Seafood Watch
Seafood Report

MONTEREY BAY AQUARIUM®

Commercially Important Gulf of Mexico/South Atlantic Snappers

Red snapper, *Lutjanus campechanus*
Vermilion snapper, *Rhomboplites aurorubens*
Yellowtail snapper, *Ocyurus chrysurus*

With minor reference to:
Gray snapper, *Lutjanus griseus*
Mutton snapper, *Lutjanus analis*
Lane snapper, *Lutjanus synagris*

Lutjanus campechanus

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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 the Internet (seafoodwatch.org) or obtained from the Seafood Watch® program by emailing seafoodwatch@mbayaq.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® Fisheries Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

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

Disclaimer
Seafood Watch® strives to 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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Table of Contents

I.	Executive Summary	4
II.	Introduction	7
III.	Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species	
	Criterion 1: Inherent Vulnerability to Fishing Pressure	11
	Criterion 2: Status of Wild Stocks	12
	Criterion 3: Nature and Extent of Bycatch	27
	Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems	29
	Criterion 5: Effectiveness of the Management Regime	29
IV.	Overall Evaluation and Seafood Recommendation	32
V.	References	36
VI.	Appendices	41

I. Executive Summary

Snappers comprise a large element of tropical and subtropical marine ecosystems in the Atlantic, Pacific, and Indian Oceans, as well as in the Caribbean and Coral Seas. Because snappers are highly desired food fish, they are sought in artisanal, recreational, and commercial fisheries throughout their range. Snappers (and reef fish in general) possess a suite of life history characteristics that make them moderately vulnerable to fishing pressure. These traits include greater longevity (20-60 yrs), high site fidelity, and regular aggregation at spawning sites.

In the continental United States, vermilion snapper (*Rhomboplites aurorubens*) accounts for approximately 43% of commercial snapper landings (1,565 metric tons (mt) in 2007); red snapper (*Lutjanus campechanus*) accounts for 38% of commercial snapper landings (1,413 mt in 2007), with over 96% of landings originating in the Gulf of Mexico (GOM); and yellowtail snapper accounts for 12% of total commercial snapper landings (444 mt in 2007).

Red snapper stocks in the South Atlantic and the Gulf of Mexico are currently overfished and undergoing overfishing, while yellowtail and mutton snapper stocks are not overfished, nor undergoing overfishing in either region. According to the most recent stock assessment, the GOM vermilion snapper stock is not overfished and not experiencing overfishing. However, this assessment is based on a new, highly uncertain model. Additionally, vermilion snapper are caught in the same fishery as red snapper, which has a critical stock status. As such, Seafood Watch® is precautionary when ranking the stock's status. In the South Atlantic[1], stock assessments indicate vermilion snapper stock health is poor and that overfishing is occurring, but it is unknown if the stock is overfished. In the South Atlantic, gray and lane snappers are considered to not be undergoing overfishing; it is unknown whether they are overfished. Their stock status in the Gulf of Mexico is unknown. Although data are generally lacking for international stocks, there is evidence that many are fully or overexploited.

U.S. fishers target snappers with bottom longline (deeper water) and handline (shallow water) gear. Bycatch discards in the handline fishery are relatively high and are reportedly a result of current regulations (closed seasons, size limits, etc.). Regulatory-induced discards contribute to overall fishing mortality of the respective snappers, as does bycatch from the shrimp-trawling fishery (GOM only), which is not evaluated here. Recent evidence also indicates bycatch and ensuing mortality of protected sea turtles is higher than previously expected in the longline fishery. Fishing methods have a moderate impact on habitat and given their roles as top predators, it is possible that reduced biomass of snappers is having direct and indirect effects on the marine ecosystems in which they live. Red, vermilion, and yellowtail snapper stocks have been assessed using fisheries-dependent and independent data, and these fisheries have been actively managed through a limited entry system, annual quotas, size limits, trip limits, and seasonal closures. Management, however, has not prevented declines in the South Atlantic and GOM red snapper stocks, and has not assessed the status of other commercially important stocks. Therefore, management is considered moderately effective. International management of snappers appears to be ineffective at preventing declines in countries where valuable snapper fisheries occur.

[1] Throughout this report, the terms 'South Atlantic' and 'southeastern Atlantic' refer to the southeastern region of the United States.

Red snapper receives a recommendation of **Avoid** due to its critical stock status. Imported snapper populations are overfished and management is ineffective, resulting in a recommendation of **Avoid**. Vermilion snapper is of poor stock status and is caught in the same fishery as red snapper, which has a critical stock status; therefore, vermilion snapper is recommended as **Avoid**. Despite high levels of bycatch in the fisheries, gray, mutton, lane, and yellowtail snappers are recommended as **Good Alternatives** due to the moderate inherent vulnerability of snappers to fishing pressure and moderately effective management.

This report was updated on February 4, 2009. For a summary of changes made at this time, please see Appendix 2.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ (Yellowtail snapper)	√ (Gray, mutton, lane snappers)	√ (Vermilion snapper, International)	√ (Red snapper)
Nature of Bycatch			√	
Habitat & Ecosystem Effects		√		
Management Effectiveness		√ (U.S.)	√ (International)	

Overall Evaluation and Seafood Ranking:

- A seafood product is ranked **Best Choice** if a total of three or more criteria are indicated as Concern: Low (green) and no remaining criteria are indicated as Concern: High or Concern: Critical
- A seafood product is ranked **Good Alternative** if a total of three or more criteria are indicated as Concern: Moderate (yellow) OR where the "Status of Stocks" and "Management Effectiveness" criteria are both indicated as Concern: Moderate
- A seafood product is ranked **Avoid** if a total of two or more criteria are indicated as Concern: High (red) OR if one or more criteria are indicated as Concern: Critical (black) in the table above

Overall Seafood Recommendation:

Gray/Lane/Mutton/Yellowtail snappers:

Best Choice | **Good Alternative** | Avoid

Red/Vermilion/International snappers:

Best Choice | Good Alternative | **Avoid**

II. Introduction

Snappers include several genera and over 100 species in the family Lutjanidae (Allen and Robertson 1994). Members of this group are found in tropical and subtropical marine ecosystems in the Atlantic, Pacific and Indian Oceans (Froese and Pauly 2002). Snappers are generally fast growing and highly fecund, forming large spawning aggregations in predictable areas. Because they are of high eating quality and were historically abundant, most species in this group have been targeted heavily by sport and commercial fishers throughout their range. Primary areas of the fishery include the tropical Pacific, the Coral Sea (between Australia and Indonesia), Micronesia, and the Caribbean. Snappers most commonly caught in the U.S. Atlantic and Gulf of Mexico (GOM) commercial and recreational fisheries include red snapper (*Lutjanus campechanus)*, yellowtail snapper *(Ocyurus chrysurus*), vermilion snapper *(Rhomboplites aurorubens*), and other snappers in the *Lutjanus* genus including lane, silk, gray and mutton snapper.

Red snapper inhabit the continental shelves of the GOM and northwest Atlantic Ocean from the Bay of Campeche, Mexico, to Massachusetts (Rivas 1966; Wilson and Nieland 2001). The species is replaced further south in the Caribbean Sea by the Caribbean red snapper (*L. purpureus)* (Wilson and Nieland 2001). Vermilion snapper range from North Carolina to the GOM and south to Brazil (Grimes 1978). Yellowtail snapper in the south Atlantic range from North Carolina to southeastern Brazil, and are most abundant off southern Florida and the Bahamas (Manooch & Drennon 1987 in Muller et al. 2003). Gray snapper are widely distributed in the western Atlantic from Florida through Brazil and the northern GOM (Robins et al. 1986 in Burton 2001). Mutton snapper range from New England to southeastern Brazil, and are most abundant around southern Florida and the Bahamas (Watanabe 2001).

Scope of the analysis and the ensuing recommendation:
Although there are many snappers caught in the southeastern U.S., only the six most commercially important species relative to landed weight and value (red, vermillion, yellowtail, gray, mutton, and lane) are discussed here. Even though there are significant recreational fisheries for many of these species, emphasis is placed on the commercial snapper fisheries in the Gulf of Mexico (Figure 1) as this sector provides most of the domestic snapper product for the U.S. seafood market. Hawaiian snappers are discussed in other Seafood Watch® reports.

Availability of Science

Life history information exists for red snapper and other commercially important snapper species, while information for some other snapper species is limited. Early life history is scant for most species, and estimates of fecundity for some species are unavailable. As with most marine fishes, data on intrinsic rate of increase (r), recruitment, pelagic phase, etc. are lacking for most snapper species. Specific fishery information (landings, fishery range and description) for countries that target snappers (other than the U.S.) probably exist, but is extremely difficult to obtain, except for those documents provided by the Food and Agriculture Organization (FAO) of the United Nations.

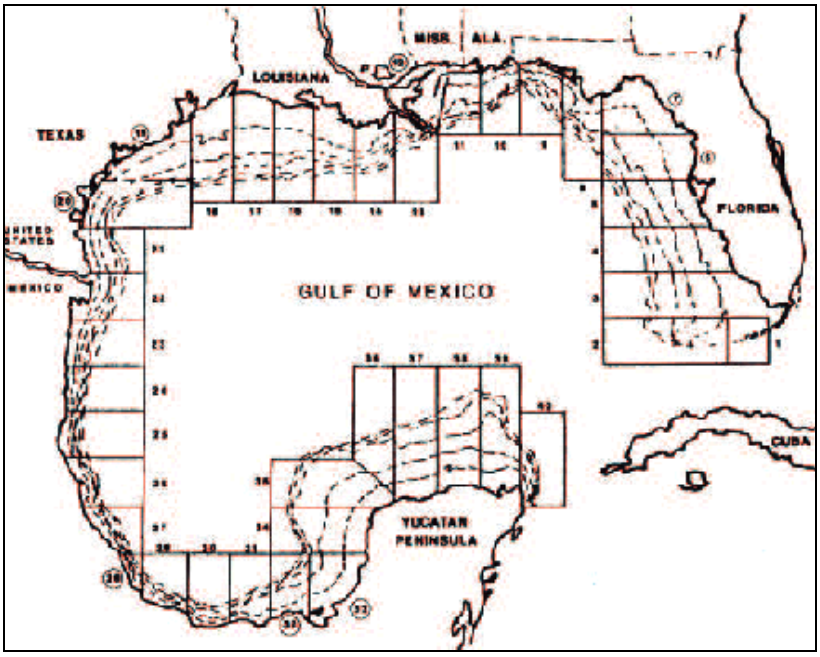


Figure 1. Map of the Gulf of Mexico region, showing NMFS survey grids (Figure from Porch and Cass-Calay 2001).

Market Information

Common/Market Names

Common names for snapper species often differ among regions, sometimes making snapper identification confusing. Additionally, the common name "red snapper" applies to at least three species of snapper around the globe; only one of which is the *Lutjanus campechanus* found in the western Atlantic and approved by the FDA to bear the authentic "red snapper" label (FDA 2002). Hawaiian red snapper, or "ehu," is *Etelis carbunculus* (WPRFMC 2000), and red snapper off the coasts of Venezuela and Brazil is *Lutjanus purpureus* (Charuau et al. 2000). Other names for red snapper in GOM include sow, rat (northwest coast of Florida), mule, chicken (northeast coast of Florida), and American red snapper (Moran 1988); when used for sushi or sashimi, red snapper is commonly sold as *tai*. Vermilion snapper are often referred to as beeliners and night snappers (Manooch 1984). Common names for gray snapper include: gray silk, mangrove, mangrove pargue, mango, black pargue, black, lawyer, silk, and snapper. Lane snapper is also called candy striper or rainbow snapper.

Seasonal Availability

Snappers are caught year-round. During the winter and spring seasons, the GOM red snapper fishery is open the first ten days of each month (until quota is reached), so fresh product may not be available on a consistent basis.

Product Forms
Snappers are available both fresh (whole, dressed, headed-and-gutted (H&G), fillets) and frozen (dressed, H&G, fillets; Business 1999) in the U.S. market. Most fillets are sold with their skin still attached to assist with species identification.

Domestic Sources
In the continental U.S., vermilion snapper composes 43% of commercial snapper landings, followed by red (38%) and yellowtail (12%) snappers (Figure 2) (NMFS 2008a).

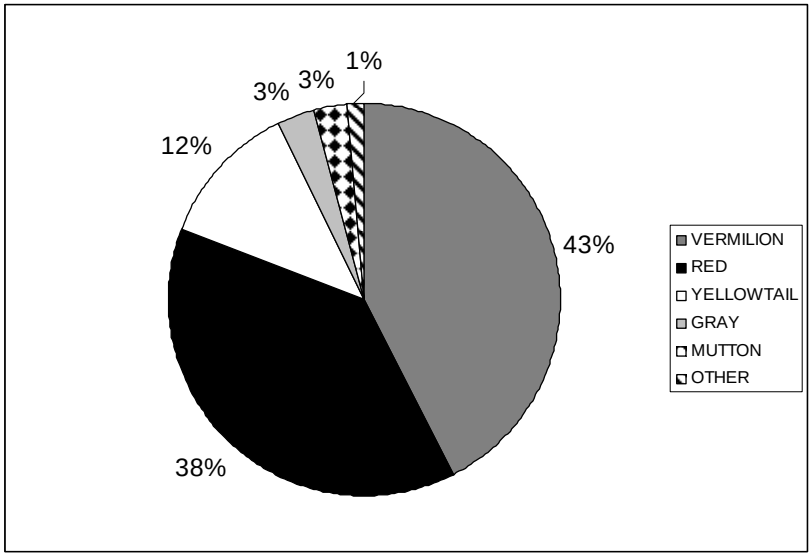


Figure 2. US commercial snapper landings by species, 2007 (Data from NMFS 2008a).

With respect to snapper landings by state, 41% of commercial landings were along the west coast of Florida (GOM) in 2007, followed by 23% in Texas, and 17% in Louisiana (Figure 3) (NMFS 2008a).

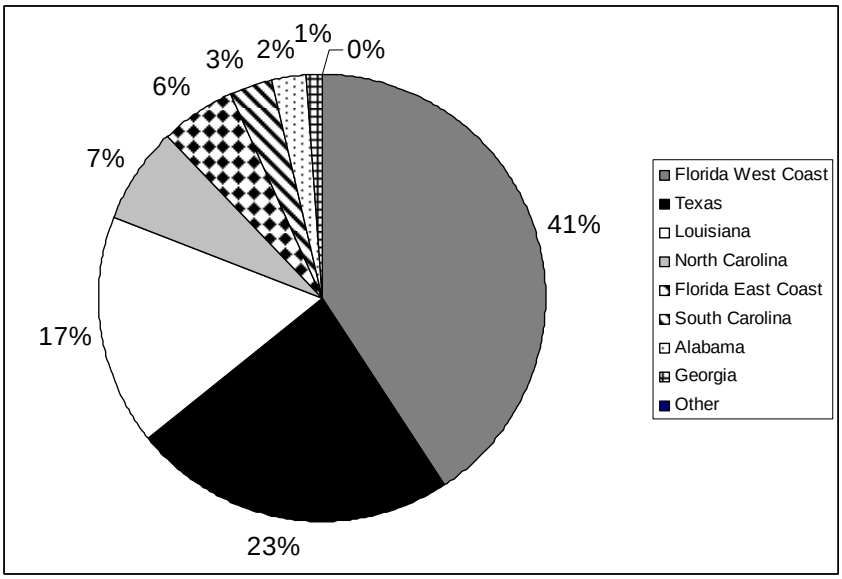


Figure 3. US commercial snapper landings by state, 2007. Note: Florida is divided between east and west coasts (Data from NMFS 2008a).

Import/Export Statistics

Imports of snapper have risen sharply in the last decade (Figure 4) (NMFS 2008f), signaling an increasing demand for this group of fish in the U.S. market. In 1989 just over 1 mt was imported; in 2007 over 18,000 mt of snapper were imported from various countries, most notably Brazil, Mexico, Nicaragua, and Panama (Figure 5) (NMFS 2008f). It does not appear that the U.S. exports snapper (NMFS 2008f), indicating the domestic catch is sold solely in the U.S. market. The combination of imports and domestic catch resulted in approximately 20,000 mt of snapper product available to the U.S. market in 2007 (NMFS 2008f).

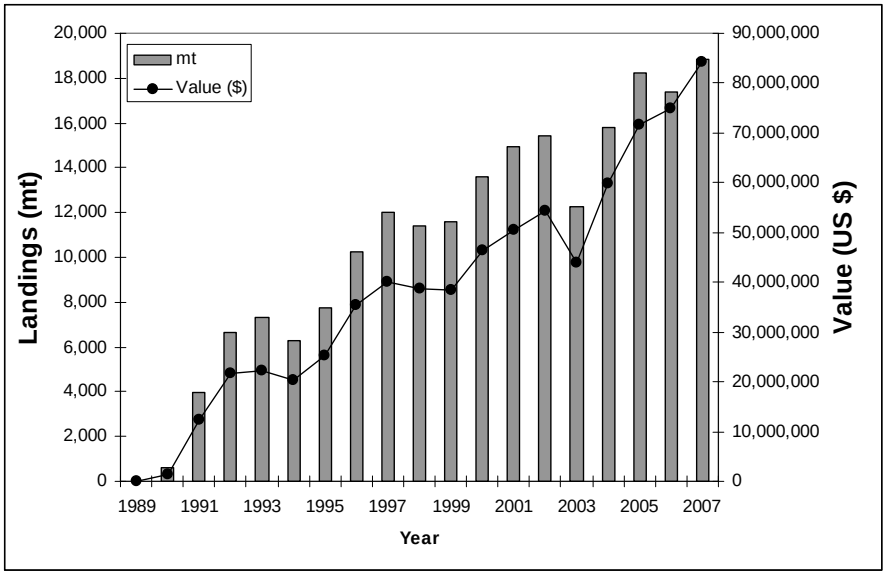


Figure 4. U.S. snapper imports, 1989 – 2007 (Data from NMFS 2008f).

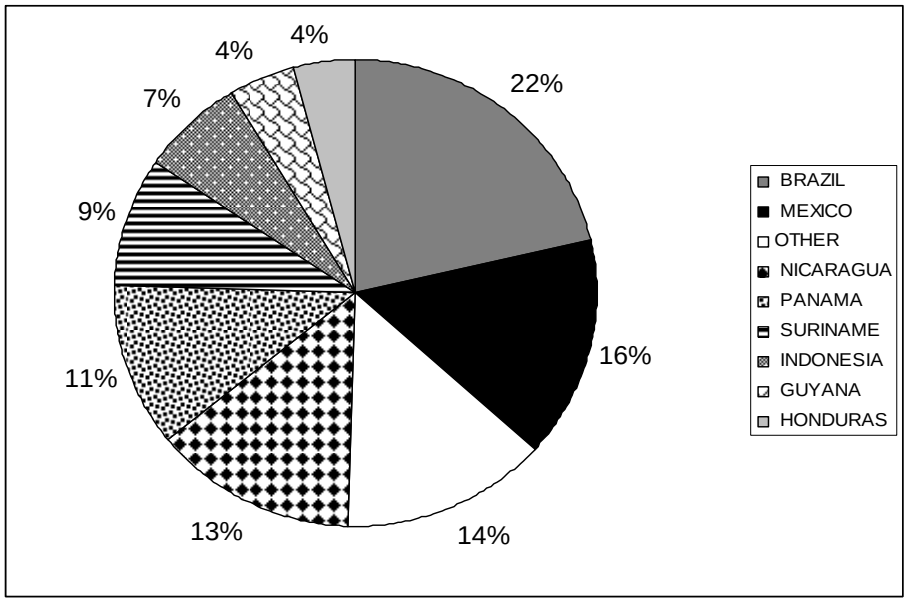


Figure 5: U.S. snapper imports by species, 2007 (Data from NMFS 2008f).

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

Criterion 1: Inherent Vulnerability to Fishing Pressure

Growth & Longevity

Snappers inhabiting the GOM are relatively fast growing and are moderately (10-30 yrs) to considerably (>30 yrs: red snapper) long-lived, with low natural mortality (Pauly 1997 in Coleman et al. 1999). Like many teleost species, snappers grow rapidly in the first few years of life and slow after reaching maturity (Moran 1988). The age at maturity is generally 1-3 years, and fecundity increases exponentially with size (Collins et al. 1987). Coleman et al. (1999) reported that one red snapper 61 cm in length produced as many eggs as 212 red snappers 42 cm in length. Longevity has been validated mainly by marginal increment analysis (MIA)[2], although the maximum age for red snapper was recently validated to be at least 55 years, using bomb radiocarbon dating (Baker and Wilson 2001). Life history information is outlined in the table below. It is important to note that this information represents general life history characteristics of snappers; regional differences have been noted.

Table 1. Life history information for commercially important GOM snappers.

COMMON NAME	GROWTH RATE/MAX SIZE	AGE @ MATURITY	LONGEVITY, VALIDATED?	FECUNDITY	Reference:
Red snapper	VBGF[3]: Male:L∞=90cm, k=0.19, Female:L∞=98cm, k=0.16	L50% = 25-36cm; A50% = 2-3yr	To 55 yrs, yes (bomb carbon)	Multiple spawn/season; 0.2 - 9.3 mil eggs (dep. on age)	(Schirripa and Legault 1999; Baker & Wilson 2001; Wilson and Nieland 2001)
Vermilion snapper	To 61cm, 2.6kg	L1st =19-32cm; A1st = 2-3	10-14 yrs, val. to age 8	Spawn Apr-Sep, 23-95 spawnings/season. 0.007 – 0.4 mil hydrated oocytes (dep. on total length)	(Zhao et al. 1997; Porch and Cass-Calay 2001; SEDAR 2006)
Yellowtail snapper	VBGF: L∞=45cm, k=0.53	L50% = 21cm; A50% = 1.7yr	To 17 years, yes (MIA)	Spawn Feb-Oct; peak in Apr-July, indeterminate fecundity	(Barbieri and Colvocoresses 2003; Garcia et al. 2003; Muller et al. 2003)
Gray snapper	VBGF: L∞ 63-72cm, k 0.13-0.17 (N vs. S FL)	2 yrs, 18-33 cm	To 25 yrs, yes (MIA)	Indeterminate fecundity	(Burton 2001; Barbieri and Colvocoresses 2003)
Mutton snapper	VBGF: L∞=87cm, k=0.16. Avg. 50cm	A50% = 3.7 yrs	To 40 yrs, yes	373,000-1.4 mil. eggs	(Watanabe 2001; Barbieri and Colvocoresses 2003; SEDAR 2008b)
Lane snapper	To 60cm TL. Avg. 36cm	10-23cm no age provided	To 17 yrs, no	Indeterminate fecundity	(Johnson et al. 1995): (Bortone and Williams 1986; Barbieri and Colvocoresses 2003)

[2] Marginal increment analysis (MIA) is an age validation method whereby the timing of ring deposition is determined.

[3] Von Bertalanffy growth function (VBGF) = a commonly used growth function in fisheries science for elucidating age and growth characteristics of fishes. Named after von Bertalanffy (1938).

Spawning
Snappers are able to spawn several times during a spawning season (Moran 1988). Most snappers aggregate to spawn, and return to the same sites to spawn each season (Coleman et al. 1999). Red snapper in the GOM generally spawn in summer and fall, and at least at one site off the coast of Florida have been observed to have one peak spawning period (Moran 1988). Yellowtail snapper are known to form large spawning aggregations off the coasts of Cuba, Turks & Caicos, and the U.S. mainland near Key West, Florida (Muller et al. 2003). Lane snapper spawn off the coast of Cuba from March through September, with spawning peaks in July and August (Bortone and Williams 1986).

Feeding
Snappers are generally nocturnal predators (Allen and Robertson 1994). Both juvenile and adult snappers are carnivorous, feeding on shrimp, mollusks, crustaceans, fish, and squid (Moran 1988; Watanabe 2001).

Species Distribution
Older red snapper in the GOM appear to favor areas of hard limestone bottoms or irregular bottom formations, and generally aggregate near coral reefs, gravel bottoms or rock outcrops, as well as on artificial reefs, oil rigs, and ship wrecks (Mosely 1966; Patterson et al. 2001). Juveniles are often found over sandy or muddy bottoms (Mosely 1966; Schirripa and Legault 1999). Mark-recapture studies off the coast of Alabama suggest that red snapper are relatively sedentary except for large storm events (hurricanes), when tagged red snapper were found to move large distances (Patterson et al. 2001). Vermilion and yellowtail snappers school in the water column above reefs and travel farther than other snapper species (Muller et al. 2003). Gray snapper and mutton snapper adults appear to associate with complex habitats, such as coral reefs, wrecks or rocky outcroppings and other natural structures, while juveniles inhabit inshore seagrass beds and mangroves (Burton 2001).

Synthesis
Snappers in the GOM and South Atlantic regions exhibit moderate (10-30 yrs) to high (>30yrs: red snapper) longevity, but grow very quickly and are fully mature in less than 5 years. They show site fidelity and aggregate to spawn, which increase their susceptibility to fishing pressure. Snappers, particularly red snapper (due to its greater longevity), are therefore considered moderately vulnerable to fishing pressure.

Inherent Vulnerability Rank:

Resilient | **Moderately Vulnerable** | Highly Vulnerable

Criterion 2: Status of Stocks

GOM Red Snapper Commercial Fishery
Red snapper is arguably the most important snapper in the GOM multi-species reef fish fishery, with catch worth US$40 million annually (Baker et al. 1998). Records of a red snapper fishery

in the GOM date as far back as the late 1800's, with 42 vessels operating out of Pensacola, Florida in 1895 (Schirripa and Legault 1999). Commercial landings of red snapper (from both Mexican and U.S. waters) peaked at approximately 6,000 mt in the mid-1960s, and exhibited a general declining trend from the mid-1960s to the mid-1970s. Landings reached an all time low in 1990; they have been relatively stable since 1995 (Figure 6) (NMFS 2008a). A TAC limit was enacted for the commercial fishery in 1990, lowered in 1991, raised in 1993 and 1996, and lowered in 2007 and 2008 (Table 4). Since their inception, commercial landings have been at or above the TAC (Figure 7) (GMFMC 2001c; NMFS 2008b; NMFS 2008c).

Figure 6. U.S. commercial landings of red snapper in the Gulf of Mexico, 1950-2007 (Data from NMFS 2008a).

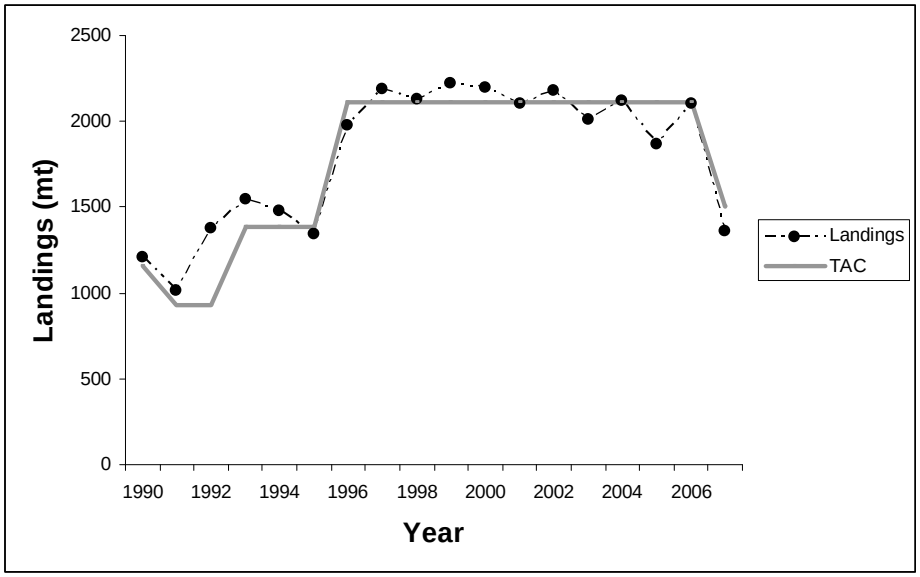


Figure 7. U.S. commercial red snapper landings vs. quota in the Gulf of Mexico, 1991-2007 (Data from GMFMC 2001c; NMFS 2008a, c).

Gulf of Mexico red snapper was most recently assessed in 2005 (SEDAR 2005). The assessment uses the effective number of spawners (S) as a proxy for stock biomass; however, data suggest that the relationship between the number of spawners and the number of recruits in the GOM is weak (SEDAR 2005). The stock is considered to be overfished when S is less than S_{MSY} and undergoing overfishing when F is greater than F_{MSY}. To better account for area-specific life history characteristics, catch statistics, and survey indices, the assessment divides the stock into an eastern and western component (SEDAR 2005). For the eastern and western components, F_{2003}/F_{MSY} is estimated at 2.6 and 2.2, respectively (2.3 combined estimate) (SEDAR 2005). For both components combined, S_{2003}/S_{MSY} is estimated at 0.29 (SEDAR 2005). According to the accepted reference points, GOM red snapper has been overfished since 1988 and is undergoing overfishing (SEDAR 2005). Stock abundance and commercial landings have exhibited declines in the long term; short term trends are variable (SEDAR 2005). Age and size distributions of the stock are truncated relative to the natural condition of the stock (SEDAR 2005). There is moderate uncertainty in the assessment (SEDAR 2005).

GOM Red Snapper Recreational Fishery

Red snapper supports an active sport fishery in the GOM, as well as the east coast of Florida, with the annual catch often surpassing the commercial catch (Figures 6 and 8). When red snapper TACs were implemented in 1990, 49% of the overall TAC was allocated to the recreational sector (MRAG AMERICAS 1997; GMFMC 2001c). Like the commercial TAC, the recreational TAC peaked in 1996 before being lowered in 2007 and 2008. In 2007, recreational fishery landings exceeded the TAC (Table 4) (Figure 9) (GFMC 2001c; NMFS 2008c). Recreational landings in 2007 totaled 1,710 mt (NMFS 2008c).

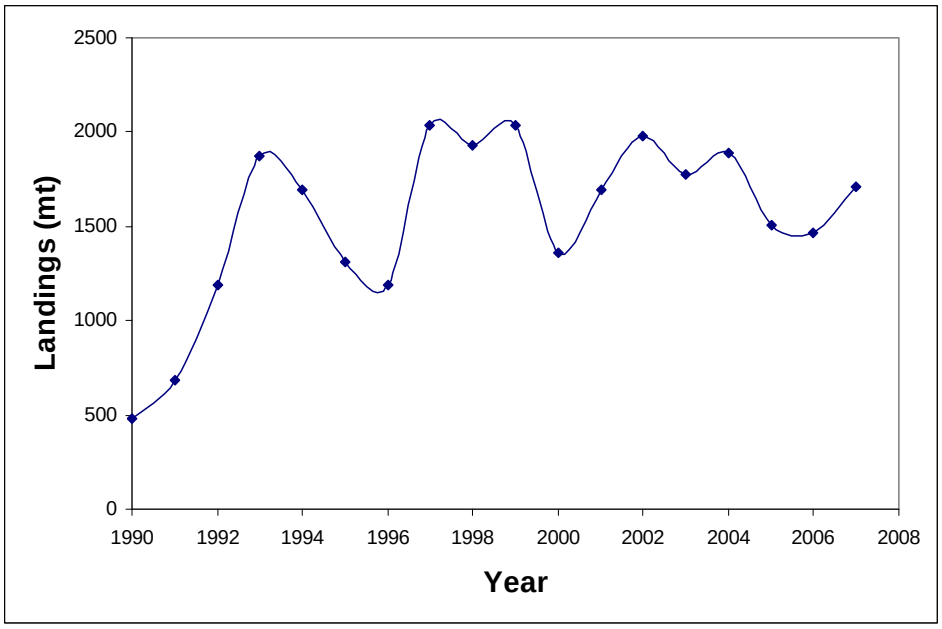


Figure 8. Recreational snapper harvest from U.S. waters, 1990-2007 (Data from NMFS 2008b).

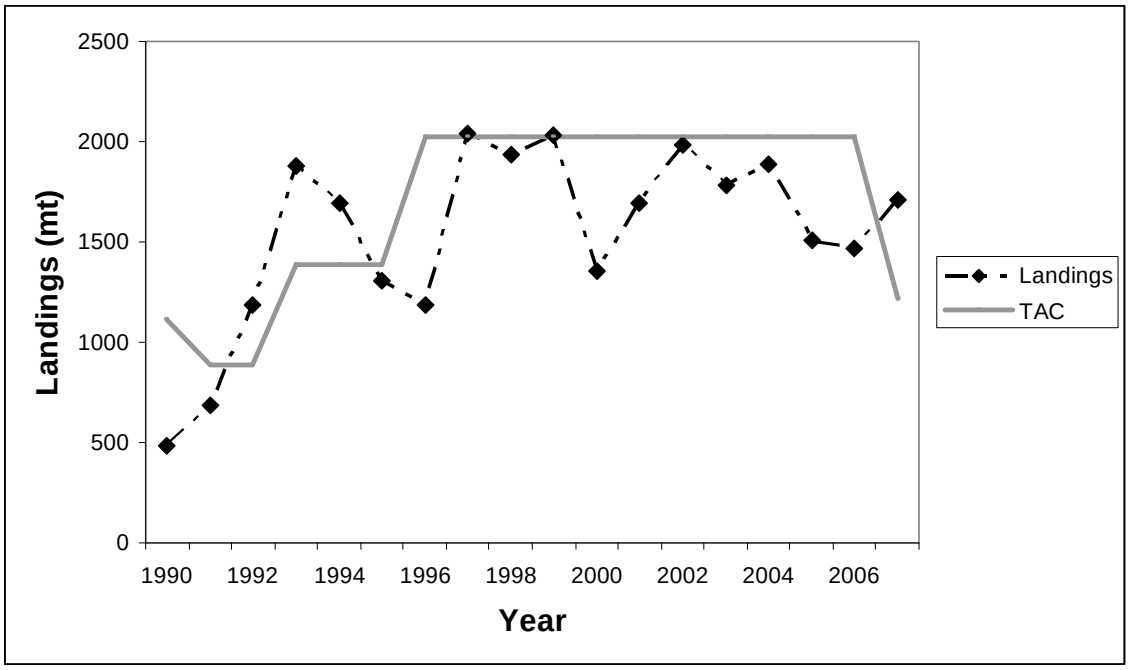


Figure 9. Recreational red snapper landings vs. quota from the Gulf of Mexico, 1990-2007 (Data from GFMC 2001c; NMFS 2008b, c).

Southeastern Atlantic Red Snapper Stock

Commercial red snapper landings peaked in 1968 at 473.1 mt in the southeastern Atlantic; in 2007 landings totaled 51.6 mt, comprising 3.6% of total U.S. commercial landings (the remaining 96.4% of landings originated from the Gulf of Mexico) (Figure 10) (NMFS 2008).

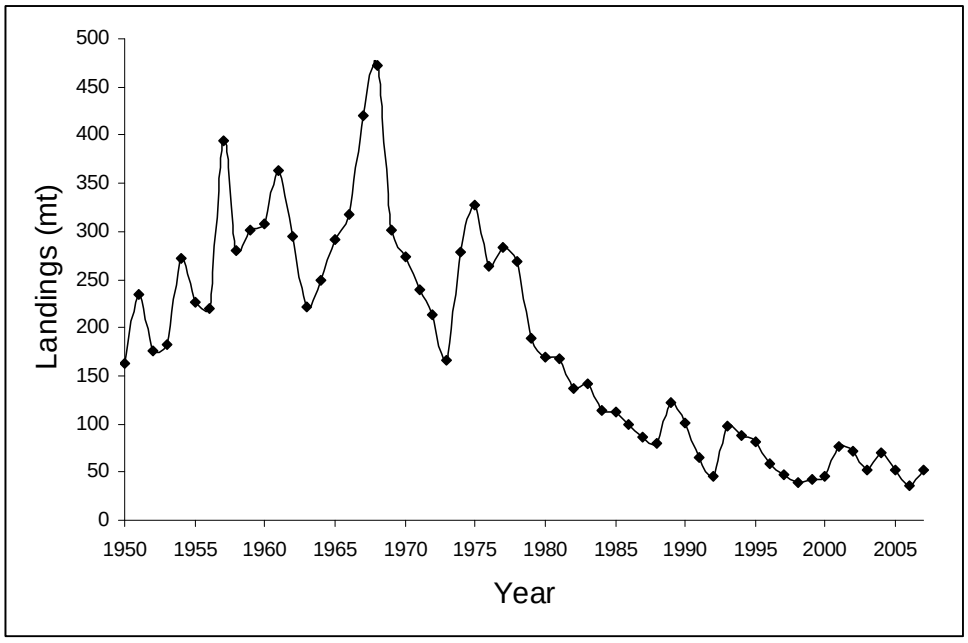


Figure 10. Commercial landings of red snapper in the southeastern Atlantic, 1950-2007 (Data from NMFS 2008).

The southeastern Atlantic red snapper stock was most recently assessed in 2008 (SEDAR 2008a). The assessment defines the stock as overfished when spawning stock biomass (SSB) is less than the minimum stock size threshold (MSST)[4] and undergoing overfishing when F is greater than the maximum fishing mortality threshold (MFMT), defined as F_{MSY} (SEDAR 2008a). The level of fishing mortality needed to produce a spawning potential ratio (SPR40%) of 40% of the unfished stock ($F_{40\%,}$), and $MSST_{F40\%}$, the minimum stock size threshold necessary to yield a SPR of 40% of the unfished stock, were used as proxies for MSY (SEDAR 2008a). The ratio of $SSB_{2006}/MSST_{F40\%}$ is estimated at 0.025 and $F_{2006}/F_{40\%}$ is estimated at 12.02, indicating that the southeastern Atlantic red snapper stock is overfished and undergoing overfishing (SEDAR 2008a). While historical data indicate that short-term trends (1984-2006) in stock abundance, measured as biomass and SSB, have been variable, there has been considerable long-term decline in the stock abundance and an increase in relative fishing mortality ($F/F_{40\%}$) (Figures 11 & 12) (SEDAR 2008a). Age structure of the stock relative to natural condition is truncated and uncertainty in the assessment is moderate (SEDAR 2008a).

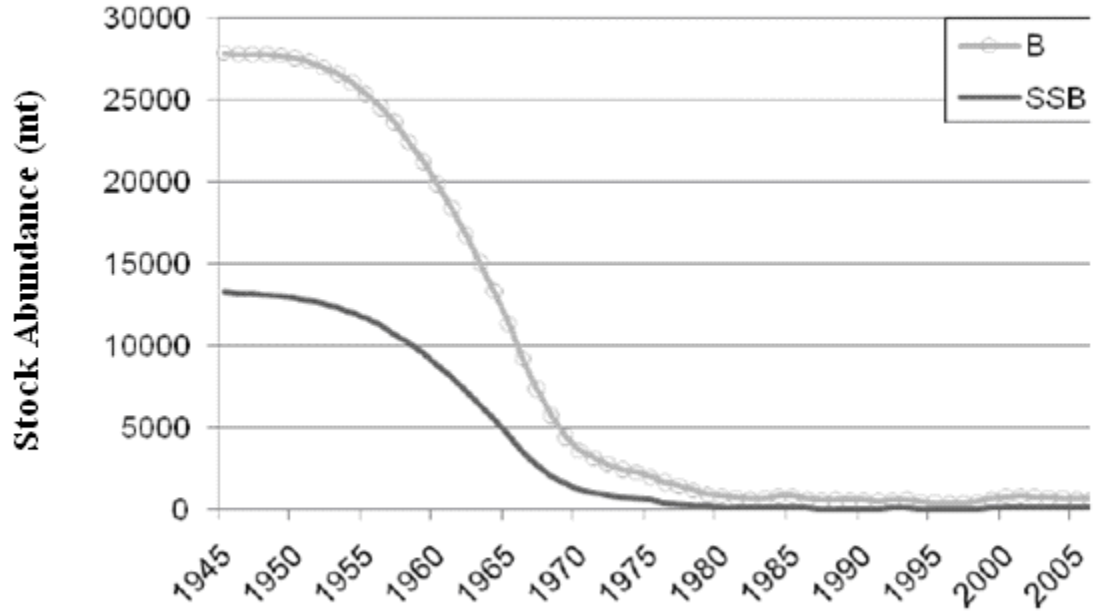


Figure 11. Biomass (B) and spawning stock biomass (SSB) of southeastern Atlantic red snapper, 1945-2007 (Figure from SEDAR 2008a).

[4] MSST is defined as $(1\text{-}M)SSB_{MSY,}$ with M (natural mortality of the stock) equaling a constant, 0.078.

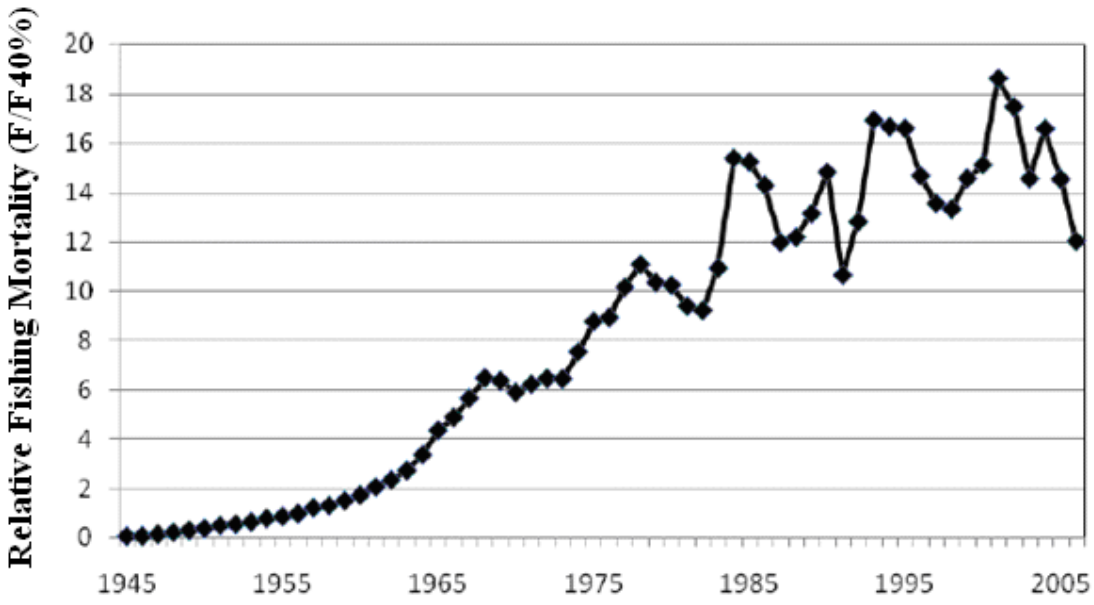


Figure 12. Relative fishing mortality of southeastern Atlantic red snapper, 1945-2007 (Figure from SEDAR 2008a).

Vermilion Snapper Fishery

Vermilion snapper is reported to be sedentary, thus it has been assumed that at least two separate stocks exist, one along the east coast and the other in the GOM (Porch and Cass-Calay 2001). Schirripa (2000) suggested that commercial fishers in the GOM may target vermilion snapper when the red snapper fishery is closed (after TAC is reached for the red snapper fishery). Landings in all sectors are mainly accomplished by using hook and line, with approximately 3% of the commercial fleet (~ 30 vessels) catching 50% of the total fish catch (Schirripa 2000). Landings were low through the 1970s, increased sharply around 1983, and peaked in 1993 at approximately 2.8 million lbs (1,236 mt; Figure 13) (Schirripa 2000). The GOM fishery accounts for a greater proportion of the commercial landings than the south Atlantic (Figure 14). Recreational landings in the GOM were greatest in the late 1980s and early 1990s (~ 650 mt), but have since declined to nearly half the level observed (~ 230 mt) in the late 1990s (Porch and Cass-Calay 2001). Recreational fishing[5] off the southeastern coast of Florida is relatively minor compared to the GOM; headboat[6] landings off southeastern Florida have held steady at about 200 mt annually (NMFS 2003).

[5] Vermilion snapper are rarely encountered nearshore, so all recreational catch comes from private or charter boat.
[6] A vessel for hire that charges each angler on a per-person, or "per-head" basis.

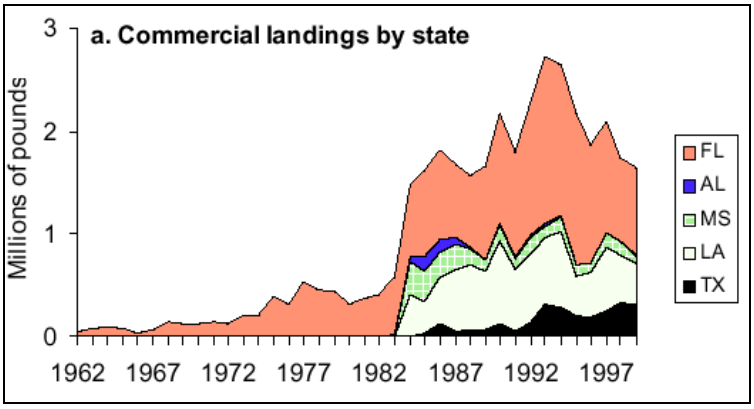


Figure 13. Commercial GOM vermilion snapper landings by state (Figure from Porch and Cass-Calay 2001).

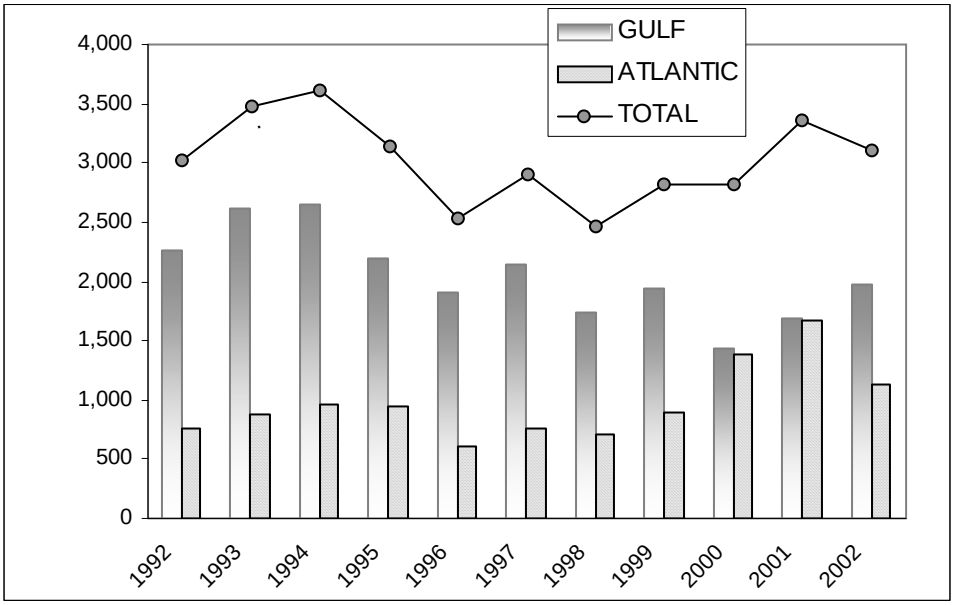


Figure 14. A comparison of commercial vermilion snapper landings (millions of pounds, mp) between the GOM and Atlantic states, 1992-2002 (Data from NMFS 2003).

GOM Vermilion Stock

This stock was first assessed in 1991 (GMFMC 2001a). By the 1996 assessment, the stock was showing signs of overfishing, such as a decrease in landings, CPUE, and mean fish size (Porch and Cass-Calay 2001). The 2001 assessment concluded that the GOM vermilion snapper stock was overfished with overfishing occurring. However, the most recent stock assessment (2006) used a new model, which concluded that the stock is neither overfished nor undergoing overfishing. Spawning stock biomass (SSB) relative to SSB at maximum sustainable yield (MSY) and SPR30% are 1.8 and 7.5, respectively, indicating that the population is not overfished (Figure 15). Biomass has decreased since 1950, but is above the overfished threshold (Figure 15). Fishing mortality (F) relative to F_{MSY} and SPR30% is 0.65 and 0.67, respectively, indicting that the population is currently not experiencing overfishing (Figure 16) (SEDAR 2006). However, the model used for the 2006 assessment is new and highly uncertain. In addition, vermilion snapper are caught in the same fishery as red snapper, which has a critical stock status. As such, Seafood Watch® remains precautionary when ranking the stock status of GOM vermilion snapper.

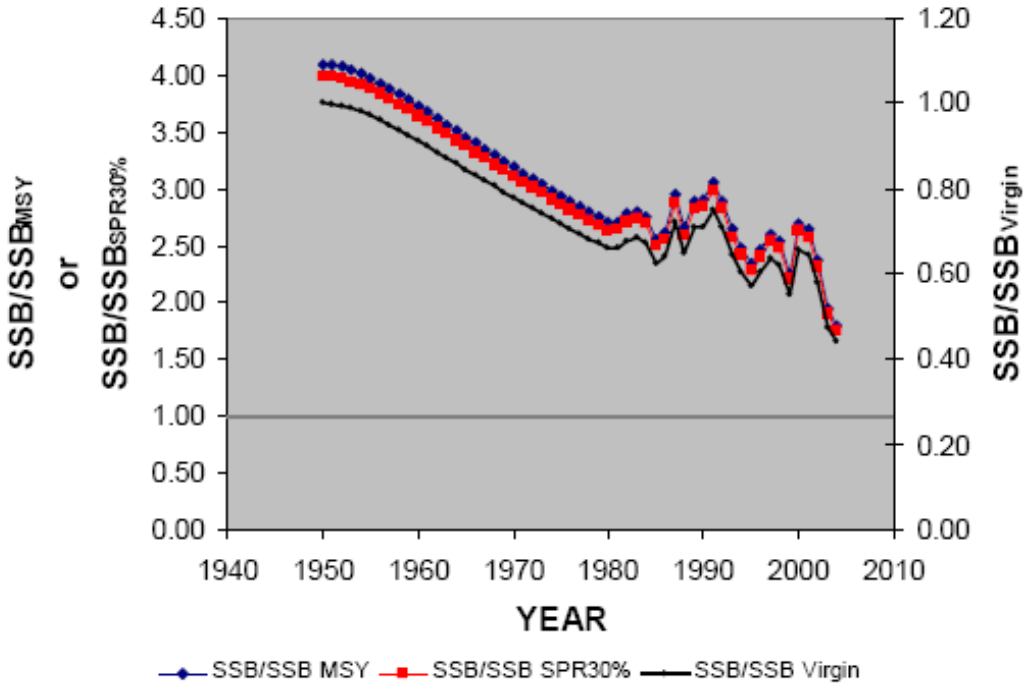


Figure 15. Spawning stock biomass (SSB) relative to SSB at MSY, SPR 30%, and virgin condition for the GOM vermilion snapper stock (SEDAR 2006).

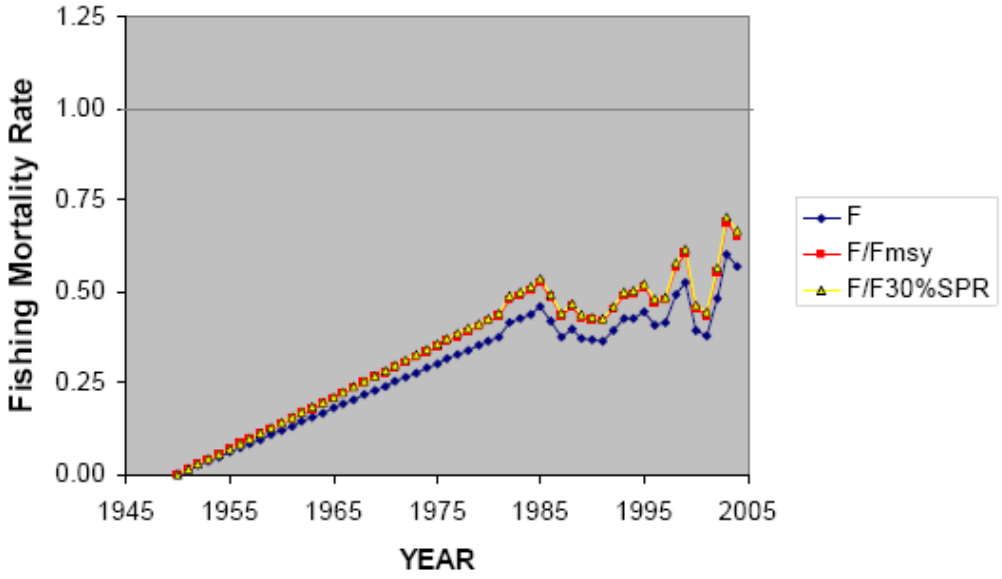


Figure 16. Fishing mortality rate (F) relative to Fmsy and F30%SPR for the GOM vermilion snapper stock (SEDAR 2006).

Southeastern Atlantic Vermilion Stock

This stock was first assessed in 1998 and the authors reported SPR values of 21 to 27% for 1996, indicating the stock was overfished (SEDAR 2003a). The most recent assessment (SEDAR

2008c) used up-to-date life history and fishery data (dependent and independent) and a slightly different model scenario[7]. Although some of the models were inconclusive with respect to stock status, there was confidence that the stock was experiencing overfishing almost every year since the early 1980s (Figure 17). Spawning stock biomass increased slightly between 1995 and 1999, but has since steadily declined (Figure 18) (SEDAR 2008c).

[7] The 2003 assessment did not consider selectivity, maturity, and fecundity as functions of age, as did the previous assessment, but rather as functions of length, which is believed to be the more accurate approach (p. 28, SEDAR 2003a).

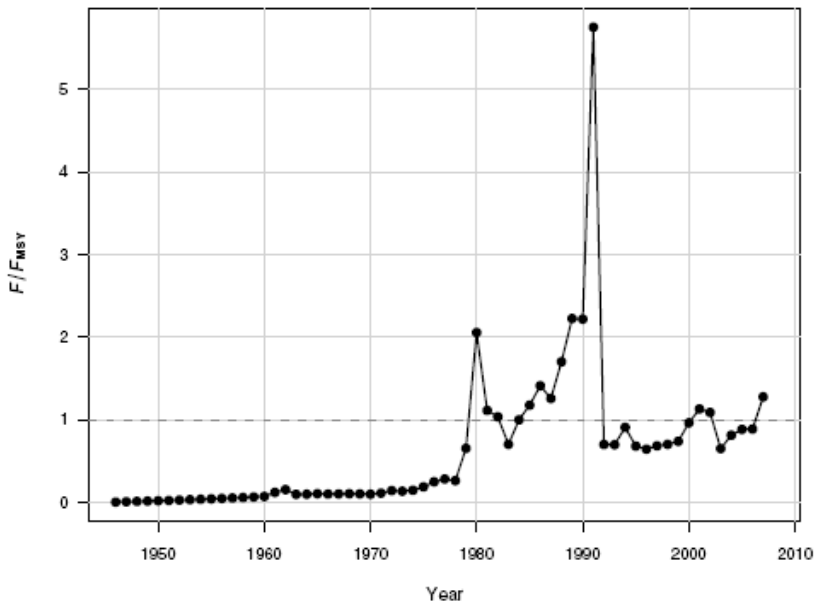


Figure 17. Estimates of full fishing mortality (F) relative to F_{MSY} for the southeastern vermilion snapper stock (Figure from SEDAR 2008c).

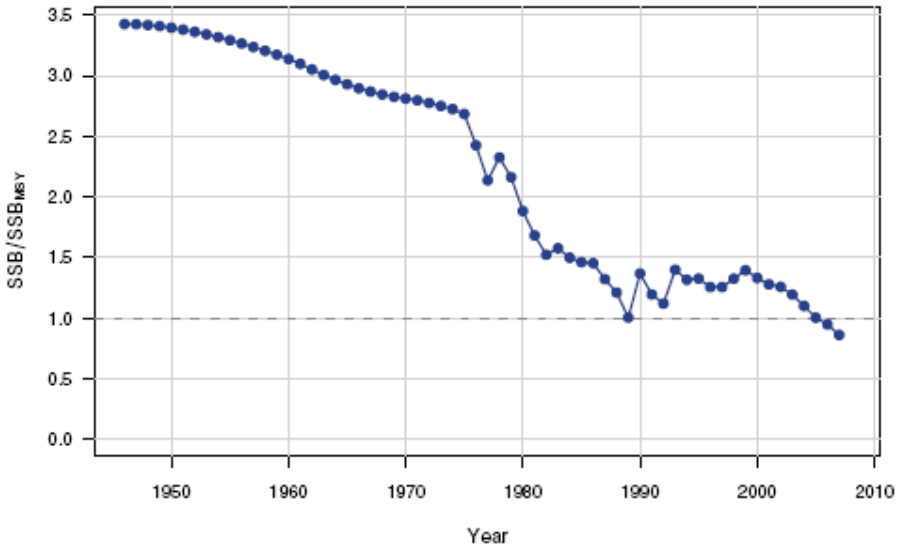


Figure 18. Trajectory of spawning-stock biomass (SSB) to SSB_{MSY} ratio for the southeastern vermilion snapper stock, estimated from base case of length-0 structured model (SEDAR 2008c).

Yellowtail Snapper

Yellowtail snapper are fished throughout the tropical Atlantic and Caribbean oceans, particularly by the countries of Brazil and Mexico (Figure 19). Due to their close association with reef structures, most yellowtail snapper landed in the U.S. originates from the Florida Keys and around southeastern Florida (SEDAR 2003b). This species is targeted primarily with hook-and-line gear by recreational, headboat, and commercial fishers (SEDAR 2003b). Landings of this species in the Florida Keys accounted for approximately 92% of U.S. commercial landings in 2001. Landings for yellowtail snapper averaged ~1,000 mt in the early 1980s, ~1,500 mt in the early 1990s, and then decreased to ~980 mt in the late 1990s (SEDAR 2003b). A total of 802 mt were harvested in 2001.

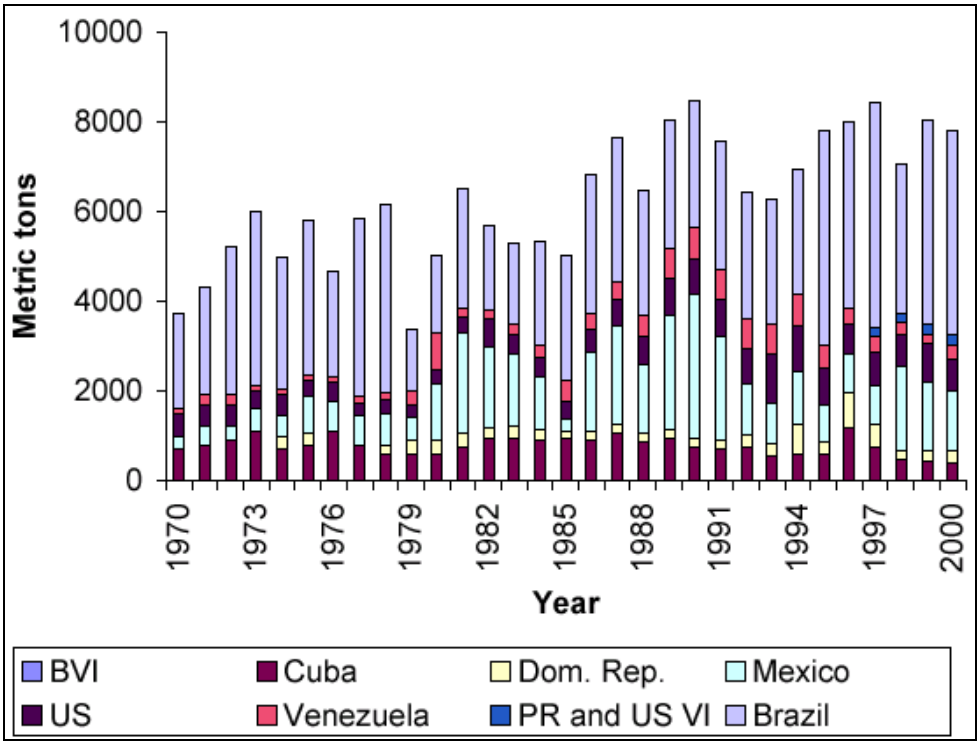


Figure 19. Western Atlantic landings (mt) of yellowtail snapper by country. Data are a composite of information from United Nations Food and Agriculture Organization (FAO), Data and Statistics Unit, and the National Marine Fisheries Service (NMFS) (SEDAR 2003b).

A formal stock assessment was initiated in 2002 over concerns that this species was experiencing overfishing. Assessment biologists used fisheries-dependent (catch/effort indices) and independent data (visual surveys, life history studies) to determine stock abundance and condition (SEDAR 2003b). Using age-structured data in population analyses, the assessment team found signs of a relatively healthy population. For example, recruitment has been high since 1999 and not particularly dependent upon spawning stock biomass (SSB), abundance of older (4+ years of age) individuals increased (Figure 20), and fishing mortality (0.4 – 0.6) has been below F_{MSY} for the past 3 years (SEDAR 2003b). The estimated MSY for this species was between 1,342 – 1,965 mt; the total recent harvest is approximately 850 – 1,000 mt (including discards) (SEDAR 2003b). Total and spawning biomass have been increasing since 1998 (Figure 21) (SEDAR 2003b) and B/B_{MSY} has recently been estimated at 1.21 (Table 3) (NMFS

2008e). Thus, the assessors concluded that the yellowtail snapper was neither overfished nor undergoing overfishing.

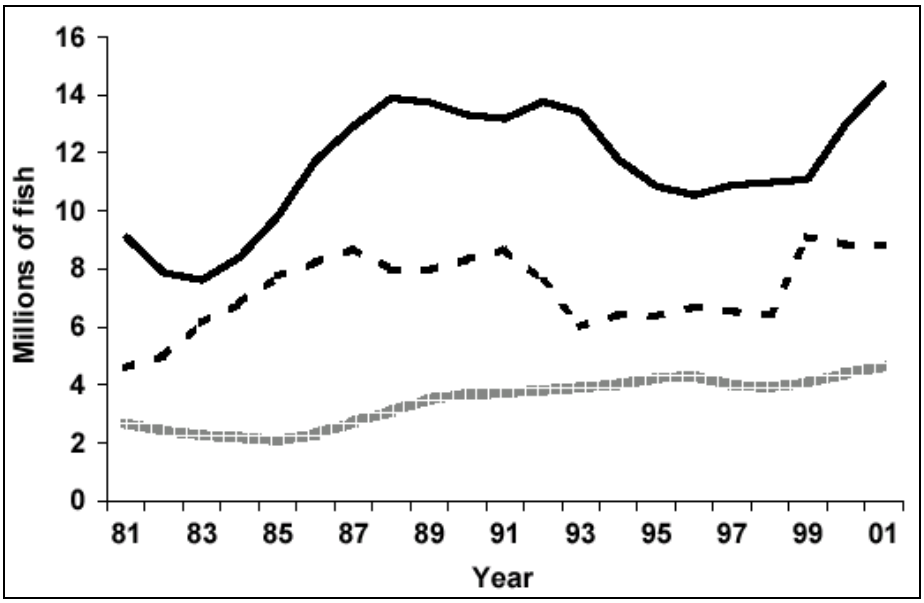


Figure 20. Estimated average annual abundance of age-0 (dashed line) and age-1 (solid line), and ages 4+ (heavy stippled line) yellowtail snapper during 1981-2001 (Figure from SEDAR 2003b).

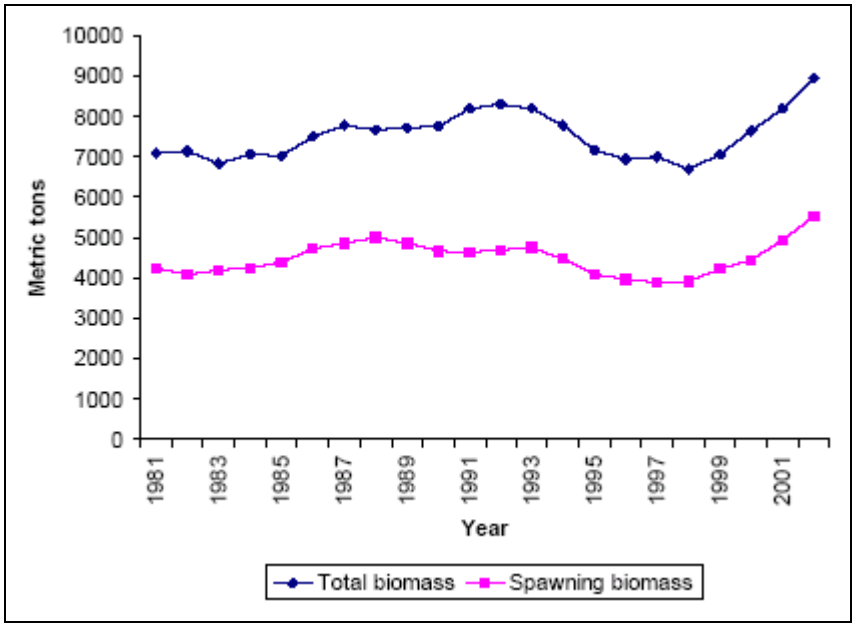


Figure 21. Estimated total and spawning biomass of yellowtail snapper in metric tons, 1981-2001 (Data from SEDAR 2003b).

Gray, Lane, and Mutton Snappers

Gray, lane, and mutton snappers are also caught in recreational, headboat and commercial fisheries, but at much lower volume than the three previously-discussed species. Gray snapper are caught primarily off the coast of Florida (Burton 2001); commercial catch averaged 163 mt/yr between 1998-2007 (NMFS 2003a). The average commercial catch of mutton and lane

snappers between 1998-2007 were 119 mt and 27 mt per year respectively (NMFS 2008a). Mutton snapper are not considered to be overfished ($B/B_{MSY} = 1.14$), nor undergoing overfishing ($F/F_{40\%} = 0.69$; $F/F_{30\%} = 0.51$) in the South Atlantic or Gulf of Mexico (NMFS 2008e). In the GOM, the stock status of gray and lane snappers and the occurrence of overfishing are unknown. In the South Atlantic, gray and lane snappers are not considered to be undergoing overfishing ($F/F_{30\%} = 0.51$) but it is unknown whether they are overfished (NMFS 2008e).

International Snapper Fisheries

The Caribbean red snapper (*Lutjanus purpureus*) is the principal stock targeted by fishers in Venezuela, Brazil, and French Guiana (Charuau et al. 2000). Red snapper composed 85% of Venezuelan demersal fleet landings from 1997-1999, and for the Brazilian fleet, it constituted 86% of the handline catch (1974-1976) and 83% of the trap catch (1998-1999; Charuau et al. 2000). Off Guyana, approximately 93% of the total yearly fish catch is red snapper. The other 7% of Guyana's yearly fish catch is comprised of grouper, vermilion snapper and other fishes (Charuau et al. 2000).

According to Charuau et al. (2000), many snapper stocks in the southeastern Caribbean are either fully or over-exploited, or the status is unknown (Table 2).

Table 2. Summary of assessment results for *L. purpureus* relevant to management by country. Source: Charuau et al. (2000)

COUNTRY	ESTIMATED STATUS OF RESOURCE	ASSESSMENT METHOD	COMMENTS
Brazil	Over-exploited and at risk of recruitment overfishing	Catch-curve analysis and per recruit reference points	72% of catch by handline and longlines and 63% of catch by traps is immature fish
French Guiana	Fully to over-exploited	VPA and per recruit analyses	Increasing numbers of young fish in catch
Suriname	No work done		
Guyana	Preliminary data only		
Venezuela:			
i) Caribbean coast	Over-exploited	Catch curve analysis and per recruit reference points	
ii) Atlantic coast	No work done		56% of catch from longline and handline fisheries is immature fish
Trinidad & Tobago	Fully exploited	Catch curve analysis and per recruit reference points	

There is very little specific information on the Mexican snapper fishery. Total fish production for the country has been around 1.5 million tons annually, and of the 30 main fish stocks in Mexican waters (GOM and Pacific), 20 are considered to be at their maximum sustainable level or are overfished (FAO 1998). These figures may or may not include snapper fisheries.

Table 3. Stock status of snappers (Gulf of Mexico = GOM; South Atlantic = SA).

Common Name	Classification Status	B/ B_{MSY}	Overfishing	F/ F_{MSY}	Abundance Trends/ CPUE	Age/Size/ Sex Distrib.	Degree of Uncertainty in Stock Status	Sources	SFW Rank
Red Snapper (GOM)	Overfished	0.11	Yes	Eastern = 2.6 Western = 2.2	Long-term decline; Short-term variable	Truncated	Moderate	MRAG AMERICAS 1997; Schirripa and Legault 1999; SEDAR 2005; NMFS 2008a; NMFS 2008e	Critical
Red Snapper (SA)	Overfished	0.025	Yes	12.02	Long-term decline; Short-term variable	Truncated	Moderate	SEDAR 2008a; NMFS 2008e	Critical
Vermilion Snapper (GOM)	Not Overfished	1.53	No	0.65	Long-term decline; Short-term decline	Unknown	High	Porch and Cass-Calay 2001; SEDAR 2006; NMFS 2008e	Poor[8]
Vermilion Snapper (SA)	Unknown	Unk.	Yes	> 1	Long-term-variable; Short-term-increase	Unknown	High	NMFS 2003; NMFS 2008e	Poor
Yellowtail Snapper	Not Overfished	1.21	No	0.41-0.6[9]	Variable	Unknown	High	SEDAR 2003b; NMFS 2008e	Healthy
Gray Snapper	GOM: Unknown SA: Unknown	Unk.	GOM: Unknown SA: No	Unk.	Unknown	Unknown	High	NMFS 2008e	Moderate
Lane Snapper	GOM: Unknown SA: Unknown	$SSB_{2006}/SSB_{F30\%}$ = 1.14	GOM: Unknown SA: No	$F_{2006}/F_{30\%}$ = 0.51	Unknown	Unknown	High	NMFS 2008e	Moderate
Mutton Snapper	GOM: Not overfished SA: Not overfished	1.14	GOM: No SA: No	$F/F_{40\%}$ = 0.69 $F/F_{30\%}$ = 0.51	Unknown	Unknown	High	NMFS 2008e; SEDAR 2008b	Moderate

[8] GOM vermilion snapper stock status is ranked as "poor" due to the fact that is caught in the same fishery as red snapper, which has a critical stock status.
[9] Estimated value range calculated from 2001 catch and the estimated MSY range found in the text.

Synthesis

Red snapper in the GOM and south Atlantic are currently classified as overfished, with the stocks currently experiencing overfishing, making it a critical conservation concern according to Seafood Watch® criteria. Based on the 2006 stock assessment model, vermilion snapper from the GOM is recovering from its overfished status and is not experiencing overfishing; however, this conclusion is based on a new and highly uncertain model. In addition, vermilion snapper is caught in the same fishery as red snapper, which has a critical stock status. Thus, Seafood Watch® is precautionary and ranks vermilion snapper as being in "poor" condition. According to FAO data, internationally caught snappers are being fully-exploited and depleted, the Atlantic vermilion stock is experiencing overfishing, and these two stocks/regions are both ranked as being in "poor" condition. Mutton snapper are not considered overfished or undergoing overfishing; however, due to the high uncertainty of the assessment, Seafood Watch® airs on the side of caution in ranking these stocks as "moderate." The stock status of gray and lane snappers is unknown and is therefore ranked as "moderate." Yellowtail snapper stocks have recently been assessed and appear to be sustained by the current level of fishing effort, and they are ranked as "healthy" at this time.

Status of Wild Stocks Rank:

Yellowtail snapper:

Healthy Moderate/Rebuilding Poor Critical

Gray, Mutton, and Lane snapper:

Healthy **Moderate/Rebuilding** Poor Critical

International, Vermilion snapper:

Healthy Moderate/Rebuilding **Poor** Critical

Red snapper:

Healthy Moderate/Rebuilding Poor **Critical**

Criterion 3: Nature of Bycatch

Seafood Watch defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for and managed in some way.

Commercial fishers generally take snapper species with bottom longlines, wire-mesh fish traps, and vertical hook and line. The snapper (reef fish) fishery in the GOM uses primarily handline, but various other types of gear, including power assisted lines (bandit rigs), bottom longlines, buoys, and to a lesser extent, fish traps (Schirripa and Legault 1999). Many commercial fishermen in the GOM fish on numerous offshore oil and gas platforms that have become valuable three-dimensional habitat for reef fish (Nieland and Wilson 2000). In the Atlantic, most snappers are caught with hook and line; trawling for vermilion snapper has been prohibited since January 1989 (NMFS 2003). Most of the catch in the southeast Caribbean (Brazil, Venezuela, French Guiana etc.) is conducted by handline and traps, with increasing use of longlines (Charuau et al. 2000).

In 1995, an observer program was initiated in the handline red snapper fishery off Louisiana and Texas to assess the degree of discard mortality in the commercial fleet. Observers aboard handline vessels reported that 40.7% of the red snapper caught were discarded, and that by weight these fish comprised approximately 19% of the entire catch (Schirripa and Legault 1999). Discard mortality was estimated to be 20% from recreational gear and 33% from commercial fisheries. More recent estimates suggest discard mortality is higher, however. Wilson et al. (2003) found that approximately 69% of released fish from the commercial fishery were dead (or near death), and over 80% of released fish from the recreational fishery showed signs of stress upon release. In the directed snapper fishery, logbook data from 2001 indicated that about 16% of discards were yellowtail snapper; of those, approximately 28% were dead (Muller et al. 2003).

In a recent study, Poffenberger (2004) reported the amount of discards from various gear types in the snapper/grouper fishery in the GOM and South Atlantic. In a random sampling of vessels (20% of the fishery) crews were asked to report discards from each trip between August 2001 and July 2003. Based on this report, it was concluded that both the bottom longline and handline fisheries in the GOM and Atlantic discard several hundred thousand pounds of finfish and sharks annually, with variable rates of mortality. It was also determined that a vast majority of discards are forced by management regulations such as size limits and closed seasons for certain species particularly red snapper (GOM only). The most common discarded species include: black sea bass, snappers, porgies, sharks, grunts, amberjacks, and groupers (Poffenberger 2004).

Recent observer data from the National Marine Fisheries Service (NMFS) revealed that longliners fishing off the Florida coast were catching relatively high abundances of sea turtles, especially loggerheads (NMFS 2008, unpublished data). The data indicate that approximately one loggerhead is hooked every two longline sets, and mortality may exceed 50%.

GOM Shrimp Fishery Bycatch

The possible role of shrimp trawl bycatch and discards on the population decline of many snapper species in the GOM was first raised in the 1970s by commercial snapper fishermen

(Bradley and Bryan 1975) and was later confirmed by discard data from the shrimp trawl fishery (Figure 22) (Schirripa 2000). In 1997, an independent report was commissioned by NMFS to evaluate research and management practices within the GOM and to address the negative impact of the shrimp trawl fishery on red snapper stocks. The report stated that the number of juvenile red snapper caught as bycatch in shrimp trawls must decrease, and that current data collection techniques used to estimate shrimp bycatch need to be improved (MRAG AMERICAS 1997).

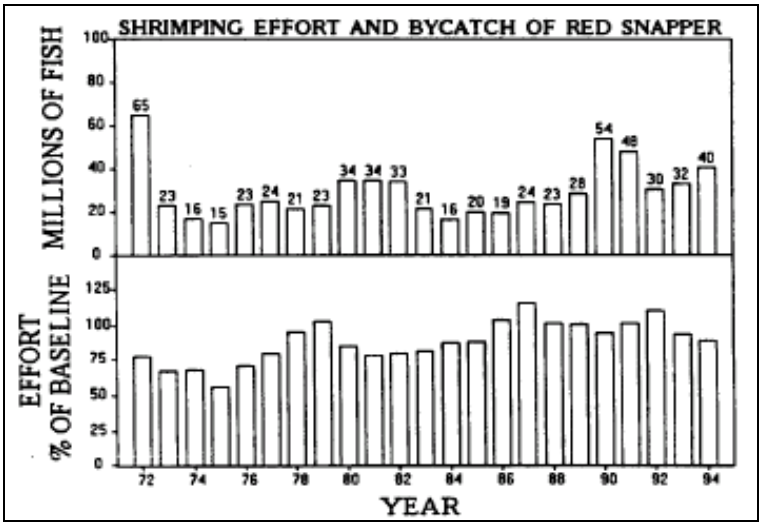


Figure 22. Estimates of the annual numbers of total red snapper discarded as shrimp bycatch and weighted shrimping effort by year (Figure from Goodyear 1995).

Shrimp fishermen operating in the U.S. South Atlantic and western GOM have been required to use bycatch reduction devices (BRDs) since 1996 and 1998, respectively. These devices are expected to reduce bycatch of red snapper and other finfish species by as much as 60% after 5 years and up to 80% after 10 years (Watson 2001). The Texas Parks and Wildlife Commission also recently implemented a regulation requiring the use of BRDs in all commercial trawls operating in state waters and targeting shrimp for consumption (TP&W 2001). The reduction in mortality to date is thought to be approximately 40%, although NMFS expects an increase to 50% over time, based on results from BRD testing[10]. There is no available information on bycatch or discard mortality in international shrimp or snapper fisheries.

Synthesis

Bycatch in snapper fisheries can be high and regularly includes protected species such as sea turtles. As such, Seafood Watch® deems bycatch in the snapper fisheries to be a high conservation concern. Bycatch of juvenile red snapper in the GOM shrimp trawl fishery has largely impacted the stock abundance of that species, but the shrimp fishery is not evaluated here.

Nature of Bycatch Rank: Low Moderate **High** Critical

[10] Steven Atran. 2003. Personal Communication. Gulf of Mexico Fishery Management Council. 3018 North U.S. Highway 301, Suite 1000, Tampa, Florida 33619-2272.

Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems

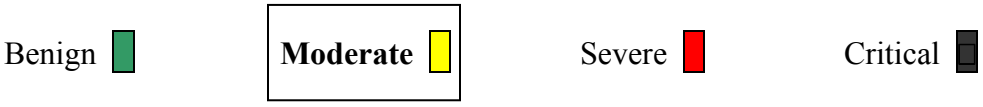
Fishing gear used to catch snapper is mainly hook and line based (rod/reel, handline, bandit gear, etc.), which, compared with more invasive trawling gears, shows minimal signs of impacting habitat. However, bottom longline and trap fisheries for snapper exist and may have moderate impacts. In a review of the fishing gear used in the Southeast region of the 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" (p. 38). It is possible that with the kind of commercial and recreational effort observed for the snapper fisheries, damage and fouling of coral structures does occur, however the extent of the effects is not known at this time.

Although the ecosystem-level effects of reduced snapper biomass remain uncertain, a few studies that include other top predators (e.g., groupers; Serranidae) provide evidence that reductions can have important direct and indirect impacts. For example, Stallings (2008) experimentally demonstrated that reduced abundances of an intensively-fished predatory reef-fish (Nassau grouper) resulted in a strong trophic cascade, with drastic negative effects on entire communities and populations of reef fishes. As management moves towards a more ecosystem-level approach, more researchers are calling for maintenance of the functional components (e.g., top level predators) of the food and interaction webs (Hughes et al. 2005; Appeldoorn 2008). Given their roles as top predators, it is possible that reduced biomass of snappers could have substantial impacts on the marine systems in which they live.

Synthesis

The GOM/South Atlantic snapper fishery occurs over coral and rocky bottom areas, which have low resilience to disturbance. Whether removal of snapper biomass has an effect on the ecosystem in general is questionable, but it is reasonable to assume there are moderate ecosystem effects associated with the volume of biomass removal (4,137 mt/year for GOM red snapper alone). Given this information, Seafood Watch ranks the habitat and ecosystem impacts of the fishery as a moderate conservation concern.

Effect of Fishing Practices Rank:



Criterion 5: Effectiveness of the Management Regime

In the U.S., snapper stocks are managed by two federal agencies: the Gulf of Mexico Fishery Management Council (GMFMC) and the South Atlantic Fishery Management Council (SAFMC). The SAFMC first implemented its Snapper-Grouper Fishery Management Plan (FMP) in 1983, which regulated fishing for 12 snapper species along the southeastern U.S., from North Carolina through the Florida Keys. The GOM snapper stocks are managed under the Reef Fish Fishery Management Plan (RFFMP), established in November 1984 and supplemented as needed by amendments designed to further protect the snapper stock.

Red snapper

The first Gulf of Mexico red snapper stock assessment, conducted in 1988, indicated that red snapper was significantly overfished, and determined that a 60-70% reduction in fishing mortality would be required to rebuild the stock to the recommended SPR20% (SEDAR 2005). Management responded in 1990 by establishing a TAC of 2,268 mt (see Table 4 for the history of TAC limits) (GMFMC 2001c; NMFS 2008c &d). In 1991, management established a target date of 2007 for the rebuilding of the stock (GMFMC 2001c). In 1992, this date was extended to 2009; in 1996, this date was extended to 2019; and in 2001, this date was extended to 2032, where it currently stands (GFMC 2001c). The latest extension was based on the estimated time to recovery without fishing mortality (12 years) and the mean generation time for red snapper (19.6 years) (GMFMC 2001b; SEDAR 2005). From 1900 to present, Gulf of Mexico red snapper fisheries have regularly exceeded their allocated TACs (Figures 7 and 9) (NMFS 2008a, b, c). Historically, management has responded to landings in excess of their TAC by implementing size limits, bag limits, and trip limits on the commercial and recreational red snapper fisheries in the Gulf of Mexico (SEDAR 2005).

Table 4. TAC limits for the Gulf of Mexico red snapper fishery (GMFMC 2001c; NMFS 2008c, d)

Year	Commercial TAC (mt)	Recreational TAC (mt)	Total TAC (mt)
1990	1156.7	1111.3	2268
1991-1992	925.3	889.1	1814.4
1993-1995	1388	1388	2776
1996-2006	2109.2	2027.6	4136.8
2007	1503.7	1220.6	2724.3
2008	1156.7	1111.3	2268

While these management efforts were intended to rebuild stocks, they instead created a "derby-style" fishery, in which fishers raced to catch as much red snapper as they can during the short fishing season (averaging 77 days from 1996-2003). According to Baker et al. (1998), this resulted in "supply gluts, depressed prices, wasteful disposal of red snapper bycatch during the off-season, increased pressure on other reef fish, danger to fishers, and damage to the long-term viability of the stock." On January 1, 2007 management addressed this concern by implementing an Individual Fishing Quota (IFQ) program for red snapper (NMFS 2008d). This program allocates transferable catch shares, defined as percentages of the commercial TAC, to commercial fishers, based on their historical landings (NMFS 2008d). The IFQ program abolishes seasons and trip limits to allow commercial fishers to fill their quotas at the rate they see fit (NMFS 2008d). Upon implementation, a total of 546 individuals qualified for initial catch shares ranging from 0.0001-6.0203% based on the criteria set forth by management (NMFS 2008d).

Intending to end the overfishing of red snapper by 2010 in order to adhere to its 2032 rebuilding target date, management added Amendment 27 and Amendment 14 to the Gulf of Mexico red snapper and shrimp FMPs (73 FR 19). Amendment 24 reduces the minimum size to 13 inches total length for the commercial fishery (the minimum size for the recreational fishery remains 16 inches); reduces the bag limit from four to two fish for the recreational fishery; establishes an

annual recreational fishing season from June 1 through September 30; and requires the use of non-stainless steel circle hooks (73 FR 19). Amendment 14 aims to reduce the shrimp trawl bycatch mortality of red snapper to 74% below 2001-2003 levels by resorting time-area closures (73 FR 19).

Vermilion Snapper

Management recently (2006) assessed the GOM vermilion stock and determined that the stock was neither overfished, nor undergoing overfishing; however the assessment relies on highly uncertain reference points. Currently, there is no TAC for vermilion snapper in the GOM (GMFMC 2003) but a size limit of 10 inches exists. Monitoring of stocks has improved over the years. Before 1993, only 20% of Florida's commercial vessels (Reef Fish Permit holders) were required to provide logbook catch data; reporting became mandatory after 1993 (Porch and Cass-Calay 2001).

Yellowtail Snapper

Management has assessed this stock as one unit and concluded that it is in relatively healthy condition. Effort is regulated through a limited entry program (Reef Fish Permit). Regulations for this species include a 12-inch size limit (305 mm); there is no set quota (GMFMC 2003).

Other Snappers

Ten other snapper species are taken in commercial and recreational reef fish fisheries. At this time management allows an aggregate, recreational bag limit. Stock assessments to determine sustainable catch levels related to abundance have yet to be conducted.

International Management

Fishery agencies in Latin America and the Caribbean have generally been downsized and transferred to lower levels of government, with limited functions and administrative responsibilities. Presently, a few occur at the Ministerial level (e.g., Cuba and Peru) and some at an under-Ministry level (e.g., Mexico), however most are lower-level fishery divisions (e.g., Panama), fishery service departments (e.g., Brazil), or fishery offices (e.g., Caribbean countries). Many are having difficulty carrying out their management and enforcement duties (FAO 1997). For example, regulations in Brazil require that no more than 15% of snapper landed be less than the size at maturity, but this regulation is not enforced (Souza and Curtrim 2000).

Table 5. Commercial catch management measures for GOM snappers.

Management Jurisdictions & Agencies	Total Allowable Landings	Size Limit	Gear Restrictions	Trip Limit	Area Closures	Sources
GMFMC, SEFMC	5 MP	Red snapper: 13 inches (C) 16 inches (R) Yellowtail snapper:	Non-stainless steel circle hooks must be used for GOM reef fish	Red snapper: 2 fish bag limit (R) [11]	Red snapper: Oct 1 - May 31 (R)	SEDAR 2005; 73 FR 19; NMFS 2008d;

[11] The commercial red snapper fishery is subject to an IFQ program.

		12 inches				

C – commercial fishery; R – recreational fishery

Synthesis

State and federal agencies in the GOM have developed a FMP to address overexploitation issues in both commercial and recreational snapper fisheries. They have assessed the stocks for red, vermilion, and yellowtail snapper, but have not adequately assessed other commercially important snapper species (gray, lane, and mutton). Of the stocks that have been assessed, red snapper is overfished with overfishing occurring; vermilion and mutton snappers are not overfished, but assessments are highly uncertain; and yellowtail snapper are neither overfished, nor experiencing overfishing. Therefore, management has a mixed track record in sustaining snapper stocks. Red snapper commercial and recreational fisheries in the GOM also have a history of exceeding TACs. Management has responded to red snapper stock status by enacting an IFQ program to encourage conservation among stakeholders as well as Amendments 27 and 14, which impose tighter restrictions on recreational fishing vessels and are intended to reduce red snapper bycatch mortality in the shrimp trawl fishery. Management of the U.S. fishery is deemed moderately effective because while it has addressed diminishing stocks and regularly assesses red, vermilion, and yellowtail snapper stocks, it has not adequately enforced TACs nor maintained stock productivity of red snapper.

The governments of Brazil and Venezuela (and other Caribbean nations) are limited by resources and personnel; more management is needed to monitor and enforce regulations there. For many other countries, management and regulations may exist, but there is almost no way of determining their success. In addition, these areas are showing signs of overfishing, indicating that management is not effective at sustaining stocks.

Effectiveness of Management Rank:

U.S. GOM/South Atlantic:

Highly Effective | **Moderately Effective** | Ineffective | Critical

International:

Highly Effective | Moderately Effective | **Ineffective** | Critical

IV. Overall Evaluation and Seafood Recommendation

Snappers (and reef fish in general) possess a suite of life history characteristics (e.g. life span of 20 to greater than 30 years, high site fidelity, and regular aggregation at spawning sites) that make them moderately vulnerable to fishing pressure. Red snapper stocks in the South Atlantic and the Gulf of Mexico are currently overfished and undergoing overfishing, while yellowtail and mutton snapper stocks are not overfished, nor undergoing overfishing in either region. According to the most recent stock assessment, the GOM vermilion snapper stock is not

overfished and not experiencing overfishing. However, this assessment is based on a new, highly uncertain model. Additionally, vermilion snapper are caught in the same fishery as red snapper, which has a critical stock status. As such, Seafood Watch® is precautionary when ranking the stock's status. In the South Atlantic[12], stock assessments indicate vermilion snapper stock health is poor and that overfishing is occurring, but it is unknown if the stock is overfished. In the South Atlantic, gray and lane snappers are considered not to be undergoing overfishing; it is unknown whether they are overfished. Their stock status in the Gulf of Mexico is unknown. Although data are generally lacking for international stocks, there is evidence that many are fully or overexploited.

U.S. fishers target snappers with bottom longline (deeper water) and handline (shallow water) gear. Bycatch discards in the handline fishery are relatively high and contribute to overall fishing mortality of the respective snappers. In addition, protected species such as sea turtles are captured in the longline fishery. Fishing methods and reductions in snapper biomass are thought to have moderate impacts on habitat and ecosystems. Red, vermilion, and yellowtail snapper stocks have been assessed using fisheries- dependent and independent data, and these fisheries have been actively managed through a limited entry system, annual quotas, size limits, trip limits, and seasonal closures. Management, however, has not prevented declines in the GOM red snapper stock (where the bulk of landings occurs), and has not assessed the status of other commercially important stocks. Therefore, management is considered moderately effective. International management of snappers appears to be ineffective at preventing declines in countries where valuable snapper fisheries occur.

Overall, red snapper receives a recommendation of **Avoid** due to its critical stock status. Imported snapper populations are overfished and management is ineffective, resulting in a recommendation of **Avoid**. Vermilion snapper is of poor stock status and is caught in the same fishery as red snapper, which has a critical stock status; therefore, vermilion snapper is recommended as **Avoid**. Due to the moderate inherent vulnerability of snappers to fishing pressure, high levels of bycatch in the fisheries, and moderately effective management, gray, mutton, lane, and yellowtail snappers are recommended as **Good Alternatives**.

Table of Sustainability Ranks

	Conservation Concern			
Sustainability Criteria	**Low**	**Moderate**	**High**	**Critical**
Inherent Vulnerability		√		
Status of Stocks	√ (Yellowtail snapper)	√ (Gray, mutton, lane snappers)	√ (Vermilion snapper, International)	√ (Red snapper)
Nature of Bycatch			√	
Habitat & Ecosystem Effects		√		
Management Effectiveness		√ (U.S.)	√ (International)	

[12] Throughout this report, the terms 'South Atlantic' and 'southeastern Atlantic' refer to the southeastern region of the United States.

Overall Seafood Recommendation:

Gray/Lane/Mutton/Yellowtail snappers:

Best Choice | **Good Alternative** | Avoid

Red/Vermilion/International snappers:

Best Choice | Good Alternative | **Avoid**

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

Supplemental Information

Consumption advice on the Seafood Watch© pocket guides is provided by Environmental Defense. Environmental Defense Fund applies the same risk-based methodology as the U.S. Environmental Protection Agency (EPA) to data from government studies and papers published in scientific journals. Environmental Defense Fund has issued a consumption advisory for mutton snapper and lane snapper due to elevated mercury levels. More detailed information about the Environmental Defense advisory can be found at www.edf.org/seafoodfhealth.

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VI. Appendices

Appendix 1

Prior to the 2006 SEDAR Gulf of Mexico vermilion stock assessment, NMFS designated the GOM vermilion snapper stock as overfished with overfishing occurring. The 2006 stock assessment used a new model, which concluded that the stock is not overfished and not experiencing overfishing. However, this new model is highly uncertain. In addition, vermilion snapper is caught in the same fishery as red snapper, which has a critical stock status. Therefore, Seafood Watch® is precautionary and ranks the stock status as "poor." The overall seafood recommendation for vermilion snapper remains "Avoid."

Appendix 2

Prior to the 2005 stock assessment (SEDAR VII), Gulf of Mexico red snapper was considered to be overfished and undergoing overfishing. The 2005 stock assessment provides stock biomass (S_{2003}/S_{MSY}= 0.29) and fishing mortality reference points (F_{2003}/F_{MSY}=2.3). NMFS recently released a 2008 southeast Atlantic red snapper stock assessment, which deems the stock to be overfished ($SSB_{2006}/MSST_{F40\%}$= 0.027) and undergoing overfishing ($F_{2006}/F_{40\%}$=12.02). The stock status of red snapper remains "critical." Red snapper management measures were also updated to incorporate the IFQ program and Amendment 27/14. U.S. management of snappers in the southeast Atlantic and the Gulf of Mexico continues to be ranked as "moderately effective." The overall seafood recommendation for red snapper remains "Avoid."

Prior to the 2008 stock assessment (SEDAR 15A), Gulf of Mexico mutton snapper was considered neither overfished nor undergoing overfishing. The 2008 stock assessment provides stock biomass ($S_{2006}/S_{30\%}$= 1.14) and fishing mortality reference points ($F_{2006}/F_{30\%}$=0.51). Population trends for mutton snapper, including abundance, biomass, and recruitment, have been up in recent years. However, concern remains over issues of bycatch, vulnerability, and habitat and ecosystem-level impacts. Thus, the overall seafood recommendation for mutton snapper remains "Good Alternative."

Appendix 3

Capture Fisheries Evaluation

Species: *Snappers*	**Region:** *South Atlantic/Gulf of Mexico*
Analyst: *Chris Stallings*	**Date:** *February 4, 2009*

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished[13] 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 guidelines[14] to synthesize these factors
- A resulting **rank** for that criterion

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

[13] "Fish" is used throughout this document to refer to finfish, shellfish and other wild-caught invertebrates.
[14] 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.

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.

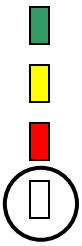
CRITERION 1: INHERENT VULNERABILITY TO FISHING PRESSURE

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 Factors[15] to evaluate

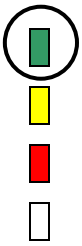
Intrinsic rate of increase ('r')

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



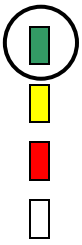
Age at 1st maturity

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



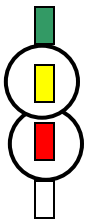
Von Bertalanffy growth coefficient ('k')

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



Maximum age

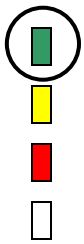
- Low (< 11 years)
- Medium (11 - 30 years) **VS, YS, GS, LS**
- High (> 30 years) **RS, MS**
- Unavailable/Unknown



[15] 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)

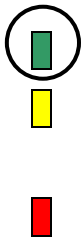
- High (> 100 inds./year)
- Moderate (10 – 100 inds./year)
- Low (< 10 inds./year)
- Unavailable/Unknown



Secondary Factors to evaluate

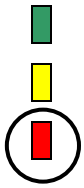
Species range

- 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)



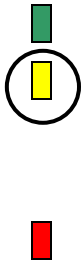
Special Behaviors or Requirements: Existence of special behaviors that increase ease or population consequences of capture (e.g. migratory bottlenecks, spawning aggregations, site fidelity, unusual attraction to gear, sequential hermaphrodites, segregation by sex, etc., OR specific and limited habitat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



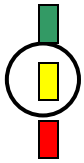
Evaluation Guidelines

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)



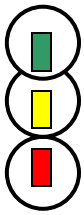
CRITERION 2: STATUS OF WILD STOCKS

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

Primary Factors to evaluate

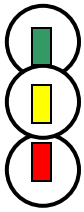
Management classification status

- Underutilized OR close to virgin biomass **YS**
- Fully fished OR recovering from overfished OR unknown **GS, LS, VS, MS**
- Recruitment or growth overfished, overexploited, depleted or "threatened" **RS, Int**



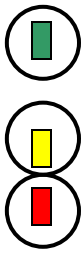
Current population abundance relative to B_{MSY}

- At or above B_{MSY} (> 100%) **YS, MS, VS_{GM}, LS**
- Moderately Below B_{MSY} (50 – 100%) OR unknown **GS, Int, VS_{SA}**
- Substantially below B_{MSY} (< 50%) **RS**



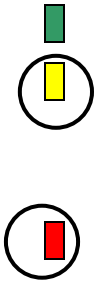
Occurrence of overfishing (current level of fishing mortality relative to overfishing threshold)

- Overfishing not occurring ($F_{curr}/F_{msy} < 1.0$) **YS, MS, VS_{GM}, LS**
- Overfishing is likely/probable OR fishing effort is increasing with poor understanding of stock status OR Unknown **GS, Int**
- Overfishing occurring ($F_{curr}/F_{msy} > 1.0$) **RS, VS_{SA}**



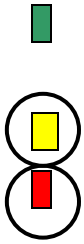
Overall degree of uncertainty in status of stock

- Low (i.e. current stock assessment and other fishery-independent data are robust OR reliable long-term fishery-dependent data available)
- Medium (i.e. only limited, fishery-dependent data on stock status are available) **RS**
- 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) **YS, MS, VS, LS, GS, Int**



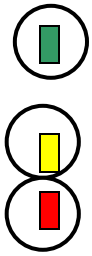
Long-term trend (relative to species' generation time) in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up
- Trend is flat or variable (among areas, over time or among methods)
- OR Unknown **YS, MS, VS_{SA}, LS, GS, Int**
- Trend is down **RS, VS_{GM}**



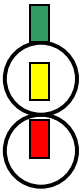
Short-term trend in population abundance as measured by either fishery-independent (stock assessment) or fishery-dependent (standardized CPUE) measures

- Trend is up **$\underline{VS_{SA}}$**
- Trend is flat or variable (among areas, over time or among methods)
- OR Unknown **YS, MS, RS, LS, GS, Int**
- Trend is down **$\underline{VS_{GM}}$**



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

- Distribution(s) is(are) functionally normal
- Distribution(s) unknown **YS, MS, VS, LS, GS, Int**
- Distribution(s) is(are) skewed **RS**



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:

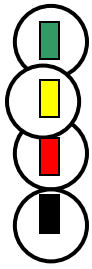
1) Is fully fished AND trend in abundance is down AND distribution parameters are skewed
2) Is overfished, overexploited or depleted AND trends in abundance and CPUE are up.
3) Overfishing is occurring AND stock is not currently overfished.

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) **YS**
- Moderate (Stock Moderate or Unknown) **GS, MS, LS**
- High (Stock Poor) **VS, Int**
- Stock Critical **RS**



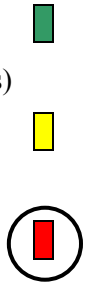
CRITERION 3: NATURE AND EXTENT OF DISCARDED BYCATCH[16]

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

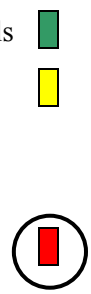
Quantity of bycatch, including any species of "special concern" (i.e. those identified as "endangered", "threatened" or "protected" under state, federal or international law)

- 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):

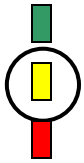
- Trend in bycatch interaction rates is down
- Trend in bycatch interaction rates is flat OR Unknown
- Trend in bycatch interaction rates is up
- Not applicable because quantity of bycatch is low

[16] 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:

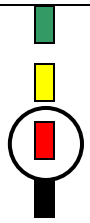
1) Quantity of bycatch is > 100% of targeted landings
2) Bycatch regularly includes species of "special concern" AND evidence indicates bycatch rate is a contributing factor toward extinction or limiting recovery AND trend in bycatch is down.

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



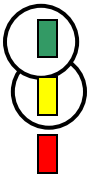
CRITERION 4: EFFECT OF FISHING PRACTICES ON HABITATS AND ECOSYSTEMS

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

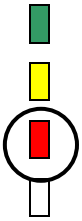
Known (or inferred from other studies) effect of fishing gear on physical and biogenic habitats

- 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



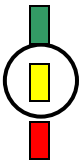
If gear impacts are moderate or great, spatial scale of the impact

- 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

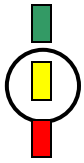
Evidence that the removal of the targeted species or the removal/deployment of baitfish has or will likely substantially disrupt the food web

- 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:

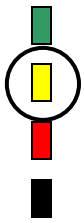
1) Gear results in great damage AND the resilience of physical and biogenic habitats to disturbance is moderate or low.
2) Both Ecosystem Factors are red.

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

- Low (Fishing Effects Benign)
- Moderate (Fishing Effects Moderate)
- High (Fishing Effects Severe)
- Critical Fishing Effects



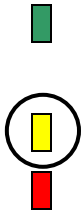
CRITERION 5: EFFECTIVENESS OF THE MANAGEMENT REGIME

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

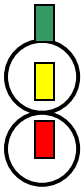
Stock Status: Management process utilizes an independent scientific stock assessment that seeks knowledge related to the status of the stock

- 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 **US, Int**
- No stock assessment available now and none is planned in the near future



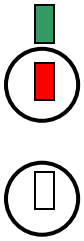
Scientific Monitoring: Management process involves regular collection and analysis of data with respect to the short and long-term abundance of the stock

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



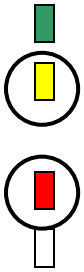
Scientific Advice: Management has a well-known track record of consistently setting or exceeding catch quotas beyond those recommended by its scientific advisors and other external scientists:

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



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 **US**
- No bycatch plan implemented or bycatch plan implemented but not meeting its conservation goals (deemed ineffective) **Int**
- Not applicable because bycatch is "low"

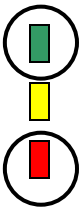


Fishing practices: Management addresses the effect of the fishing method(s) on habitats and ecosystems

- 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 **US, Int**

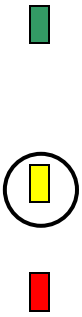
Enforcement: Management and appropriate government bodies enforce fishery regulations

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



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 **US, Int**
- 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

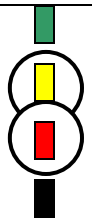
Management is deemed to be "Ineffective" if three individual management factors are red, including especially those for Stock Status and Bycatch.

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 (US)

- Low (Management Highly Effective)
- Moderate (Management Moderately Effective) **US**
- High (Management Ineffective) **Int**
- 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

	Conservation Concern			
Sustainability Criteria	Low	Moderate	High	Critical
Inherently Vulnerability		●		
Status of Wild Stocks	●	●	●	●
Nature and Extent of Discarded Bycatch			●	
Habitat and Ecosystem Effects		●		
Effectiveness of Management		●	●	

Overall Seafood Recommendation

Best Choice

Good Alternative **GS, LS, MS, YS**

Avoid **RS, VS, Int**