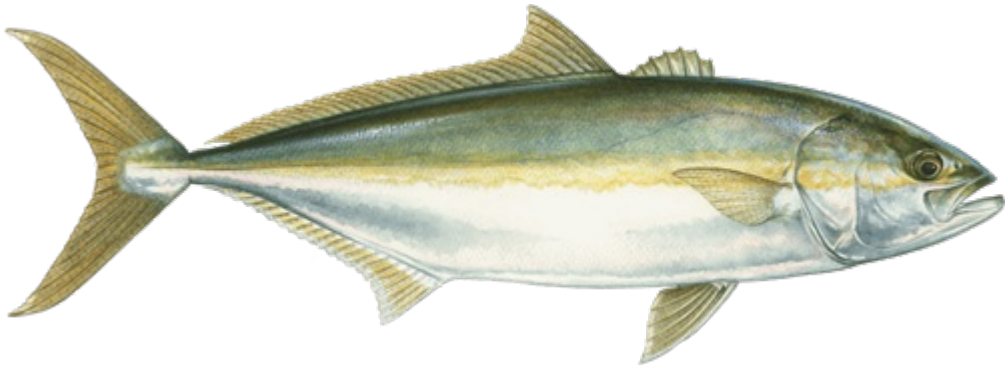
Monterey Bay Aquarium Seafood Watch®

White Seabass & California Yellowtail

Atractoscion nobilis
Seriola lalandi



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California and Eastern Central Pacific

Bottom gillnet, Drift gillnets (driftnets), Hooks and lines

September 5, 2018

Seafood Watch Consulting Researcher

Seafood Watch Standard used in this assessment: Standard for Fisheries vF3

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

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

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Watch assessments in any way they find useful.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

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

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

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

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

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

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

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

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

Summary

This report covers the white seabass (*Atractoscion nobilis)*, California yellowtail *(Seriola lalandi)*, and giant sea bass (*Stereolepis gigas)* fisheries that are mostly concentrated in southern California between Point Conception and the US–Mexico border. The white seabass fishery also has a component in Monterey Bay. Mexican and recreational fisheries are not assessed in this report. Because the stock is shared with Mexico, this report considers stock abundance and fishing mortality information from Mexico and recreational fishing mortality. White seabass, California yellowtail, and giant sea bass are caught primarily with drift and set gillnet throughout southern California. Commercial hook and line fishing occurs for California yellowtail in southern California and for white seabass in Monterey Bay.

Both white seabass and California yellowtail were rated as "moderate" concern for abundance and fishing mortality. White seabass is not overfished, nor is overfishing occurring, though all sources of fishing mortality, including from Mexico and the recreational fishery, surpassed this level in at least one year. There is no formal stock assessment or reference points for California yellowtail, and the species is not highly vulnerable. Giant sea bass is listed as "Critically Endangered" by the International Union for the Conservation of Nature and Natural Resources (IUCN). Fishing mortality for giant sea bass is unknown because no scientific research has been done to establish population trends.

Bottom and drift gillnets are of highest concern for impacts on other species, including humpback whales and white sharks. GIllnets are prohibited in a substantial proportion of representative habitats and the fishery is limited entry, both of which help mitigate some bycatch impacts. The southern stock of California halibut also overlaps with the white seabass set gillnet fishery.

The California Deptartment of Fish and WIldlife (CDFW) manages these fisheries. Management strategy and implementation is "moderately effective" for all three gear types (bottom gillnet, drift gillnets, and handlines/hand-operated pole-and-lines). Management measures temporally and spatially limit fishing activities, but lack appropriate reference points. The 2016 stock assessment for white seabass has not yet been incorporated into the fishery management plan, and there is no stock assessment or fishery management plan for California yellowtail or giant sea bass.

Ecosystem-based fisheries management is considered to be of "moderate" concern for all three species because of uncertainty about their roles in the ecosystem and how their removal may be impacting the food web.

Final Seafood Recommendations

SPECIES/FISHERY	CRITERION 1: IMPACTS ON THE SPECIES	CRITERION 2: IMPACTS ON OTHER SPECIES	CRITERION 3: MANAGEMENT EFFECTIVENESS	CRITERION 4: HABITAT AND ECOSYSTEM	OVERALL RECOMMENDATION
Yellowtail California Eastern Central Pacific, Drift gillnets	Yellow (2.64)	Red (1.00)	Yellow (3.00)	Green (3.87)	**Good Alternative (2.35)**
White seabass California Eastern Central Pacific, Drift gillnets	Yellow (2.64)	Red (1.00)	Yellow (3.00)	Green (3.87)	**Good Alternative (2.35)**
Giant seabass California Eastern Central Pacific, Drift gillnets	Red (1.00)	Red (1.73)	Yellow (3.00)	Green (3.87)	**Avoid (2.12)**
White seabass California Eastern Central Pacific, Handlines and hand-operated pole-and-lines	Yellow (2.64)	Green (5.00)	Yellow (3.00)	Green (3.46)	**Good Alternative (3.42)**
Yellowtail California Eastern Central Pacific, Handlines and hand-operated pole-and-lines	Yellow (2.64)	Green (5.00)	Yellow (3.00)	Green (3.46)	**Good Alternative (3.42)**
Giant seabass California Eastern Central Pacific, Set gillnets	Red (1.00)	Red (1.73)	Yellow (3.00)	Green (3.24)	**Avoid (2.03)**
Yellowtail California Eastern Central Pacific, Set gillnets	Yellow (2.64)	Red (1.00)	Yellow (3.00)	Green (3.24)	**Good Alternative (2.25)**
White seabass California Eastern Central Pacific, Set gillnets	Yellow (2.64)	Red (1.00)	Yellow (3.00)	Green (3.24)	**Good Alternative (2.25)**

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores
- **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

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

Introduction

Scope of the analysis and ensuing recommendation

This report covers the white seabass (*Atractoscion nobilis*), California yellowtail (*Seriola lalandi*), and giant sea bass (*Stereolepis gigas)* fisheries that are mostly concentrated in southern California between Point Conception and the US–Mexico border. The white seabass fishery also has a component in Monterey Bay. Mexican and recreational fisheries are not assessed in this report. However, because the stock is shared with Mexico, this report considers stock abundance and fishing mortality information from Mexico and recreational fishing mortality. White seabass, California yellowtail, and giant sea bass are caught primarily with drift and set gillnets throughout southern California. Commercial hook and line fishing occurs for California yellowtail in southern California and for white seabass in Monterey Bay.

Species Overview

White seabass, *Atractoscion nobilis,* are large, mobile, substratum predatory fish that primarily inhabit the coastal waters of southern California and Baja California, Mexico (Allen et al. 2007). They also are found in the northern Gulf of California (CDFG 2001). During periods of higher ocean temperature such as El Niño Southern Oscillation (ENSO) events, white seabass have been observed as far north as Juneau, Alaska (Donohoe 1997) (Allen et al. 2007). Contrary to their name, white seabass are not true bass but are the largest member of the croaker family (Sciaenidae). They attain sizes up to 1.7 m and up to 41 kg (CDFG 2002). Recent length frequency distributions indicate a variation in size from Southern California to Southern Baja California. The mean length of white seabass sampled was 81.5 cm in Southern Baja California, 113.8 cm in Northern Baja California, and 118.6 cm in Southern California. Length sampled in all regions ranged from 31.0 cm to 156.0 cm (Romo-Curiel et al. 2015). White seabass rapidly increase in size in the first 8 years of life and decline thereafter (Romo-Curiel et al. 2015). Most females are estimated to mature at 60.7 cm and 3 years old and most males at 50.8 cm and 2 years old; all are mature by at least 80 cm and 4 years old (CDFG 2002). Maximum observed age is estimated at 28 years old (Romo-Curiel et al. 2015). Pelagic spawning occurs from March to July (peaking in May), from 2 hours before sunset to 4.5 hours after sunset, and in the greatest amount in the 5 days during and after the new moon (Aalbers 2008). Females spawn with approximately 0.76 to 1.5 million eggs per batch (CDFG 2002). Adult white seabass eat a variety of fishes and invertebrates including northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), blacksmith (*Chromis punctipinnis*), silversides (*Atherinopsidae* spp.), Pacific mackerel (*Scomber japonicus*), market squid (*Loligo opalescens*), and pelagic red crab (*Pleuroncodes planipes*) (Thomas 1968).

White seabass have been fished since the 1890s with landings fluctuating widely over time (CalCOFI 2013). Since the early 1980s, US vessels have not been permitted to fish in Mexican waters for white seabass (CalCOFI 2013). By the 1980 to 1981 fishing season, the fishery had collapsed to 10 percent of its historic catch (Allen et al. 2007), and annual landings remained low for the next 15 years (CalCOFI 2013). According to the most recent stock assessment (2016), abundance remains historically low (Valero and Waterhouse 2016). In 1983, the California State Legislature passed legislation funding research into artificial propagation (aquaculture) for depleted finfish. Since 1986, the Ocean Resources Enhancement and Hatchery Program (OREHP), managed by the California Department of Fish and Wildlife (CDFW) (formerly the California Department of Fish and Game), has propagated, reared, and released white seabass juveniles into the ocean with the goal "to enhance populations of marine finfish species important to California for their sport and commercial fishing value" (CDFG 2010c). A review of the program, published in 2017, stated that one of the achievements of the OREHP is its "contributions to research discoveries surrounding the biology and culture of all life stages of White Seabass," though it determined that the "survival of hatchery fish and the contribution of hatchery fish to the White Seabass fishery" has been low (California Sea Grant 2017).

The commercial fishery using bottom and drift gillnets south of Point Conception and hook and line in Monterey

Bay is managed by CDFW. In the past twenty years, gillnet restrictions have prohibited fishing in state waters and waters less than 109.7 m (60 FM). Even with these restrictions, most commercial white seabass are still landed in bottom and drift gillnets (CalCOFI 2013). There is a minimum size limit of 71.12 cm (28 in), the fishery is closed from 15 March to 15 June to protect spawning aggregations, and there is an annual review of the fishery management plan published in 2002 (CDFG 2002) (CDFG 2011) (CDFG 2012). There is a large recreational fishery for white seabass, but it is not addressed in this report. However, fishing mortality from all sources, including the recreational fishery, is considered.

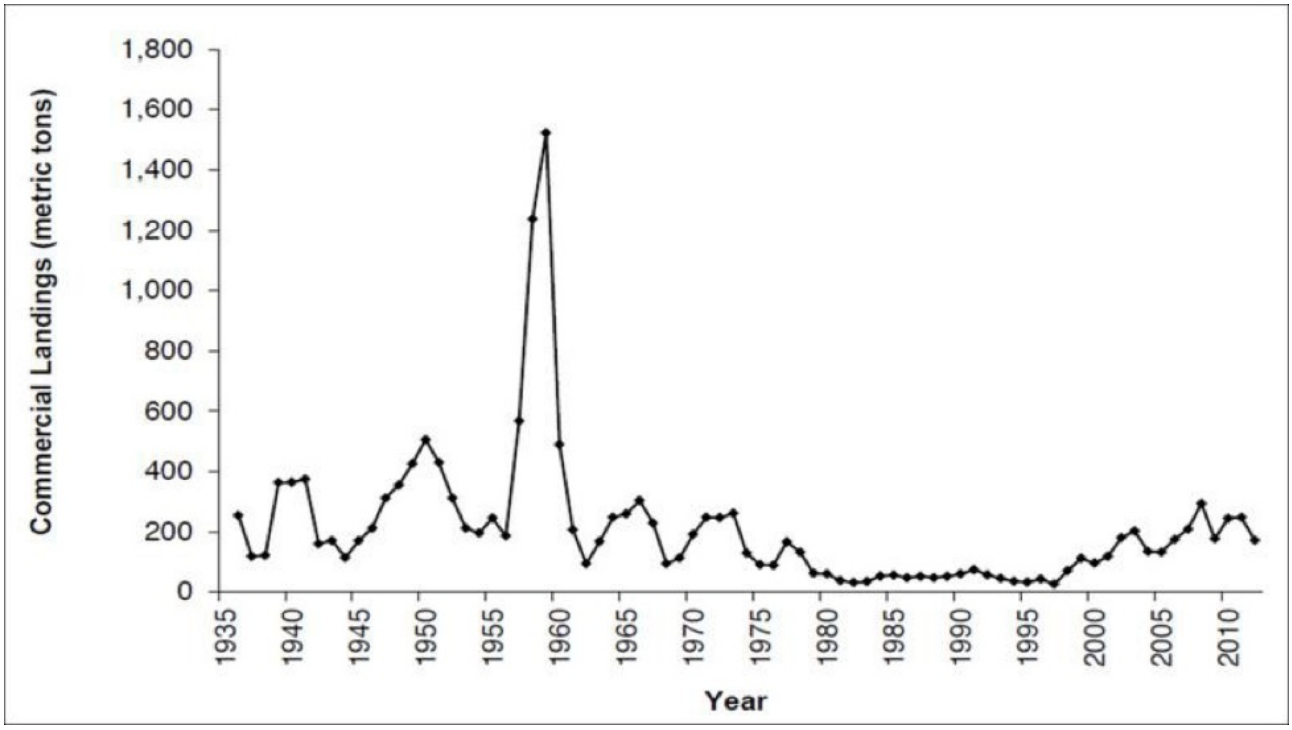

Figure 1 California commercial landings of white seabass, 1936-2012. Adapted from CalCOFI 2013.

California yellowtail, *Seriola lalandi*, is a large, fast-swimming, coastal, pelagic species (Love 1996) and a highly prized game fish in southern California (CDFG 2001). The species ranges from southern Washington, USA to Mazatlán, Mexico (CDFG 2001) with northerly movement into California from Mexico in the spring and summer with warm ocean temperatures (Baxter 1960) (CDFG 2001). The maximum recorded size is 1.5 m and 36.3 kg (80 lb) (Love 1996). All females older than three years are 71.12 cm (28 in) and are capable of spawning, which occurs in summer months (CDFG 2001). Older females are capable of spawning multiple times per season, and a 9.1 kg (20 lb) fish is capable of producing 940,000 eggs during one season (CDFG 2001). Adult California yellowtail eat Pacific sardines, northern anchovies, jack mackerel (*Trachurus symmetricus*), Pacific mackerel, market squid, and pelagic red crabs (CDFG 2001).

Fishing for California yellowtail has existed since the late 1800s predominately south of Point Conception (CDFG 2001). The commercial fishery is largely incidental to the commercial white seabass drift and set gillnet fisheries (Baxter 1960) but also has a southern California hook and line component. The fisheries are managed by the CDFW. Commercial catch declined significantly due to the elimination of purse seining in California waters and reduced demand (Collins 1973). Landings dropped again following the 1994 gillnet bans in state waters, since California yellowtail are denser in nearshore waters (CDFG 2001). Currently, there is no stock assessment or fishery management plan in place for California yellowtail.

The giant sea bass, *Stereolepis gigas*, is a large, coastal pelagic species that is distributed from Humboldt Bay, California to Mexico (Masuda et al. 1984). Giant sea bass are estimated to attain an age of at least 76 years (Hawk and Allen 2014). Giant sea bass occur nearshore, along drop offs, and in kelp. Large giant sea bass are

usually found in waters deeper than 30 m and smaller fish are more commonly found in sandy habitat or in kelp (Eschmeyer at al. 1983). Few studies have been done on the reproductiion of giant sea bass, with one 1971 study estimating the age at maturity to be 11 to 13 years (Fitch and Lavenberg 1971). A recent study shed some light on their reproductive behavior, with evidence suggesting that courtship occurs in late afternoon before dusk and spawning occurs just after dusk (Clark 2016). Due to the fact that this species is slow growing and matures at a relatively old age, giant sea bass is vulnerable to overfishing (CDFG 2001).

Giant sea bass was heavily exploited in the US and Mexico in the early 1900s. In the US, commercial landings peaked in 1932 at 115 metric tons (MT) and rapidly declined the following year. Commercial landings in Mexico had a similar decline, though it occurred more gradually. Historical existence of spawning aggregations of giant sea bass on the southern Pacific coast of Baja California, once reported by fishermen, has disappeared (Sala et al. 2003). Sala et al. (2003) emphasize the importance of protecting giant seabass spawning areas to recover the population. In 1981, the California State Legislature passed a law that prohibited take of giant sea bass, with the exception of incidental take in the commercial gillnet and trammel net fisheries of two fish per trip. Additionally, the law allowed up to 1,000 lb of giant sea bass taken in Mexican waters to be landed in the US, with a limit of 3,000 lb in a calendar year. The law was changed in 1988 to reduce incidental catch of black sea bass to one fish per trip (FGC §8380). CDFW has reported that anecdotal evidence from sightings by scuba divers off of La Jolla, Anacapa Island, and Catalina Island indicates that there may be an increase in abundance (CDFG 2010b). The current population size is estimated at 500 individuals, with evidence that the population is expanding in the region (Chabot et al. 2015). A 2014/2015 survey at Catalina Island also suggests that giant sea bass are recovering, when compared to historical data for the island (House et al. 2016).

Production Statistics

White seabass landings in net fisheries (bottom and drift gillnet) from 2011 to 2015 (in that order) were 198.7 MT, 110.1 MT, 87.7 MT, 85 MT, 64.4 MT and in the handline fishery were 72.5 MT, 69.3 MT, 29.2 MT, 35.8 MT, and 20.2 MT (NMFS 2017). During this time, bottom and drift gillnets accounted for as little at 62% (2012) of the total landings and as much as 98% (2008). However, even in the years with a relatively high proportion of landings by hook and line, landings data indicate that a majority of the hook and line vessels opportunistically land white seabass rather than directly target it (CalCOFI 2013).

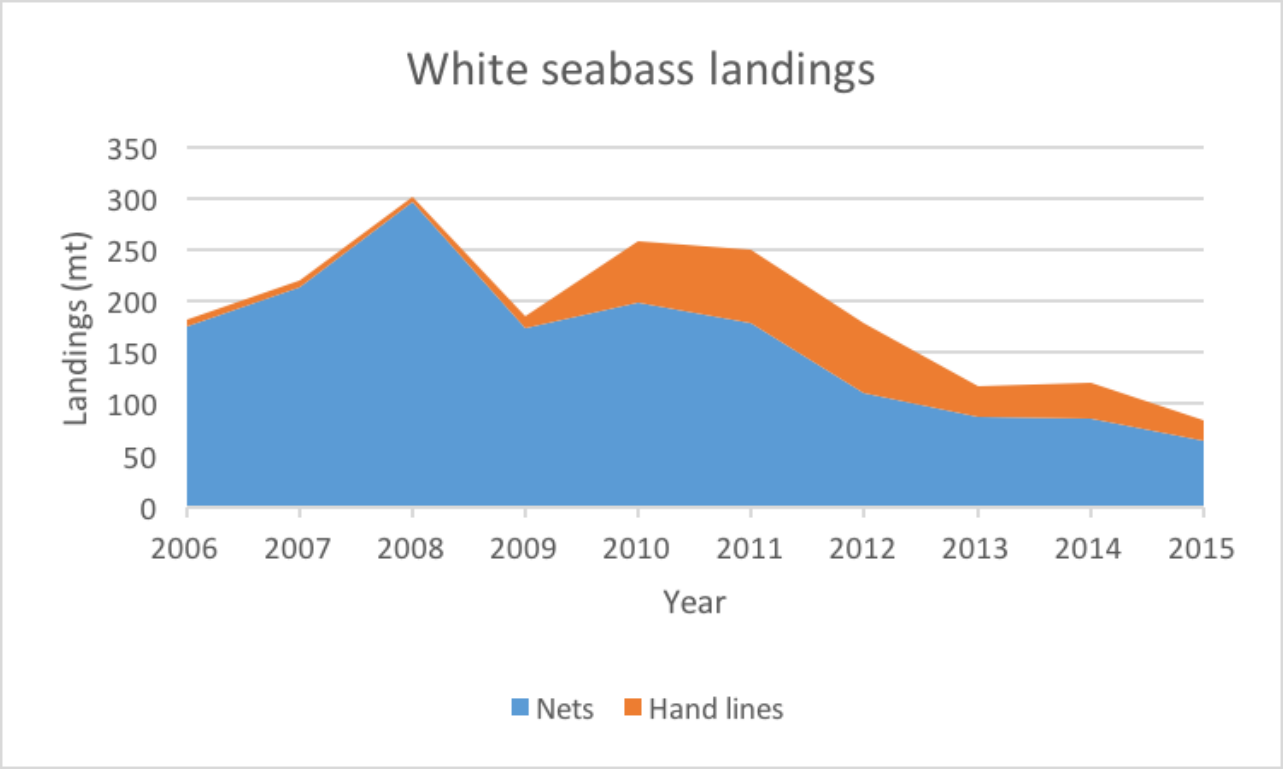

Figure 2 Commercial white seabass landings by gear type, 2006-2015. Data from NMFS 2017

California yellowtail is, by and large, commercially caught incidentally to the white seabass fishery (CDFG 2001). Recent landings of California yellowtail in net fisheries (bottom and drift gillnet) from 2011 to 2015 (in that order) were 1.8 MT, 3.6 MT, 1.5 MT, 7.7 MT, and 24.1 MT, and landings in the hand line fishery were 0.7 MT, 3.5 MT, 0.4 MT, 4.3 MT, and 25 MT (NMFS 2017). (See Figure 2 for total California yellowtail landings)

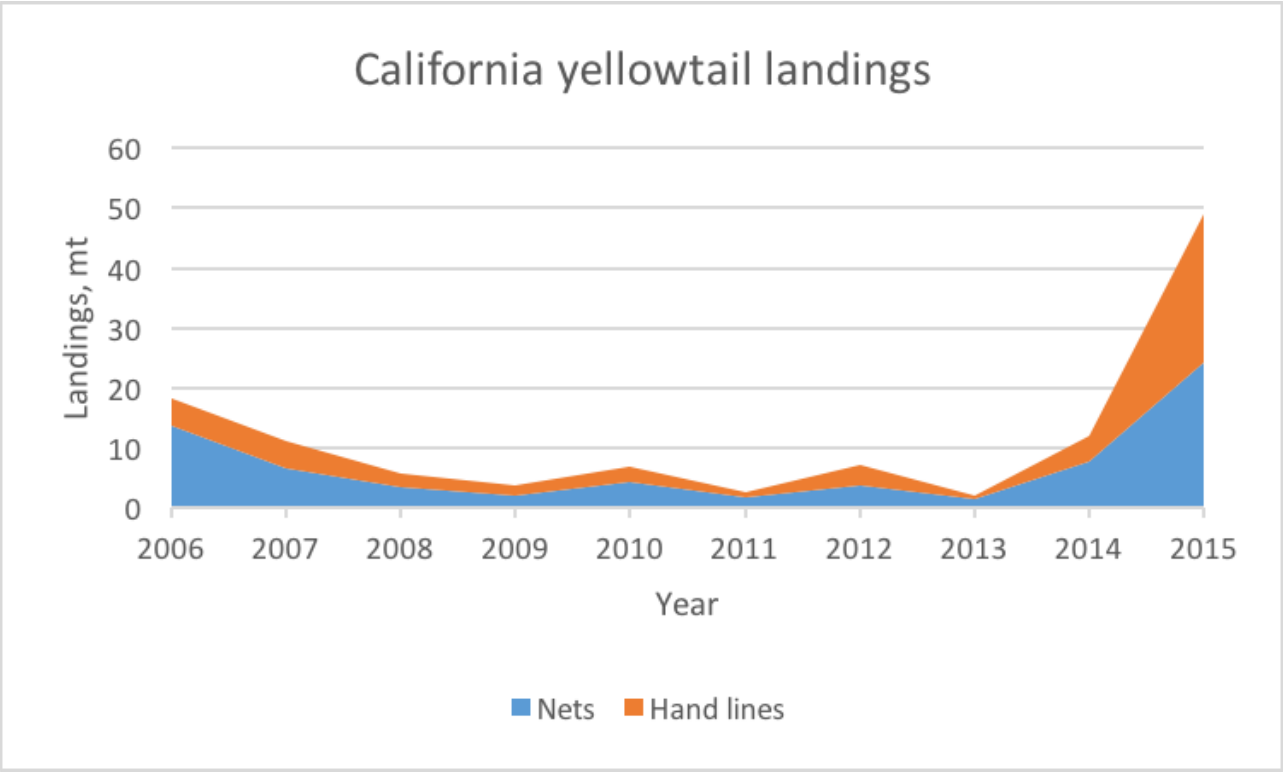

Figure 3 Commercial landings of California yellowtail by gear type, 2006-2015.

As mentioned above, there is no commercial fishery for giant sea bass in California and landings are from incidental take in the commercial gillnet and trammel net fisheries, or taken in Mexican waters and landed in the US (FGC §8380). From 1998 to 2015, incidental catch ranged from 1,712 pounds (0.78 MT) in 2013 to 14,049 lb (6.37 MT) in 2010 (CDFW 2017b). According to the CDFW, incidental landings of giant sea bass in the gillnet fisheries from 2011 to 2015 were 1.6 MT, 1.1 MT, 0.8 MT, 1.2 MT, and 2.9 MT, respectively (CDFW 2017c). Landings data from NMFS for 1996 to 2015 is below.

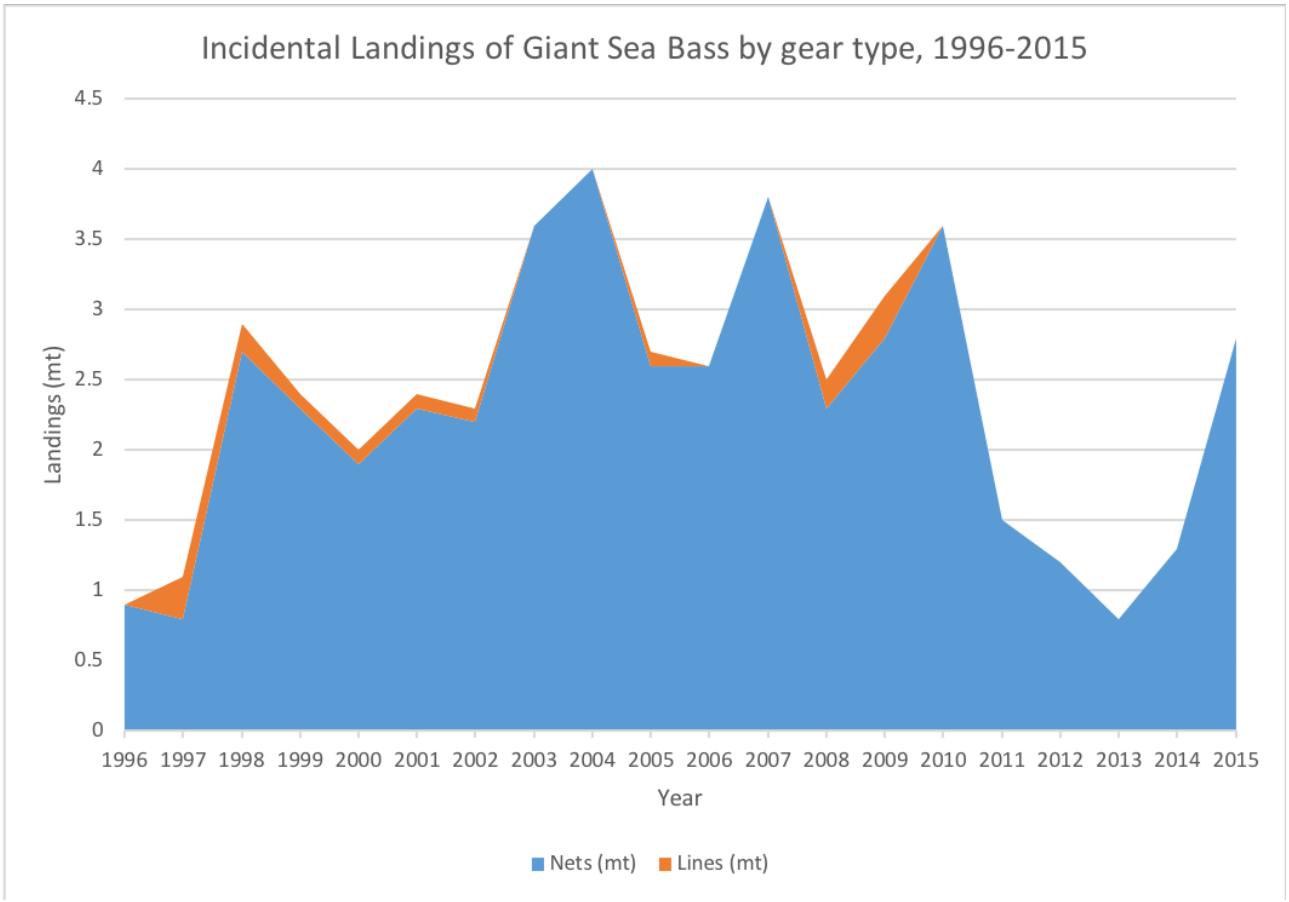

Figure 4 Incidental landings of giant sea bass by gear type, 1996-2015. Data from NMFS 2017.

Importance to the US/North American market.

White seabass and giant sea bass exports are negligible. Mexico is the only potential foreign source of white seabass or giant sea bass. Import and export data from the National Marine Fisheries Service (NMFS) Foreign Trade Database do not differentiate between various species of seabass or grouper (NMFS 2017d). Therefore, precise import and export data for white seabass and giant sea bass are unavailable.

California yellowtail exports are believed to be negligible, with Mexico as the only potential foreign source of California yellowtail. Import and export data from the NMFS Foreign Trade Database groups California yellowtail with "marine fish nspf" (not specified further) (NMFS 2017d). Therefore, precise import and export data for yellowtail are unavailable.

The value of giant sea bass to commercial fishing is negligible, estimated at $12,600 per year (Guerra et al. 2017). It should be noted that the non-consumptive value of giant sea bass to the recreational diving industry was estimated at $2.3 million per year, since this is a popular species for divers to encounter in the waters of Southern California (Guerra et al. 2017).

Common and market names.

The common name for *Atractoscion nobilis* is white seabass. The market name is seabass and other vernacular names include corbina and California white seabass (US FDA 2013).

The common name for *Seriola lalandi* is yellowtail. The market names are yellowtail or amberjack, and other vernacular names include California yellowtail, great amberjack, horseeye bonito, coronado, and amberjack (US FDA 2013).

The common name for *Stereolepis gigas* is giant sea bass, although in California it is commonly referred to as black sea bass. Market names include bass, black sea bass, and California black seabass (US FDA 2017) (Fishbase 2017).

Primary product forms

White seabass is sold whole or as fillets, both fresh and frozen. California yellowtail is sold as fillets, which can be fresh, frozen, or salted and dried (Smith-Vaniz 1995). Giant sea bass is sold as fresh fillets.

Assessment

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

Criterion 1: Impacts on the Species Under Assessment

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

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

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

Guiding Principles

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

Criterion 1 Summary

GIANT SEABASS			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
California/Eastern Central Pacific | Drift gillnets	1.00: High Concern	1.00: High Concern	Red (1.00)
California/Eastern Central Pacific | Set gillnets	1.00: High Concern	1.00: High Concern	Red (1.00)

WHITE SEABASS			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
California/Eastern Central Pacific | Drift gillnets	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)
California/Eastern Central Pacific | Handlines and hand-operated pole-and-lines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)
California/Eastern Central Pacific | Set gillnets	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)

YELLOWTAIL			
Region | Method	**Abundance**	**Fishing Mortality**	**Score**
California/Eastern Central Pacific | Drift gillnets	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)
California/Eastern Central Pacific | Handlines and hand-operated pole-and-lines	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)
California/Eastern Central Pacific | Set gillnets	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.64)

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Abundance

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

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

Factor 1.2 - Fishing Mortality

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

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

GIANT SEABASS

Factor 1.1 - Abundance

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

High Concern

The International Union for the Conservation of Nature and Natural Resources (IUCN) first listed giant sea bass

as "Critically Endangered" in 1996 and updated this assessment in 2004 with the same category (IUCN 2017). Recent evidence suggests the giant sea bass population may be recovering, though this has not impacted the IUCN listing (House et al. 2016). For this reason, abundance is considered "high" concern.

Factor 1.2 - Fishing Mortality

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

High Concern

Fishing mortality for giant sea bass is unknown because no scientific research has been done to establish population trends (CDFG 2010b). Because giant sea bass fishing mortality is unknown, the species has a high susceptibility to capture in gillnets, and it is listed as "Critically Endangered" under the IUCN, fishing mortality is deemed "high" concern.

Justification:

Giant sea bass was heavily exploited in the US and Mexico in the early 1900s. In the US, commercial landings peaked in 1932 at 115 MT and rapidly declined the following year. Commercial landings in Mexico had similar decline, though it occurred more gradually. As further described in the introduction, current law prohibits take of giant sea bass with the exception of one fish per trip as incidental catch in the commercial and gill net trammel net fisheries (FGC §8380). CDFW has reported that anecdotal evidence from sightings by scuba divers off of La Jolla, Anacapa Island, and Catalina Island indicates that there may be an increase in abundance (CDFG 2010b). The current population size is estimated at 500 individuals, with evidence that the population is expanding in the region (Chabot et al. 2015). A 2014/2015 survey at Catalina Island also suggests that giant sea bass are recovering, when compared to historical data for the island (House et al. 2016).

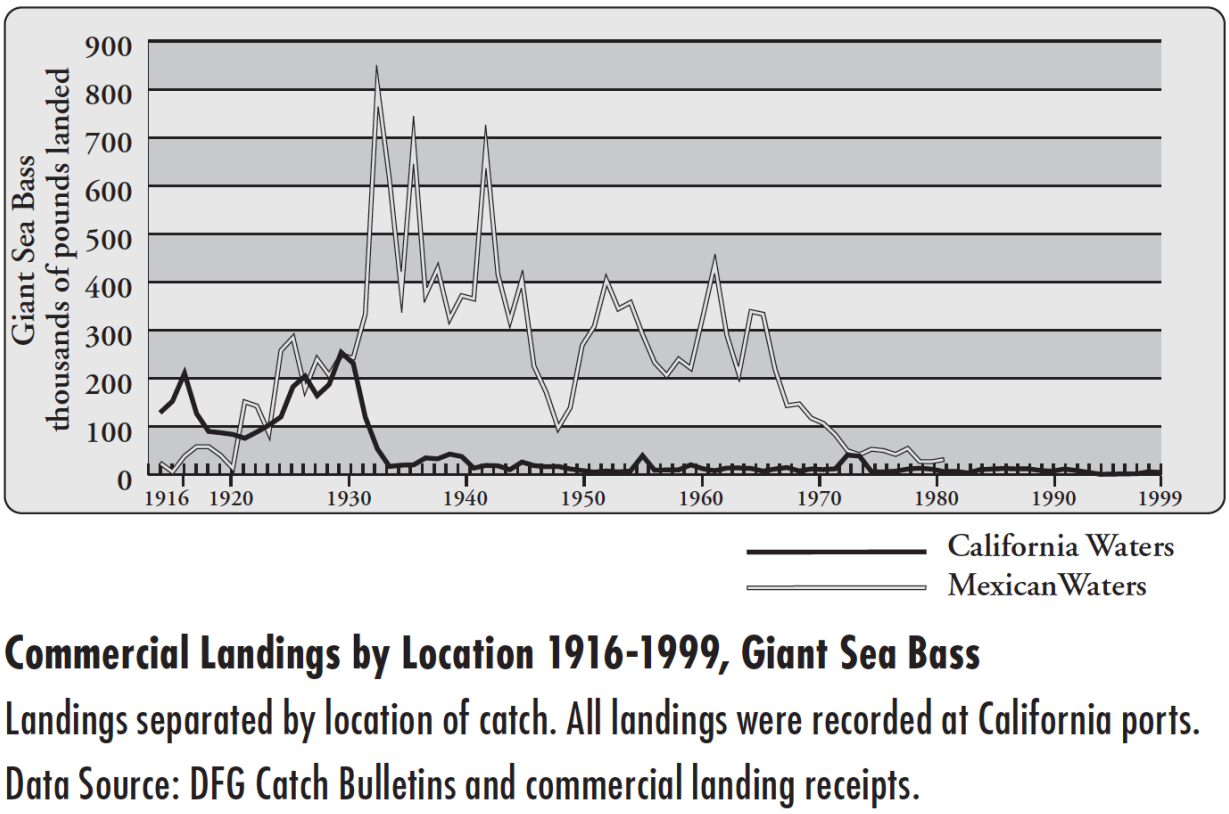

Figure 5 Commercial landings of giant sea bass, 1916-1999

WHITE SEABASS

Factor 1.1 - Abundance

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

The first US stock assessment for white seabass was conducted in 2016 and shows that B is just below B_{MSY} (B = .73B_0 and B_{MSY} = .76B_0). White seabass is not considered overfished (CDFG 2002). The biomass of white seabass in Mexico is unknown (Baja California Gobierno Del Estado 2015). Therefore, white seabass abundance is deemed "moderate" concern.

Justification:

The most recently published FMP annual review was for the 2013 to 2014 season. CDFW did not find any resource conservation issues. The first stock assessment for white seabass was published in 2016. Prior to this, the best information was a fisheries management plan (FMP) that was published in 2002 and is updated annually (CDFG 2002). The maximum sustainable yield (MSY) biomass was estimated at 7,257.5 MT (16 million lb) and the MSY proxy, including a natural mortality rate of 0.1, was 725.7 MT (1.6 million lb) (CDFG 2002). According to the 2016 assessment, the white seabass population was at 27% depletion in 2015, just above the B_{MSY} of 0.24 depletion (Valero and Waterhouse 2016). White seabass are aggregate spawners, increasing the species' vulnerability to overfishing (CDFG 2002). Because the stock assessment was published after the most recent FMP annual review, how CDFW will use this information in consideration of stock status is to be determined.

Factor 1.2 - Fishing Mortality

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

According to the 2016 stock assessment, MSY is 306 MT, corresponding to a depletion of 0.24 (Valero and Waterhouse 2016). Although in the last decade commercial fishing in the US has not surpassed this level, all sources of fishing mortality (including recreational fishing) have surpassed this level in at least one year (2011) (CalCOFI 2013) (NMFS 2017). In 2011 total commercial fishing mortality was 250.9 MT (NMFS 2017) and recreation fishing mortality was 124 MT, totaling 373.9 MT (CalCOFI 2013). Though this is below the determined optimum yield (OY) for that year (544.2 MT), it is above the threshold determined in the 2016 stock assessment of 306 MT (CDFG 2002) (Valero and Waterhouse 2016). US fishing mortality is currently below the reference point, but the reference point is less conservative than F_{MSY}, and does not include take in Mexico. Some historic information on retained catch in Mexico is included in the 2016 stock assessment (see page 133 of Valero and Waterhouse 2016), but current fishing data combines white seabass with 14 other species and total fishing mortality in Mexico is unknown (Baja California Gobierno Del Estado 2015). Therefore, it is possible that fishing mortality for the entire stock has been above MSY in additional years. For these reasons, fishing mortality is deemed of "moderate" concern.

Justification:

The annual harvest quota or OY calculated as 75% of the MSY was established at 544.3 (1.2 million lb) in 2002 and did not change in subsequent years (CDFG 2002) (CDFG 2011b). Total fishing mortality in 2011 and 2012 was therefore below the set OY of 544.2 MT (CDFG 2002) (CalCOFI 2013). Prior to 2016 the white seabass fishery lacked a quantitative stock assessment and target reference points, but landings in a season did not exceed the set OY (CDFG 2011) (CDFG 2010)(CDFG 2009) (CDFG 2008) (CDFG 2007) (CDFG 2006) (CDFG 2005) (CDFG 2004). A 2007 fisheries independent survey of juvenile white seabass indicated that white seabass was in the process of recovery (Allen et al. 2007).

Although fishing mortality has remained below set reference points, the 2016 stock assessment determined that these reference points were not appropriate: "MSY is estimated by this stock assessment at less than half of that reported by previous works and to occur at a relatively low fraction of the unexploited female spawning biomass" (Valero and Waterhouse 2016). Therefore, total fishing mortality for 2011 was above the MSY estimated by the 2016 stock assessment (306 MT) (Valero and Waterhouse 2016). However, fishing mortality has declined since 2011 and it appears that total fishing mortality is currently below F_{MSY}.

WHITE SEABASS

Factor 1.1 - Abundance

CALIFORNIA/EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Moderate Concern

The first US stock assessment for white seabass was conducted in 2016 and shows that B is just below B_{MSY} (B = .73B_0 and B_{MSY} = .76B_0). White seabass is not considered overfished (CDFG 2002). The biomass of white seabass in Mexico is unknown (Baja California Gobierno Del Estado 2015). Therefore, white seabass abundance is deemed "moderate" concern.

Justification:

The most recently published FMP annual review was for the 2013 to 2014 season. CDFW did not find any resource conservation issues. The first stock assessment for white seabass was published in 2016. Prior to this, the best information was a fisheries management plan (FMP) that was published in 2002 and is updated annually (CDFG 2002). The maximum sustainable yield (MSY) biomass was estimated at 7,257.5 MT (16 million lb) and the MSY proxy, including a natural mortality rate of 0.1, was 725.7 MT (1.6 million lb) (CDFG 2002). According to the 2016 assessment, the white seabass population was at 27% depletion in 2015, just above the B_{MSY} of 0.24 depletion (Valero and Waterhouse 2016). White seabass are aggregate spawners, increasing the species' vulnerability to overfishing (CDFG 2002). Because the stock assessment was published after the most recent FMP annual review, how CDFW will use this information in consideration of stock status is to be determined.

Factor 1.2 - Fishing Mortality

CALIFORNIA/EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Moderate Concern

According to the 2016 stock assessment, MSY is 306 MT, corresponding to a depletion of 0.24 (Valero and Waterhouse 2016). Although in the last decade commercial fishing in the US has not surpassed this level, all sources of fishing mortality (including recreational fishing) have surpassed this level in at least one year (2011) (CalCOFI 2013) (NMFS 2017). In 2011 total commercial fishing mortality was 250.9 MT (NMFS 2017) and recreation fishing mortality was 124 MT, totaling 373.9 MT (CalCOFI 2013). Though this is below the determined optimum yield (OY) for that year (544.2 MT), it is above the threshold determined in the 2016 stock assessment of 306 MT (CDFG 2002) (Valero and Waterhouse 2016). US fishing mortality is currently below the reference point, but the reference point is less conservative than F_{MSY}, and does not include take in Mexico. Some historic information on retained catch in Mexico is included in the 2016 stock assessment (see page 133 of Valero and Waterhouse 2016), but current fishing data combines white seabass with 14 other species and total fishing mortality in Mexico is unknown (Baja California Gobierno Del Estado 2015). Therefore, it is possible that fishing mortality for the entire stock has been above MSY in additional years. For these reasons, fishing mortality is deemed of "moderate" concern.

Justification:

The annual harvest quota or OY calculated as 75% of the MSY was established at 544.3 (1.2 million lb) in 2002 and did not change in subsequent years (CDFG 2002) (CDFG 2011b). Total fishing mortality in 2011 and 2012 was therefore below the set OY of 544.2 MT (CDFG 2002) (CalCOFI 2013). Prior to 2016 the white seabass fishery lacked a quantitative stock assessment and target reference points, but landings in a season did not exceed the set OY (CDFG 2011) (CDFG 2010)(CDFG 2009) (CDFG 2008) (CDFG 2007) (CDFG 2006) (CDFG 2005) (CDFG 2004). A 2007 fisheries independent survey of juvenile white seabass indicated that white seabass was in the process of recovery (Allen et al. 2007).

Although fishing mortality has remained below set reference points, the 2016 stock assessment determined that these reference points were not appropriate: "MSY is estimated by this stock assessment at less than half of that reported by previous works and to occur at a relatively low fraction of the unexploited female spawning biomass" (Valero and Waterhouse 2016). Therefore, total fishing mortality for 2011 was above the MSY estimated by the 2016 stock assessment (306 MT) (Valero and Waterhouse 2016). However, fishing mortality has declined since 2011 and it appears that total fishing mortality is currently below F_{MSY}.

YELLOWTAIL

Factor 1.1 - Abundance

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

There is no formal stock assessment or reference points for the California yellowtail stock and the species is not highly vulnerable. Therefore, abundance is deemed "moderate" concern.

Justification:

There is no stock assessment for California yellowtail. A 2001 report by the California Department of Fish and Game suggested that although the size of the Callifornia yellowtail stock is smaller than in the 1950s, it could still support substaintial harvest pressure {CDFG 2001}. An age and size shift in harvest was observed in commercial passenger fishing vessels (CPFV) data from the 1970s compared to the 1980s and 1990s, with more recenet catches dominated by two and three year old fish comared to the 1970s, which was dominated by six-to-nine year olds {CDFG 2001}. Recent evidence from 1966 to 2013 suggests that the trophy size of California yellowtail decreased in the

1970s, which was dominated by six-to-nine year olds (CDFG 2001). Recent evidence from 1966 to 2013 suggests size of California yellowtail decreased in the 1970s and has been increasing since that time (Bellquist et al. 2016 takes into account the California yellowtail stock in Mexico, where biomass is also unknown (SAGARPA 2010).

Productivity Attributes	Value	Score (1 = low risk; 2 = medium risk; 3 = high risk)
Average age at maturity (years)	3	1
Average maximum age (years)	12	2
Fecundity (egg/yr)	450,000	1
Average maximum size (cm) (not to be used when scoring invertebrate species)	150	2
Average size at maturity (cm) (not to be used when scoring invertebrate species)	71	2
Reproductive strategy	Broadcast spawner	1
Trophic level	4.1	3
Density dependent (invertebrates only)		
Productivity subscore		**1.71**

Susceptibility Attribute	Information	Score (1 = low risk; 2 = medium risk; 3 = high risk
Areal overlap	Unknown	3
Vertical overlap	Targeted species	3
Selectivity of fishery	Not considered "high risk"	2
Post-capture mortality	Targeted species	3
Susceptibility Subscore		**2.33**

Productivity-Susceptibility Score	2.89
Vulnerability Rating (high, medium, low)	Medium

Factor 1.2 - Fishing Mortality

CALIFORNIA/EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA/EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES
CALIFORNIA/EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

California yellowtail is by and large commercially caught incidentally to the white seabass fishery (CDFG 2001). Fishing mortality of California yellowtail is unknown and there are no reference points. Fishing mortality in Mexico is also unknown (Baja California Gobierno Del Estado 2015). When biomass is unknown relative to reference points and vulnerability to fishing is not high, Seafood Watch Criteria deems fishing mortality as "moderate" concern.

Criterion 2: Impacts on Other Species

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

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

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

Guiding Principles

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

Criterion 2 Summary

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

GIANT SEABASS - CALIFORNIA/EASTERN CENTRAL PACIFIC - DRIFT GILLNETS					
Subscore:	**1.73**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.73**
Species	**Abundance**		**Fishing Mortality**		**Subscore**
Humpback whale	1.00:High Concern		3.00:Moderate Concern		Red (1.73)
White shark	1.00:High Concern		3.00:Moderate Concern		Red (1.73)
Yellowtail	2.33:Moderate Concern		3.00:Moderate Concern		Yellow (2.64)
White seabass	2.33:Moderate Concern		3.00:Moderate Concern		Yellow (2.64)

GIANT SEABASS - CALIFORNIA/EASTERN CENTRAL PACIFIC - SET GILLNETS					
Subscore:	**1.73**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.73**
Species	**Abundance**		**Fishing Mortality**		**Subscore**
White shark	1.00:High Concern		3.00:Moderate Concern		Red (1.73)
Humpback whale	1.00:High Concern		3.00:Moderate Concern		Red (1.73)
Yellowtail	2.33:Moderate Concern		3.00:Moderate Concern		Yellow (2.64)

White seabass	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)
California flounder	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)

WHITE SEABASS - CALIFORNIA/EASTERN CENTRAL PACIFIC - DRIFT GILLNETS					
Subscore:	**1.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Giant seabass	1.00:High Concern	1.00:High Concern	Red (1.00)		
Humpback whale	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
White shark	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
Yellowtail	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		

WHITE SEABASS - CALIFORNIA/EASTERN CENTRAL PACIFIC - HANDLINES AND HAND-OPERATED POLE-AND-LINES					
Subscore:	**5.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**5.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
No other main species caught					

WHITE SEABASS - CALIFORNIA/EASTERN CENTRAL PACIFIC - SET GILLNETS					
Subscore:	**1.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Giant seabass	1.00:High Concern	1.00:High Concern	Red (1.00)		
White shark	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
Humpback whale	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
Yellowtail	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		
California flounder	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		

YELLOWTAIL - CALIFORNIA/EASTERN CENTRAL PACIFIC - DRIFT GILLNETS					
Subscore:	**1.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Giant seabass	1.00:High Concern	1.00:High Concern	Red (1.00)		
Humpback whale	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
White shark	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
White seabass	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		

YELLOWTAIL - CALIFORNIA/EASTERN CENTRAL PACIFIC - HANDLINES AND HAND-OPERATED POLE-AND-LINES					
Subscore:	**5.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**5.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
No other main species caught					

YELLOWTAIL - CALIFORNIA/EASTERN CENTRAL PACIFIC - SET GILLNETS					
Subscore:	**1.00**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.00**
Species	**Abundance**	**Fishing Mortality**	**Subscore**		
Giant seabass	1.00:High Concern	1.00:High Concern	Red (1.00)		
White shark	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
Humpback whale	1.00:High Concern	3.00:Moderate Concern	Red (1.73)		
White seabass	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		
California flounder	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.64)		

Bycatch is mostly of concern in the gillnet fisheries, as the hook and line fishery is very species selective. Although bycatch does occur with hook and line, no species occur in large enough numbers to be included in this report. Additionally, hook and line fishermen make significant efforts to release unwanted bycatch alive including releasing them without removing them from the water.

For both the bottom and drift gillnet fisheries, giant sea bass and white shark have the lowest scores overall. The International Union for the Conservation of Nature and Natural Resources (IUCN) has listed giant sea bass as "Critically Endangered" and the white shark as "Threatened." There are currently no stock assessments for either of these species and, therefore, fishing mortality is unknown. Though white shark is included in this report, large individuals are rarely caught in the white seabass fishery and the concern is based on interactions with the large mesh thresher shark and swordfish gillnet fishery. Humpback whale abundance is also of "high" concern, since the two Distinct Population Segments interacting with this fishery are listed as "endangered" and "threatened" under the Endangered Species Act. However, humpback whales were rated as "moderate" concern for fishing mortality based on the combination of very low known entanglements in the gillnet fisheries and the low annual mortality throughout California relative to the allowed Potential Biological Removal (PBR) under the US Marine Mammal Protection Act. Sea otters, though listed as threatened on the endangered species list, were not included as bycatch in the gillnet fisheries because the bottom gillnet depth restrictions eliminated overlap with sea otters, resulting in sea otter entanglement that is at or near zero. White shark bycatch are of concern in both gillnet fisheries, but large individuals are rarely caught and there is evidence that the local population is expanding. Skate is sometimes caught in the white seabass and halibut bottom trawl fishery, but it was not included in this report because it did not meet the criteria (<5% of skate mortality is caused by gillnets).

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance

(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality

(same as Factor 1.2 above)

HUMPBACK WHALE

Factor 2.1 - Abundance

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

High Concern

Humpback whales from the Mexico and Central America Distinct Population Segments (DPS) are present in the waters of offshore California. The Mexico DPS is listed as threatened under the ESA and the Central America DPS is listed as endangered (81FR62259). Therefore, abundance of humpback whale is considered of "high" conservation concern.

Justification:

Humpback whale has been listed as endangered under the ESA since 1970 (81FR62259). In 2016, NOAA fisheries revised the ESA listing to identify 14 Distinct Population Segments (DPS); the whales in California waters are part of the Mexico DPS and the Central America DPS. At this time, four DPS were determined to be "endangered" (Cape Verde/Northwest Africa, Western North Pacific, Central America, and Arabian Sea). The Mexico DPS was determined as "threatened," while the remaining nine DPSs were determined "not at risk" (81FR62259). The most recent humpback whale stock assessment report does not take into account the new DPS determination, and the humpback whale section is listed as revised in 2014. According to this stock assessment, the best estimate of population size was 1,918. The Potential Biological Removal (PBR) calculated from this population estimate is 11 whales per year (Caretta et al. 2016). Threats to humpback whale are entanglement in fishing gear (mainly trap/pot gear with a smaller amount of gillnet gear), ship strikes, harassment, habitat impacts, and harvest (NOAA 2017). Humpback whale is considered "high" conservation concern.

Factor 2.2 - Fishing Mortality

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

The west coast gillnet fisheries account for take of humpback whales between 10 to 50% of the PBR (Caretta et al. 2016). Although the recent stock assessment estimates that cumulative fishing mortality is less than PBR (Caretta et al. 2016), recent entanglements from 2015 to 2016 suggest that total fishery impacts to humpback whales is increasing. None of the entangled whales were observed to have died, but mortality and serious injury of 59 whale entanglements is unknown. Therefore, by taking a conservative estimate that whale mortality in all fisheries combined may in fact be greater than PBR, fishing mortality is considered of "moderate" conservation concern in the set and drift gillnet fisheries.

Justification:

A Category II fishery in the annual List of Fisheries by NOAA means that the fishery has "occasional incidental mortality or serious injury of marine mammals" (NMFS 2017c). The List of Fisheries documented one humpback whale as seriously injured in 2007 for the set gillnet fishery, which resulted in an annual mortality and serious injury rate of 0.2 humpback whales per year, 1.7% of the stock's PBR of 11.3 (the PBR at the date of analysis) (NMFS 2017c). Assigning all unknown entanglement mortalities and serious injuries to the white

seabass set gillnet fishery is very conservative. According to the most recent stock assessment, humpback whale has a PBR allocation for US waters of 11 whales per year (Caretta et al. 2016). Eighteen whales were observed entangled, alive or dead, in fishing gear from 2004 to 2008, and eleven were entangled in trap/pot gear (Caretta et al. 2013). The remaining seven were observed entangled in unknown fishing gear that may have included set and drift gillnets (Caretta et al. 2013). From 2007 to 2011, there were 16 documented interactions with trap/pot fisheries and 10 interactions with gillnet and unidentified fisheries, including 1 death (Caretta et al. 2016). In recent years there has been an increase in whale entanglements. In 2016, 71 whale entanglements were reported on the west coast with 42 confirmed by NOAA. Of the 71 reported entanglements, 54 were humpback whales. In 2015, there were 35 reported entanglements of humpback whales.

While a majority of these entanglements were attributed to the dungeness crab commercial trap fishery, two humpback whale entanglements were attributed to gillnet fisheries. Of the reported sightings, the cause for 42 entanglements was unconfirmed; thus, the impact from gillnet fisheries could be greater than reported (NMFS 2017e). Regardless, the increase in entanglements from all fisheries in recent years raises concerns for the impact of fishing on the west coast to humpback whale populations. This species is listed as threatened or endangered, depending on the DPS; therefore, it is automatically a strategic stock under the marine mammal protection act (MMPA). The 2016 stock assessment stated the population was not experiencing cumulative fishing mortality in excess of Potential Biological Removal (PBR); the estimated annual mortality and serious injury due to entanglement was 4.4 per year from commercial fisheries, which is less than the allowed PBR (11), but greater than 10% of the PBR (Caretta et al. 2016). However, recent estimates of entanglement indicate this is no longer the case as entanglements are greater than PBR (NMFS 2017e).

Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS

< 100%

The discard to landings ratio for drift gillnets targeting white seabass and California yellowtail have not been estimated (Valero and Waterhouse 2016). Global discard to landings in gillnets is 0.5% (Kelleher 2005). The California drift gillnet fishery for swordfish has a discard rate of 66% (Kelleher 2005), but the mesh size is greater than 35.56 cm, whereas the white seabass and California yellowtail fishery has a mesh size of 8.89 to 35.56 cm (NMFS 2013b). With no other data, an estimate of the discards to landings ratio is 20 to 40%.

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

< 100%

The discards to landings ratio for gillnet fisheries worldwide are estimated to be an average rate of 10% or a weighted rate of 0.5% (Kelleher 2005). Gillnets worldwide (drift and set) account for less than 30,000 MT of discards with reported landings of over 3 million MT (Kelleher 2005). This likely is not the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available (Valero and Waterhouse 2016). A study of bycatch in small-scale (vessels less than 15 m) set gillnet fisheries in Baja California, Mexico calculated a discards-to-landings ratio of 34.3% by weight (Shester and Micheli 2011). The conservative discards to landings ratio is 20 to 40%.

Justification:

The weighted discard rate is considered to be the most accurate and representative at a global level (Kelleher 2005).

WHITE SHARK

Factor 2.1 - Abundance

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

High Concern

There is no stock assessment for white shark; therefore, there are no reference points to use to assess the stock status. White sharks are listed as "Vulnerable" with an unknown population trend by the IUCN red list of threatened species (IUCN 2017). Therefore, the stock status is of "high" concern.

Justification:

In 2013, the California Fish and Game Commission accepted a petition to list the Northeastern Pacific Ocean population of white shark under the California Endangered Species Act (CESA) (CDFW 2015). In 2014, the Commission found that listing white shark as threatened or endangered under the CESA was not warranted. White sharks are listed as "Vulnerable" with an unknown population trend by the IUCN red list of threatened species (IUCN 2017). White sharks were proposed for listing as "threatened" or "endangered" under the Endangered Species Act (ESA) but the status review determined that the population was most likely at a low to very low risk of extinction and therefore white shark was not listed (NMFS 2013b).

CDFW abundance estimates have been based on two location-dependent studies, the sum of which estimates 339 sub-adult and adult white shark (Sosa-Nishizaki et al. 2012) (Chapelle et al. 2011), though one of the study cautions using this estimate for absolute abundance (Sosa-Nishizaki et al. 2012) and the CDFW determined that this underestimates the population because it does not take into account individuals that congregate at other areas (CDFW 2014). Burgess et al. (2014) uses a dataset from sampling at the same locations as Chapelle et al. (2011) and is critical of the methodology used. Burgess et al. (2014) estimate the California subpopulation size at a minimum 2000 individuals. There are no historic estimates as a basis of comparison.

There has been an increase in reported white shark catch in California fisheries (particularly young of the year (YOY) since 2005, but there has not been an increase in fishing pressure. This suggests that more white sharks are present and that the population is increasing and could be in part due to the nearshore gillnet bans in 1994 and the white shark bans (Lowe et al. 2012).

Factor 2.2 - Fishing Mortality

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

The fishing mortality is unknown with respect to reference points because none are available for white shark. The Biological Review Team determined that shark bycatch across fisheries in California and Mexico posed a moderate risk to the white shark population (NMFS 2013b). Therefore, fishing mortality is of "moderate" concern.

Justification:

It is illegal to retain a white shark in California state and federal waters, although this does not preclude it from incidental catch (CDFW 2015). There is some indication that YOY and juvenile white sharks exhibit fairly high post release survival from gillnet gear, when they are found alive in the gear (about one-third to one-half of the time) (Lowe et al. 2012). The shorter the soak time, the greater the survival rate (Lyons et al. 2013). A majority of white sharks caught in drift and set gillnet gear are YOY and juveniles (Lowe et al. 2012). From 2006 to 2009 there were 56 documented white shark captures in southern California drift and set gillnets (including drift gillnets for swordfish (*Xiphias gladius*) and thresher sharks (*Alopias* spp.) (Lyons et al. 2013). The recent status review of the local white shark population estimated the average annual bycatch from 2001 to 2011 as 28 individuals with 16 mortalities per year (NMFS 2013b). Although the above studies suggest low fishing mortality due to a relative low catch rate of white shark and good post release survival from incidental catch, recent tagging data indicates that the main source of mortality in white sharks in the northeast Pacific is bycatch (Benson et al. 2018). Additionally, there is little information on bycatch of white shark in Mexico waters, though managers consider the ecological impact of fisheries to white shark within a high-risk category (Castillo-Genes and Tovar-Avila 2016). The amount of mortality the population can withstand is unknown.

Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS

< 100%

The discard to landings ratio for drift gillnets targeting white seabass and California yellowtail have not been estimated (Valero and Waterhouse 2016). Global discard to landings in gillnets is 0.5% (Kelleher 2005). The California drift gillnet fishery for swordfish has a discard rate of 66% (Kelleher 2005), but the mesh size is greater than 35.56 cm, whereas the white seabass and California yellowtail fishery has a mesh size of 8.89 to 35.56 cm (NMFS 2013b). With no other data, an estimate of the discards to landings ratio is 20 to 40%.

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

< 100%

The discards to landings ratio for gillnet fisheries worldwide are estimated to be an average rate of 10% or a weighted rate of 0.5% (Kelleher 2005). Gillnets worldwide (drift and set) account for less than 30,000 MT of discards with reported landings of over 3 million MT (Kelleher 2005). This likely is not the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available (Valero and Waterhouse 2016). A study of bycatch in small-scale (vessels less than 15 m) set gillnet fisheries in Baja California, Mexico calculated a discards-to-landings ratio of 34.3% by weight (Shester and Micheli 2011). The conservative discards to landings ratio is 20 to 40%.

Justification:

The weighted discard rate is considered to be the most accurate and representative at a global level (Kelleher 2005).

Criterion 3: Management Effectiveness

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

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

The Criterion 3 rating is determined as follows:

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

Rating is Critical if Management Strategy and Implementation is Critical.

GUIDING PRINCIPLE

- The fishery is managed to sustain the long-term productivity of all impacted species.

Criterion 3 Summary

Fishery	Management Strategy	Bycatch Strategy	Research and Monitoring	Enforcement	Stakeholder Inclusion	Score
Fishery 1: California / Eastern Central Pacific | Drift gillnets	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.00)
Fishery 2: California / Eastern Central Pacific | Handlines and hand-operated pole-and-lines	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.00)
Fishery 3: California / Eastern Central Pacific | Handlines and hand-operated pole-and-lines	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.00)
Fishery 4: California / Eastern Central Pacific | Set gillnets	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.00)

Criterion 3 Assessment

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderately Effective

Gillnets are prohibited in waters less than 110 to 128 m (60 to 70 fms) (CalCOFI 2013) (CDFG 2012) and within state waters from Pt. Arguello to the Mexican border (3 nautical miles off the mainland and 1 nautical mile off islands) (FGC §8610.2). As noted previously in this report, California yellowtail and giant sea bass (incidental) are also retained as part of this multi-species fishery. Minimum mesh size restrictions are 15.24 cm (6 in) to fish white seabass and 8.89 cm (3.5 in) to fish California yellowtail (CDFW 2015). White seabass can be taken in gillnets with mesh size 3.5 to 6 in if it does not comprise more than 20 percent of the load (FGC §8623) (CDFW 2015). The white seabass fishery is closed from 15 March through 15 June to protect spawning schools. The yellowtail fishery is closed from 1 May to 31 August, and no more than 0.227 MT (500 lb) of California yellowtail may be landed per vessel or 1.134 MT (2500 lb) for vessels with five or more persons (CDFW 2015). A minimum size limit of 71.12 cm (28 in) is in place for both species, with the exception of one fish less than 28 in per day or per trip (CDFW 2015). Giant sea bass is caught incidentally in gillnet fisheries. The 1994 gillnet closure in Southern California significantly reduced bycatch of giant sea bass by moving fleets away from the majority of its habitat (CDFG 2010b). Based on these restrictions and the fact that no reference points are available, the management strategy of the drift and bottom gillnet fisheries is "moderately effective."

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Moderately Effective

The white seabass fishery management plan is reviewed annually (CDFW 2018) and the first stock assessment for white seabass has not yet been incorporated into the management plan. There is no stock assessment for California yellowtail. The white seabass fishery is closed from 15 March through 15 June to protect spawning schools. The yellowtail fishery is closed from 1 May to 31 August, and no more than 0.227 MT (500 lb) of California yellowtail may be landed per vessel or 1.134 MT (2500 lb) for vessels with five or more persons (CDFW 2015). A minimum size limit of 71.12 cm (28 in) is in place for both species (CDFW 2015). Therefore, the management strategy of the hook and line fishery is considered "moderately effective."

Factor 3.2 - Bycatch Strategy

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

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderately Effective

The bottom and drift gillnet fisheries have measures in place to reduce bycatch of species of concern as

discussed below, but at this time not enough information on bycatch is available to know the effectiveness of some of these measures. Others have proven effective. Therefore, the bycatch management strategy of white seabass and California yellowtail bottom gillnets is considered "moderately effective."

Justification:

Gillnets are prohibited in waters less than 110 to 128 m (60 to 70 fms), which includes state waters (0 to 3 nm) and effectively reduces bycatch of shallower living animals, including sea otters and seabirds (CalCOFI 2013) (Caretta et al. 2013). Minimum mesh size restrictions are 3.5 in to fish white seabass and California yellowtail (CDFW 2015). California halibut bycatch has a minimum size of 55.9 cm (22") (CalCOFI 2012) and a recent stock assessment says that the stock is depleted to 14% of the unfished biomass but is not experiencing overfishing (CDFG 2011b). There is a concern for white shark bycatch in gill nets, mostly in the large mesh thresher shark and swordfish fishery; the nets in the white seabass and California yellowtail fisheries are size-selective, so large individuals are rarely caught (Lowe et al. 2012). The gillnet depth restrictions eliminated bycatch of sea otters, while humpback whale bycatch is also moderate with moderate mortality of entangled whales (Caretta et al. 2013).

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Highly Effective

Handlines and hand-operated pole-and-lines fishing is highly selective for the target species. Fishes landed beside the target generally occur in low numbers (<5% of catch) (Bellman et al. 2012). Bycatch from the white seabass hook and line fishery is assumed to be low and incidentally caught species are released alive with high post release survival. California halibut is targeted by commercial hook and line fishers in Monterey Bay, but are not considered bycatch because they have their own fishery. Please refer to the California halibut Seafood Watch Report for more. Because this fishery has very low bycatch (<5%) with live release of non-target species, and with no bycatch of species of concern, bycatch strategy for hook and lines is considered "highly effective."

Factor 3.3 - Scientific Research and Monitoring

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

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderately Effective

The first stock assessment for white seabass was completed in 2016. The fishery management plan has not yet been updated to include this information, though the Department did consider the assessment in the most recent review (CDFW 2018b) (Valero and Waterhouse 2016). There is no stock assessment or fishery management plan for California yellowtail or giant sea bass. However, CDFW does use logbook data to analyze trends for these species and to determine bycatch (CDFG 2001). Therefore, scientific research and monitoring for the bottom and drift gillnet fisheries is considered "moderately effective."

Justification:

The first stock assessment for white seabass was published in 2016. Prior to this, the best information was a fisheries management plan (FMP) that was published in 2002 and is updated annually (CDFG 2002). The most recently published FMP annual review was for the 2016 to 2017 season, and included limited information about the stock assessment (CDFW 2018b) (Valero and Waterhouse 2016). The CDFW considers the stock assessment to be a "point of concern" in the FMP criteria during its annual review, though the FMP has not been updated to include information from the assessment (CDFW 2018) (Valero and Waterhouse 2016).

The CPFV logbook data have been used in the past to determine that the yellowtail stock size had declined from historic levels and that the age structure of the stock has shifted to younger fish (Crooke 1983) (CDFG 2001).

In 2010, 12.5% of set gillnets from both the California halibut and the white seabass fishery were observed, with 8.0% observers in 2011, and 5.5% observed in 2012. For the small net mesh fishery targeting white seabass and California Yellowtail, observations from 2010 to 2012 were 0.7%, 3.3%, and 4.6%, respectively (Caretta et al. 2016).

As of publishing this report, CDFW was working on a report that would include bycatch data from logbooks for the white seabass gillnet fisheries, which would provide more information on the composition of bycatch in the white seabass fisheries (pers. comm., Miranda Brett 2017).

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Moderately Effective

The first stock assessment for white seabass was published in 2016. Prior to this, the best information was a fisheries management plan (FMP) that was published in 2002 and is updated annually (CDFG 2002). The most recently published FMP annual review was for the 2013 to 2014 season, prior to completion of the stock assessment (CDFW 2015b) (Valero and Waterhouse 2016). Because the stock assessment was published after the most recent FMP annual review, how CDFW will use this information in consideration of stock status is to be determined. As of the writing of this report, the Southern California staff was conducting a study to evaluate white seabass size at maturity (CDFW 2017e). There is no federal observer coverage currently (NMFS 2011). Therefore, scientific research and monitoring in the handlines and hand-operated pole-and-lines fishery is considered "moderately effective."

Factor 3.4 - Enforcement of Management Regulations

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

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Highly Effective

CDFW officers patrol and enforce fishing regulations including areas where gillnets are prohibited. Additionally dockside sampling does occur and logbooks are required in gillnet fisheries (see 3.3) (CDFW 2015). There is currently no federal observer coverage of these fisheries (NMFS 2011). Because regulations are regularly enforced and independently verified through dockside sampling and logbooks, and the capacity to control compliance is appropriate to the scale of the fisheries, enforcement for the gillnet fisheries is considered "highly effective."

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

Highly Effective

CDFW officers patrol and enforce regulations. Fishery-dependent monitoring of central and southern California ports is conducted by California Fisheries Research and Monitoring Project (CDFW 2017e).

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Highly Effective

CDFW develops notices of preparation (NOP) for environmental documents they are preparing to inform interested individuals and organizations if they would like to submit comments to the documents (CDFG 2002). Additionally CDFW conducted three public meetings with a panel of scientists chosen to advise CDFW on the white seabass fishery management plan preparation (CDFG 2002). The White Seabass Scientific and Constituent Advisory Panel (WSSCAP) also meets annually to review the FMP annual reports (CDFW 2015b). No recent environmental documents have been prepared for California yellowtail, but the same process would apply. The level of stakeholder inclusion in the management of this fishery is considered "highly effective."

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

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

GUIDING PRINCIPLES

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
California / Eastern Central Pacific / Drift gillnets	5	0	Moderate Concern	Green (3.87)
California / Eastern Central Pacific / Handlines and hand-operated pole-and-lines	4	0	Moderate Concern	Green (3.46)
California / Eastern Central Pacific / Handlines and hand-operated pole-and-lines	4	0	Moderate Concern	Green (3.46)
California / Eastern Central Pacific / Set gillnets	3	+0.5	Moderate Concern	Green (3.24)

Criterion 4 Assessment

SCORING GUIDELINES

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

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

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

Factor 4.3 - Ecosystem-Based Fisheries Management

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

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

scientific evidence is not available for this fishery.
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

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

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS

5

Drift gillnets do not contact the bottom during fishing; therefore, they have no impact on the seafloor (Chuenpagdee et al. 2003).

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

4

Handlines and hand-operated pole-and-lines present a vertical line in the water that has minimal impact on the seafloor (Chuenpagdee et al. 2003); this results in a "very low" conservation concern, rated 4 based on the Seafood Watch Standard.

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

3

Set gillnets for white seabass are operated solely south of Point Conception (CalCOFI 2013), and likely over soft sediment with minimal boulder or reef (Love 1996). For this reason the bottom gillnet fishery receives a score of 3.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS

0

This is not applicable because gear is benign and the fishery received a score of 5 for 4.1.

CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES

0

Commercial handlines and hand-operated pole-and-lines fishing for white seabass can be conducted by any fisher with a commercial fishing license. There are no specific area restrictions for hook-and-line gear except those areas where no fishing is allowed (e.g., state marine reserves). As a result, there is no effective mitigation of hook and line impacts.

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

+0.5

All gillnets were prohibited within 3 nm of mainland south of Pt. Arguello and 1 nm around the Channel Island

in 1994 (Larese 2009). Gillnets were also banned in waters less than 110 m (60 fathoms) from Point Reyes south to Point Arguello to protect seabird and sea otter populations in 2002, which effectively ended gillnet fishing north of Point Conception (CalCOFI 2013). Also, the set gillnet fishery has been a limited entry fishery since 1986; new permits may not be issued and restrictions exist for transferring existing permits (Huppert and Odemar 1986). Mitigation of gear impacts receives a modifying factor of +0.5 because a substantial proportion of representative habitats are protected from bottom contact, and vulnerable habitats are strongly protected.

Factor 4.3 - Ecosystem-Based Fisheries Management

CALIFORNIA / EASTERN CENTRAL PACIFIC, DRIFT GILLNETS
CALIFORNIA / EASTERN CENTRAL PACIFIC, HANDLINES AND HAND-OPERATED POLE-AND-LINES
CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

In the white seabass FMP, CDFW acknowledges the need to better understand the species' ecosystem role and the impact from fishing. CDFW also has stated that the goal is to move away from single species management and towards multi species ecosystem-based management. Since the release of the white seabass FMP, CDFW has taken steps towards this goal by completing the first white seabass stock assessment. However, the assessment acknowledged that how varying levels of exploitation would impact the food web is unknown (Valero and Waterhouse 2016). From March through September of 2016 and 2017, CDFW collected essential fishery information to better estimate spawning biomass (CDFW 2017). Although these efforts are contributing to the goal of an ecosystem-based approach to management, the fishery lacks spatial management or other policies to protect ecosystem functioning and account for the ecological role of white seabass. The food web impacts of California yellowtail and giant sea bass are also unknown. Considering the uncertainty of this species' ecosystem role, detrimental food web impacts are possible. Therefore, ecosystem-based fisheries management is considered to be of "moderate" concern.

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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.

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Appendix A: Extra By Catch Species

CALIFORNIA FLOUNDER

Factor 2.1 - Abundance

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

The first stock assessment for California halibut was completed in 2011. California flounder was assessed in two stocks: a southern stock, south of Point Conception, and a central stock, north of Point Conception (CDFG 2011b). The spawning biomass of the southern stock was estimated to be depleted to 14% of the unexploited spawning biomass level and above the level that would produce MSY (7%, 392 MT). The spawning biomass was also estimated to be low (16%) at the start of the modeling period (1971) (CDFG 2011b). However, it should be noted that MSY is not an appropriate reference point for California flounder based on the biology of the species, and especially since MSY occurs at such a high depletion level (CDFG 2011b). For comparison, the overfished limit reference point for other Northeast Pacific flatfish is 12.5% of the unexploited spawning biomass, while the biomass at MSY proxy is 25% of the unexploited biomass (Haltuch et al. 2011) (Hicks and Wetzel 2011) (Kaplan and Helser 2007). If these reference points for similar species were used, then southern California flounder would be considered above the overfished limit. Because the stock is above the limit reference point but no target reference point has been determined, the conservation concern for the California halibut (southern stock) is of "moderate" concern.

Justification:

The southern stock spawning biomass has been estimated to be low since the start of the modeling time period (1971). The California flounder are prolific enough and have a high reproductive potential: when environmental conditions are favorable, biomass can increase relatively quickly in a short time. The assumption is that recruitment is independent of stock size at the observed abundance levels. Recruitments since 1999 are estimated to have been low. The MSY is estimated to occur at a very low fraction of the unexploited biomass (7 to 12% of the unexploited spawning biomass level) (CDFG 2011b).

Factor 2.2 - Fishing Mortality

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

Moderate Concern

The southern stock that overlaps with the white seabass set gillnet fishery has an estimated fishing mortality lower than the level that would produce MSY; CDFW estimates the fishing multiplier ("multiplier on the current fishing mortality... that would produce MSY") as 4.49 for the southern stock (CDFG 2011b). However, MSY may not be set at an appropriate level (CDFG 2011b). The stock assessment also states that California flounder has sustained high fishing levels for decades and fishing does not constrain or limit the central California population (CDFG 2011b); however, management action may be needed to reduce the risk of fishery collapse in southern California (CDFG 2011b). Although fishing mortality appears to be below F_{MSY}, due to the uncertainty and conflicting information around the appropriate fishing mortality level to sustain the southern flounder stock, we rate this as "moderate" concern.

Factor 2.3 - Discard Rate

CALIFORNIA / EASTERN CENTRAL PACIFIC, SET GILLNETS

< 100%

The discards to landings ratio for gillnet fisheries worldwide are estimated to be an average rate of 10% or a weighted rate of 0.5% (Kelleher 2005). Gillnets worldwide (drift and set) account for less than 30,000 MT of discards with reported landings of over 3 million MT (Kelleher 2005). This likely is not the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available (Valero and Waterhouse 2016). A study of bycatch in small-scale (vessels less than 15 m) set gillnet fisheries in Baja California, Mexico calculated a discards-to-landings ratio of 34.3% by weight (Shester and Micheli 2011). The conservative discards to landings ratio is 20 to 40%.

Justification:

The weighted discard rate is considered to be the most accurate and representative at a global level (Kelleher 2005).