 
- Trend is down **Gag (Atlantic)** 

Short-term trend in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up **Red (Gulf), Black (Gulf and Atlantic)** 
- Trend is flat or variable (among areas, over time or among methods) OR Unknown **Red and Gag (Atlantic) – variable; all others (unknown)** 
- Trend is down **Gag (Gulf)** 

Current age, size or sex distribution of the stock relative to natural condition

- Distribution(s) is(are) functionally normal 
- Distribution(s) unknown **Red (Gulf), Gag (Gulf), Black (Atlantic and Gulf), Snowy (Gulf), Yellowedge (Atlantic)** 
- Distribution(s) is(are) skewed **Red (Atlantic), Gag (Atlantic), Snowy (Atlantic), Warsaw (Gulf and Atlantic), Yellowedge (Gulf)** 

Evaluation Guidelines

A “Healthy” Stock:

- 1) Is underutilized (near virgin biomass)
- 2) Has a biomass at or above BMSY AND overfishing is not occurring AND distribution parameters are functionally normal AND stock uncertainty is not high

A “Moderate” Stock:

- 1) Has a biomass at 50-100% of BMSY AND overfishing is not occurring
- 2) Is recovering from overfishing AND short-term trend in abundance is up AND overfishing not occurring AND stock uncertainty is low
- 3) Has an Unknown status because the majority of primary factors are unknown.

A “Poor” Stock:

- 1) Is fully fished AND trend in abundance is down AND distribution parameters are skewed
- 2) Is overfished, overexploited or depleted AND trends in abundance and CPUE are up.
- 3) Overfishing is occurring AND stock is not currently overfished.

A stock is considered a **Critical Conservation Concern** and the species is ranked “Avoid”, regardless of other criteria, if it is:

- 1) Overfished, overexploited or depleted AND trend in abundance is flat or down
- 2) Overfished AND overfishing is occurring
- 3) Listed as a “threatened species” or similar proxy by national or international bodies

Conservation Concern: Status of Stocks

➤ **Low (Stock Healthy)**

Red grouper, black grouper (Gulf of Mexico)



➤ Moderate (Stock Moderate or Unknown)



➤ High (Stock Poor)



➤ **Stock Critical**



Gag (Gulf); Red, Black, and Gag (Atlantic); Yellowedge, Warsaw and Snowy (Gulf and Atlantic)

Red, black and gag grouper in the Atlantic are considered to have a critical stock status because they are caught together in a multi-species fishery, and red grouper (Atlantic) has critical stock status due to being overfished with overfishing occurring. Gulf of Mexico gag grouper also has critical stock status because it is overfished with overfishing occurring; however, catch of gag is strictly limited to preclude directed fishing in the Gulf, and therefore black and red grouper from the Gulf are ranked independently (healthy, because they are not overfished with no overfishing). Warsaw, snowy and yellowedge grouper are considered to have critical stock status because they are listed as critically endangered or vulnerable under IUCN.

CRITERION 3: NATURE AND EXTENT OF DISCARDED BYCATCH⁴

Guiding Principle: A sustainable wild-caught species is captured using techniques that minimize the catch of unwanted and/or unmarketable species.

Primary Factors to evaluate

Quantity of bycatch, including any species of “special concern” (i.e. those identified as “endangered”, “threatened” or “protected” under state, federal or international law)

- Quantity of bycatch is low (< 10% of targeted landings on a per number basis) AND does not regularly include species of special concern 
- Quantity of bycatch is moderate (10 – 100% of targeted landings on a per number basis) AND does not regularly include species of special concern OR Unknown 
- Quantity of bycatch is high (> 100% of targeted landings on a per number basis) OR **bycatch regularly includes threatened, endangered or protected species** 

Population consequences of bycatch

- Low: Evidence indicates quantity of bycatch has little or no impact on population levels 
- Moderate: Conflicting evidence of population consequences of bycatch OR Unknown 
- Severe: Evidence indicates quantity of bycatch is a contributing factor in driving one or more bycatch species toward extinction OR is a contributing factor in limiting the recovery of a species of “special concern” 

Trend in bycatch interaction rates (adjusting for changes in abundance of bycatch species) as a result of management measures (including fishing seasons, protected areas and gear innovations):

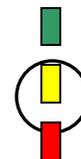
- Trend in bycatch interaction rates is down 
- Trend in bycatch interaction rates is flat OR Unknown 
- Trend in bycatch interaction rates is up 
- Not applicable because quantity of bycatch is low 

⁴ Bycatch is defined as species that are caught but subsequently discarded because they are of undesirable size, sex or species composition. Unobserved fishing mortality associated with fishing gear (e.g. animals passing through nets, breaking free of hooks or lines, ghost fishing, illegal harvest and under or misreporting) is also considered bycatch. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, is accounted for, and is managed in some way.

Secondary Factor to evaluate

Evidence that the ecosystem has been or likely will be substantially altered (relative to natural variability) in response to the continued discard of the bycatch species

- Studies show no evidence of ecosystem impacts
- Conflicting evidence of ecosystem impacts OR Unknown
- Studies show evidence of substantial ecosystem impacts

***Evaluation Guidelines***

Bycatch is “**Minimal**” if:

- 1) Quantity of bycatch is <10% of targeted landings AND bycatch has little or no impact on population levels.

Bycatch is “**Moderate**” if:

- 1) Quantity of bycatch is 10 - 100% of targeted landings
- 2) Bycatch regularly includes species of “special concern” AND bycatch has little or no impact on the bycatch population levels AND the trend in bycatch interaction rates is not up.

Bycatch is “**Severe**” if:

- 1) Quantity of bycatch is > 100% of targeted landings
- 2) Bycatch regularly includes species of “special concern” AND evidence indicates bycatch rate is a contributing factor toward extinction or limiting recovery AND trend in bycatch is down.

Bycatch is considered a **Critical Conservation Concern** and the species is ranked “Avoid”, regardless of other criteria, if:

- 1) Bycatch regularly includes species of special concern AND evidence indicates bycatch rate is a factor contributing to extinction or limiting recovery AND trend in bycatch interaction rates is not down.
- 2) Quantity of bycatch is high AND studies show evidence of substantial ecosystem impacts.

Conservation Concern: Nature and Extent of Discarded Bycatch

- Low (Bycatch Minimal)
- Moderate (Bycatch Moderate)
- High (Bycatch Severe)
- Bycatch Critical



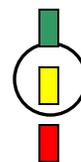
CRITERION 4: EFFECT OF FISHING PRACTICES ON HABITATS AND ECOSYSTEMS

Guiding Principle: Capture of a sustainable wild-caught species maintains natural functional relationships among species in the ecosystem, conserves the diversity and productivity of the surrounding ecosystem, and does not result in irreversible ecosystem state changes.

Primary Habitat Factors to evaluate

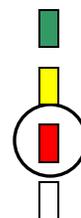
Known (or inferred from other studies) effect of fishing gear on physical and biogenic habitats

- Minimal damage (i.e. pelagic longline, midwater gillnet, midwater trawl, purse seine, hook and line, or spear/harpoon)
- Moderate damage (i.e. bottom gillnet, bottom longline or some pots/ traps)
- Great damage (i.e. bottom trawl or dredge)



For specific fishery being evaluated, resilience of physical and biogenic habitats to disturbance by fishing method

- High (e.g. shallow water, sandy habitats)
- Moderate (e.g. shallow or deep water mud bottoms, or deep water sandy habitats)
- Low (e.g. shallow or deep water corals, shallow or deep water rocky bottoms)
- Not applicable because gear damage is minimal



If gear impacts are moderate or great, spatial scale of the impact

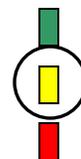
- Small scale (e.g. small, artisanal fishery or sensitive habitats are strongly protected)
- Moderate scale (e.g. modern fishery but of limited geographic scope)
- Large scale (e.g. industrialized fishery over large geographic areas)
- Not applicable because gear damage is minimal



Primary Ecosystem Factors to evaluate

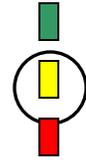
Evidence that the removal of the targeted species or the removal/deployment of baitfish has or will likely substantially disrupt the food web

- The fishery and its ecosystem have been thoroughly studied, and studies show no evidence of substantial ecosystem impacts
- Conflicting evidence of ecosystem impacts OR Unknown
- Ecosystem impacts of targeted species removal demonstrated



Evidence that the fishing method has caused or is likely to cause substantial ecosystem state changes, including alternate stable states

- The fishery and its ecosystem have been thoroughly studied, and studies show no evidence of substantial ecosystem impacts
- Conflicting evidence of ecosystem impacts OR Unknown
- Ecosystem impacts from fishing method demonstrated



Evaluation Guidelines

The effect of fishing practices is “**Benign**” if:

- 1) Damage from gear is minimal AND resilience to disturbance is high AND neither Ecosystem Factor is red.

The effect of fishing practices is “**Moderate**” if:

- 1) Gear effects are moderate AND resilience to disturbance is moderate or high AND neither Ecosystem Factor is red.
- 2) Gear results in great damage AND resilience to disturbance is high OR impacts are small scale AND neither Ecosystem Factor is red.
- 3) Damage from gear is minimal and one Ecosystem factor is red.

The effect of fishing practices is “**Severe**” if:

- 1) Gear results in great damage AND the resilience of physical and biogenic habitats to disturbance is moderate or low.
- 2) Both Ecosystem Factors are red.

Habitat effects are considered a **Critical Conservation Concern** and a species receives a recommendation of “**Avoid**”, regardless of other criteria if:

- Four or more of the Habitat and Ecosystem factors rank red.

Conservation Concern: Effect of Fishing Practices on Habitats and Ecosystems	
<ul style="list-style-type: none"> ➤ Low (Fishing Effects Benign) ➤ Moderate (Fishing Effects Moderate) ➤ High (Fishing Effects Severe) ➤ Critical Fishing Effects 	

CRITERION 5: EFFECTIVENESS OF THE MANAGEMENT REGIME

Guiding Principle: The management regime of a sustainable wild-caught species implements and enforces all local, national and international laws and utilizes a precautionary approach to ensure the long-term productivity of the resource and integrity of the ecosystem.

Primary Factors to evaluate

Stock Status: Management process utilizes an independent scientific stock assessment that seeks knowledge related to the status of the stock

- Stock assessment complete and robust 
- Stock assessment is planned or underway but is incomplete OR stock assessment complete but out-of-date or otherwise uncertain 
- No stock assessment available now and none is planned in the near future 

Scientific Monitoring: Management process involves regular collection and analysis of data with respect to the short and long-term abundance of the stock

- Regular collection and assessment of both fishery-dependent and independent data 
- Regular collection of fishery-dependent data only 
- No regular collection or analysis of data 

Scientific Advice: Management has a well-known track record of consistently setting or exceeding catch quotas beyond those recommended by its scientific advisors and other external scientists:

- No 
- Yes 
- Not enough information available to evaluate OR not applicable because little or no scientific information is collected 

Bycatch: Management implements an effective bycatch reduction plan

- Bycatch plan in place and reaching its conservation goals (deemed effective) 
- Bycatch plan in place but effectiveness is not yet demonstrated or is under debate 
- No bycatch plan implemented or bycatch plan implemented but not meeting its conservation goals (deemed ineffective) 
- Not applicable because bycatch is “low” 

Fishing practices: Management addresses the effect of the fishing method(s) on habitats and ecosystems

- Mitigative measures in place and deemed effective 
- Mitigative measures in place but effectiveness is not yet demonstrated or is under debate 
- No mitigative measures in place or measures in place but deemed ineffective 
- Not applicable because fishing method is moderate or benign 

Enforcement: Management and appropriate government bodies enforce fishery regulations

- Regulations regularly enforced by independent bodies, including logbook reports, observer coverage, dockside monitoring and similar measures 
- Regulations enforced by fishing industry or by voluntary/honor system 
- Regulations not regularly and consistently enforced 

Management Track Record: Conservation measures enacted by management have resulted in the long-term maintenance of stock abundance and ecosystem integrity

- Management has maintained stock productivity over time OR has fully recovered the stock from an overfished condition 
- Stock productivity has varied and management has responded quickly OR stock has not varied but management has not been in place long enough to evaluate its effectiveness OR Unknown 
- Measures have not maintained stock productivity OR were implemented only after significant declines and stock has not yet fully recovered 

Evaluation Guidelines

Management is deemed to be “**Highly Effective**” if the majority of management factors are green AND the remaining factors are not red.

Management is deemed to be “**Moderately Effective**” if:

- 1) Management factors “average” to yellow
- 2) Management factors include one or two red factors

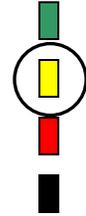
Management is deemed to be “**Ineffective**” if three individual management factors are red, including especially those for Stock Status and Bycatch.

Management is considered a **Critical Conservation Concern** and a species receives a recommendation of “**Avoid**”, regardless of other criteria if:

- 1) There is no management in place
- 2) The majority of the management factors rank red.

Conservation Concern: Effectiveness of Management

- Low (Management Highly Effective)
- Moderate (Management Moderately Effective)
- High (Management Ineffective)
- Critical (Management Critically Ineffective)



Overall Seafood Recommendation

Overall Guiding Principle: Sustainable wild-caught seafood originates from sources that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Evaluation Guidelines

A species receives a recommendation of “**Best Choice**” if:

- 1) It has three or more green criteria and the remaining criteria are not red.

A species receives a recommendation of “**Good Alternative**” if:

- 1) Criteria “average” to yellow
- 2) There are four green criteria and one red criteria
- 3) Stock Status and Management criteria are both ranked yellow and remaining criteria are not red.

A species receives a recommendation of “**Avoid**” if:

- 1) It has a total of two or more red criteria
- 2) It has one or more Critical Conservation Concerns.

Summary of Criteria Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability				
Status of Wild Stocks				
Red grouper, black grouper (Gulf): Low Gag grouper (Gulf): Critical Red grouper, Gag grouper, and Black grouper (Atlantic): Critical Yellowedge grouper, Snowy grouper, and Warsaw grouper (Atlantic & Gulf): Critical				
Nature and Extent of Discarded Bycatch				
Habitat and Ecosystem Effects				
Effectiveness of Management				

Overall Seafood Recommendation

Best Choice



Good Alternative: Red grouper, black grouper (Gulf)



Avoid: Gag grouper (Gulf); Red grouper, Gag grouper, and Black grouper (Atlantic); Yellowedge grouper, Snowy grouper, and Warsaw grouper (Atlantic and Gulf):

