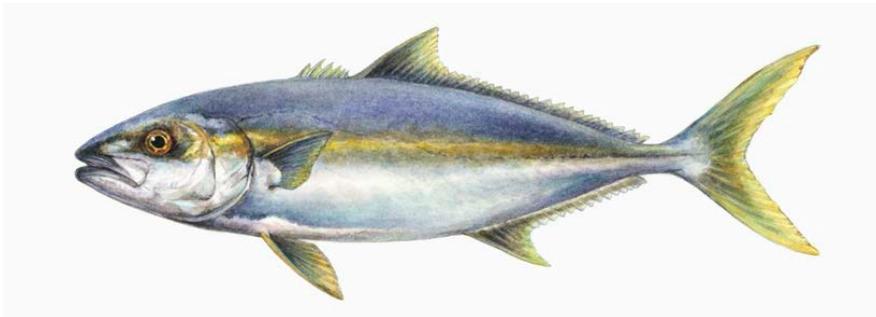


# Monterey Bay Aquarium Seafood Watch®

## California yellowtail, White seabass

*Seriola lalandi, Atractoscion nobilis*



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## California

Bottom gillnet, Drift gillnet, Hook and Line

February 13, 2014

Kelsey James, Consulting researcher

### Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

## Final Seafood Recommendation

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
White seabass California: Southern Northeast Pacific - Gillnet, Drift	Green (3.32)	Red (1.82)	Yellow (3.00)	Green (3.87)	<b>Good Alternative (2.894)</b>
White seabass California: Southern Northeast Pacific - Gillnet, Bottom	Green (3.32)	Red (1.82)	Yellow (3.00)	Yellow (3.12)	<b>Good Alternative (2.743)</b>
White seabass California: Central Northeast Pacific - Hook/line	Green (3.32)	Green (4.07)	Yellow (3.00)	Green (3.46)	<b>Best Choice (3.442)</b>
California yellowtail California: Southern Northeast Pacific - Gillnet, Drift	Yellow (2.64)	Red (1.82)	Yellow (3.00)	Green (3.87)	<b>Good Alternative (2.734)</b>
California yellowtail California: Southern Northeast Pacific - Gillnet, Bottom	Yellow (2.64)	Red (1.82)	Yellow (3.00)	Yellow (3.12)	<b>Good Alternative (2.591)</b>
California yellowtail California: Southern Northeast Pacific - Hook/line	Yellow (2.64)	Green (4.75)	Yellow (3.00)	Green (3.46)	<b>Best Choice (3.380)</b>

**Scoring note** – 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** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores

● **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores

■ **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores.

## **Executive Summary**

This report covers white seabass, *Atractoscion nobilis*, and California yellowtail, *Seriola lalandi*. Both fisheries are concentrated in southern California between Point Conception and the U.S.-Mexico border. The white seabass fishery has a component in Monterey Bay. The Mexican fishery for either fish is not assessed in this report, neither are the recreational fisheries. White seabass and California yellowtail 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 have medium inherent vulnerabilities. White seabass has a fishery management plan (FMP) that is reviewed annual, but no formal stock assessment and no references points. California yellowtail does not have a stock assessment, FMP, or references points. Both species have a moderate stock status concern. The commercial landings of white seabass have not exceeded the recommended optimal yield since its implementation after the 2002 FMP. Also the overfishing criterion for white seabass have not been met, therefore the fishing mortality for white seabass is of low concern. California yellowtail is caught incidentally to the white seabass gillnet fisheries and has low recent annual landings. The stock does not appear depleted, but with no reference points the fishing mortality for California yellowtail is of moderate concern.

Humpback whale have the lowest scores overall, but are only subject to entanglement in the gillnet fisheries. They have a high inherent vulnerability and a high stock status concern because they are listed as endangered on the endangered species list. Humpback whale have low 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). Sea otters, while listed as threatened on the endangered species list, were not included as bycatch in the bottom gillnet fishery because the gillnet depth restrictions eliminated overlap of sea otters and the gillnet fishery 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. The hook and line fishery is very species selective and while bycatch does occur no species occur in large enough numbers to be included here. Additionally, hook and line fishermen make significant efforts to release unwanted bycatch alive including releasing them without removing them from the water.

The management strategies for white seabass and California yellowtail is moderate for all fisheries. This is due to the lack of stock assessments and reference points for both species. The management strategies for bycatch species of these fisheries are moderate for both bottom and drift gillnet. The gillnet fisheries have a moderate ranking based on variable management strategies of bycatch species; good management of humpback whales, but moderate management of California halibut. Bycatch in hook and line fisheries is negligible and any bycatch is released alive and in good condition. Overall, the effectiveness of fishery management is moderate for the white seabass and California yellowtail

fisheries.

The impacts of these gears on the substrate vary. Drift gillnet has no impact and therefore no mitigation of gear impacts on the habitat. Hook and line gear has a very low impact on the substrate, but no effective mitigation of this impact. Bottom gillnet has a low impact on the substrate due to the limited area they are operated in (south of Point Conception) and they are operated over soft sediment. There is minimal mitigation in place for bottom gillnet based on the gillnet bans in waters less than 110 m. There is no evidence that exceptional species are caught in any of these gear types, but there also is no evaluation of ecosystem impacts underway either. Overall drift gillnet and hook and line gear have low habitat and ecosystem impacts, while bottom gillnet has moderate impacts.

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## **Introduction**

### **Scope of the analysis and ensuing recommendation**

This report covers the white seabass, *Atractoscion nobilis*, and California yellowtail, *Seriola lalandi*. Both fisheries are concentrated in southern California between Point Conception and the U.S.-Mexico border. The white seabass fishery has a component in Monterey Bay. The Mexican fishery for either fish is not assessed in this report, neither are the recreational fisheries. White seabass and California yellowtail 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.

### **Overview of the species and management bodies**

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 are also 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). Most females are 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 27 years old (Franklin 1997). Pelagic spawning occurs during the summer with females spawning 4-5 times per season with 0.76-1.5 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 are not permitted to fish in Mexican waters for white seabass (CalCOFI 2013). By the 1980-1981 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). 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 CDFW, has released 2 million white seabass juveniles into the ocean (Johnson pers. comm. 2014). The commercial fishery using bottom and drift gillnets south of Point Conception and hook and line in Monterey Bay is managed by the California Department of Fish and Wildlife (CDFW). In the past twenty years gillnet restrictions have prohibited fishing in state waters and less than 109.7 m (60 FM), but 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"), 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 2011b)(CDFG 2012). There is a large recreational fishery for white seabass, but it is not addressed in this report.

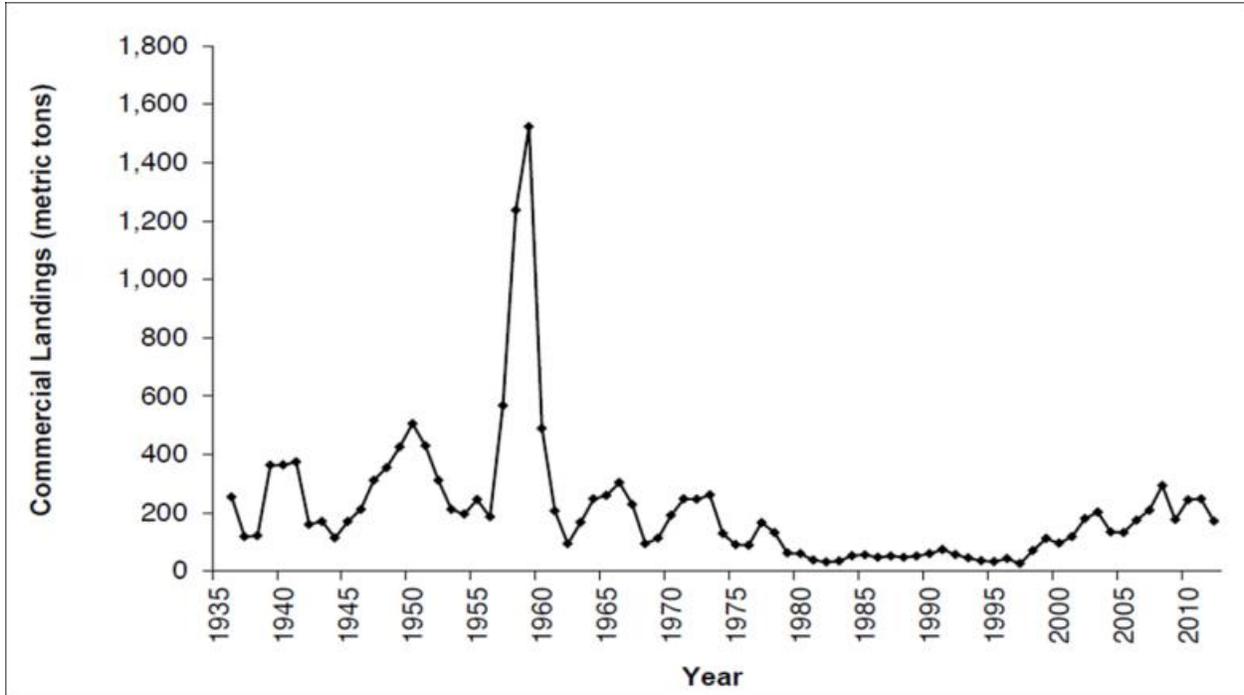
California yellowtail, *Seriola lalandi*, is a large, fast-swimming, coastal pelagic species (Love 1996) and a highly prized game fish in southern California (CDFG 2001). The species ranges from southern Washington, USA to Mazatlán, Mexico (CDFG 2001) with northerly movement into California from Mexico in the spring and summer with warm ocean temperatures (CDFG 2001)(Baxter 1960). The maximum recorded size is 1.5 m and 36.3 kg (80 lbs.) (Love 1996)(CDFG 2001). All females older than three years are 71.12 cm (28") 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 lbs.) 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). There currently is no stock assessment or fishery management plan in place for California yellowtail.

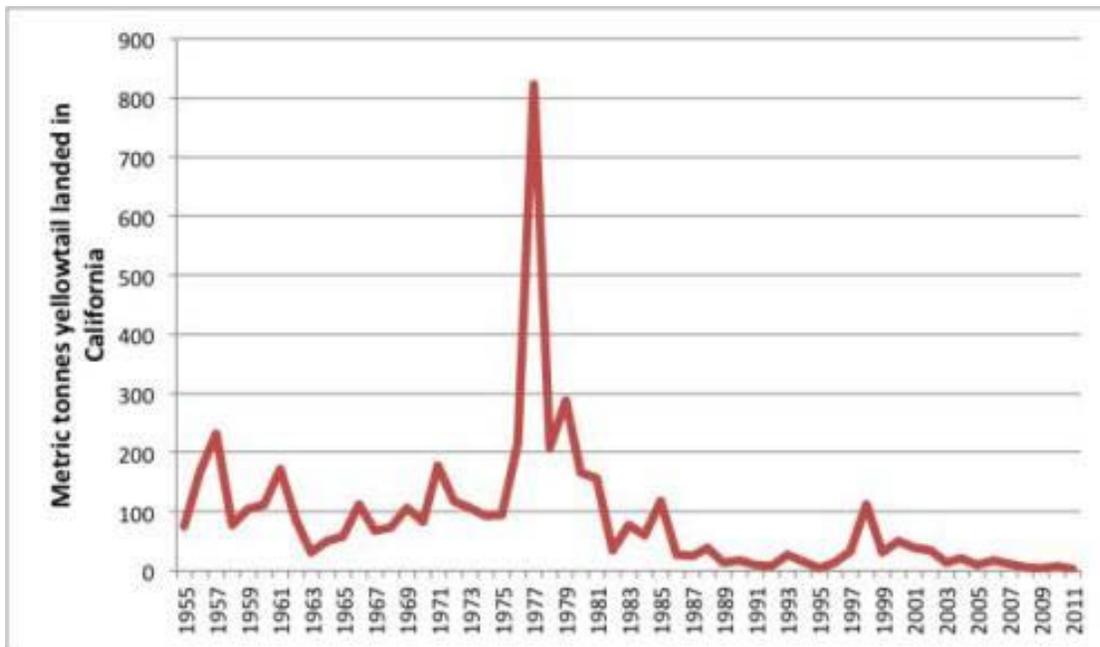
### **Production Statistics**

Total white seabass landings in 2012 were 171 MT and 247 MT in 2011 (Figure 1) (CalCOFI 2013). In 2012, bottom and drift gillnets accounted for 62% of the commercial landings by weight, while hook and line vessels accounted for 38% (CalfCOFI 2013). However, the landings data indicate that a majority of the hook and line vessels opportunistically land white seabass rather than directly target it (CalCOFI 2013).

Total California yellowtail landings were 4.1 MT in 2012 and 2.5 MT in 2011 (Figure 2) (NMFS 2013d).



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



**Figure 2:** Annual California yellowtail landings in California from 1955 to 2011 in metric tonnes. Adapted from NMFS landing statistics.

### **Importance to the US/North American market**

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

California yellowtail exports are believed to negligible with Mexico being 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). Therefore, precise import and export data for yellowtail are unavailable.

### **Common and market names**

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

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

### **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).

## Analysis

### Scoring Guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at <http://www.seafoodwatch.org>

### **Criterion 1: Stock for which you want a recommendation**

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

<b>CALIFORNIA YELLOWTAIL</b>				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
California: Southern Northeast Pacific Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
California: Southern Northeast Pacific Gillnet, Drift	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
California: Southern Northeast Pacific Hook/line	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>

<b>WHITE SEABASS</b>				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
California: Central Northeast Pacific Hook/line	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	<b>Green (3.318)</b>
California: Southern Northeast Pacific Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	<b>Green (3.318)</b>
California: Southern Northeast Pacific Gillnet, Drift	2.00:Medium	3.00:Moderate Concern	3.67:Low Concern	<b>Green (3.318)</b>

Both white seabass and California yellowtail have medium inherent vulnerabilities. White seabass has a fishery management plan (FMP) that is reviewed annual, but no formal stock assessment and no references points. California yellowtail does not have a stock assessment, FMP, or references points.

Both species have a moderate stock status concern. The commercial landings of white seabass have not exceeded the recommended optimal yield since its implementation after the 2002 FMP. Also the overfishing criterion for white seabass have not been met, therefore the fishing mortality for white seabass is of low concern. California yellowtail is caught incidentally to the white seabass gillnet fisheries and has low recent annual landings. The stock does not appear depleted, but with no reference points the fishing mortality for California yellowtail is of moderate concern.

## Justification of Ranking

### CALIFORNIA YELLOWTAIL

#### Factor 1.1 - Inherent Vulnerability to Fishing

- Low = FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.
- Medium = FishBase vulnerability score for species 36-55 OR life history characteristics that make it neither particularly vulnerable or resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.
- High = FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.

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

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

California: Southern Northeast Pacific, Hook/line

2.00

Medium

The California yellowtail's, *Seriola lalandi*, inherent vulnerability was determined using the average of six attributes of a productivity susceptibility analysis (PSA). The average age of maturity is 3 years old (CDFG 2001), which scores a 3 and broadcast spawns over 450,000 eggs each spawning season (Baxter 1960)(CDFG 2001), which scores a 3. The maximum known age is 12 years old (Collins 1973), which scores a 2. The average size at maturity is 71 cm (CDFG 2001), which scores a 2. The average maximum length is 1.5 m (Love 1996), which scores a 2. California yellowtail feeds on sardines, anchovies, jack

mackerel, squid and red crab (Baxter 1960)(CDFG 2001) and has a trophic level of 4.1 +/- 0.3 s.e (Froese and Pauly 2013), which scores a 1. The average of these six scores is 2.167, which represents a medium inherent vulnerability.

**Rationale:**

The FishBase score of 69 out of 100 (Froese and Pauly 2013) was not used for California yellowtail because it overstates the vulnerability. The PSA was determined to better represent California yellowtail inherent vulnerability.

**Factor 1.2 - Abundance**

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

**California: Southern Northeast Pacific, Gillnet, Bottom**

**California: Southern Northeast Pacific, Gillnet, Drift**

**California: Southern Northeast Pacific, Hook/line**

**3.00**

**Moderate Concern**

There is no formal stock assessment or reference points for the California yellowtail stock. A 2001 report by the California Department of Fish and Game suggested that while the size of the California yellowtail stock is smaller than in the 1950s, it could still support substantial harvest pressure (CDFG 2001). An age and size shift in harvest has been observed in commercial passenger fishing vessels (CPFV) data from the 1970s compared to the 1980s and 1990s with more recent catches dominated by two and three year old fish compared to the 1970s which was dominated by six to nine year olds (CDFG 2001). With the unknown stock status and a medium inherent vulnerability the stock status is of moderate concern.

**Factor 1.3 - Fishing Mortality**

- 5 (Very Low Concern) = Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY) OR fishery does not

target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality)

- 3.67 (Low Concern) = Probable ( $>50\%$  chance) that fishing mortality is at or below a sustainable level, but some uncertainty OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught)
- 2.33 (Moderate Concern) = Fishing mortality is fluctuating around sustainable levels OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery, and if species is depleted, reasonable management is in place.
- 1 (High Concern) = Overfishing is occurring, but management is in place to curtail overfishing OR fishing mortality is unknown, species is depleted and no management is in place
- 0 (Critical) = Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

##### 2.33 Moderate Concern

California yellowtail is predominately commercially caught incidentally to the white seabass fishery (CDFG 2001). Recent catches of California yellowtail in net fisheries (bottom and drift gillnet) are 4.4, 1.8, and 3.6 MT in 2010, 2011, and 2012, respectively (NMFS 2013d). The fishing mortality in relation to reference points is unknown since none have been established. The stock does not appear depleted and is moderately susceptible to gillnet fisheries therefore the fishing mortality is moderate.

#### California: Southern Northeast Pacific, Hook/line

##### 2.33 Moderate Concern

California yellowtail is landed in hook and line gear mainly in southern California (CDFG 2001). Recent catches of California yellowtail in hook and line fisheries are 2.4, 0.7, and 3.5 MT in 2010, 2011, and 2012, respectively (NMFS 2013d). The fishing mortality in relation to reference points is unknown since none have been established. The stock does not appear depleted and is moderately susceptible to hook and line fisheries therefore the fishing mortality is moderate.

## **WHITE SEABASS**

### **Factor 1.1 - Inherent Vulnerability to Fishing**

- Low = FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.
- Medium = FishBase vulnerability score for species 36-55 OR life history characteristics that make it neither particularly vulnerable or resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.
- High = FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.

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

**California: Central Northeast Pacific, Hook/line**

**California: Southern Northeast Pacific, Gillnet, Bottom**

**California: Southern Northeast Pacific, Gillnet, Drift**

**2.00**

**Medium**

The vulnerability of white seabass, *Atractoscion nobilis*, is calculated by a productivity and susceptibility analysis (PSA) by averaging the scores of six productivity attributes. The average age at maturity is 4 years for females and 3 years for males (Vojkovich and Crooke 2001)(Vojkovich 1992)(CDFG 2002) which scores a 3. The maximum known age is 27 years old (CDFG 2002) which results in a conservative score of 1. The average maximum size is 1.7 m (Love 1996), which scores a 2. The size at maturity is 61 cm for females and 51 cm for males (Vojkovich and Crooke 2001)(Vojkovich 1992)(CDFG 2002), which scores a 2. The reproductive strategy is broadcast spawning with a release of 760,000-1,500,000 eggs per batch (Thomas 1968)(CDFG 2002), which scores a 3. White seabass aggregate to spawn(Thomas 1968), which makes them more vulnerable to exploitation, but at this time this factor is not addressed by the PSA. White seabass feeds primarily on anchovies (*Engraulis* spp.), herring (*Clupea* spp.), sardines (*Sardinops* spp.), squid (*Loligo* spp.), and pelagic crabs (Pleuroncodesplanipes) (Thomas 1968)(Vojkovich and Reed 1983) which results in an estimated tropic level of  $3.2 \pm 0.4$  standard error (Froese and Pauly 2013) and a score of 2. The average of these scores is 2.17 which is a moderate inherent vulnerability.

**Rationale:**

The FishBase score of 70 out of 100 (Froese and Pauly 2013) was not used for white seabass because it overstates the vulnerability (Sepulveda pers. comm. 2013). The PSA was determined to better represent white seabass inherent vulnerability.

### Factor 1.2 - Abundance

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

California: Central Northeast Pacific, Hook/line

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

**3.00**

**Moderate Concern**

The first stock assessment for white seabass is underway in 2014. The best information until the assessment is completed is a fishery 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 lbs.) and the MSY proxy including a natural mortality rate of 0.1 was 725.7 MT (1.6 million lbs.)(CDFG 2002). The annual harvest quota or optimum yield (OY) calculated as 75% of the MSY was established at 544.3 (1.2 million lbs.) in 2002 and has not changed for the fishery since (CDFG 2002)(CDFG 2011b). The white seabass fishery lacks a quantitative stock assessment or target reference points, but landings in a season have never exceeded the set OY (CDFG 2004)(CDFG 2005)(CDFG 2006)(CDFG 2007)(CDFG 2008)(CDFG 2009)(CDFG 2010)(CDFG 2011b). A fisheries independent survey of juvenile white seabass indicates that white seabass is in the process of recovery (Allen et al. 2007), but without formal reference points the conservation concern for the white seabass stock is moderate.

### Factor 1.3 - Fishing Mortality

- 5 (Very Low Concern) = Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY) OR fishery does not

target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality)

- 3.67 (Low Concern) = Probable ( $>50\%$  chance) that fishing mortality is at or below a sustainable level, but some uncertainty OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught)
- 2.33 (Moderate Concern) = Fishing mortality is fluctuating around sustainable levels OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery, and if species is depleted, reasonable management is in place.
- 1 (High Concern) = Overfishing is occurring, but management is in place to curtail overfishing OR fishing mortality is unknown, species is depleted and no management is in place
- 0 (Critical) = Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.

#### California: Central Northeast Pacific, Hook/line

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

### 3.67 Low Concern

The 2011-12 fishery landed 171 MT whereas the 2010-11 fishery landed 247 MT and the 2009-10 fishery landed 219 MT (CDFG 2011b)(CalCOFI 2013). This is significantly below the set OY of 544.2 MT (CDFG 2002). The recreational landings of white seabass was estimated at 107 MT in 2012 (CalCOFI 2013). While the recreational fishery is not considered here, the sum of commercial and recreational landings (278 MT) still does not exceed the set OY. Commercial landings in a season have never exceeded the set OY (Figure 1)(CDFG 2004)(CDFG 2005)(CDFG 2006)(CDFG 2007)(CDFG 2008)(CDFG 2009)(CDFG 2010)(CDFG 2011b) indicating that the stock is not experiencing overfishing. The White Seabass Scientific and Constituent Advisory Panel (WSSCAP) and the California Department of Fish and Wildlife (CDFW) agreed that overfishing criterion were not met (CDFG 2011b). Due to the continued catch less than the estimated OY across gear types, the fishing mortality is deemed of low conservation concern for set gillnet, drift gillnet, and hook and line fisheries.

#### Rationale:

The three criterion used to determine overfishing are (1) 20% decline in the total annual commercial landings for the past two consecutive seasons compared to the prior 5-season running average, (2) a 20% decline in both the number and average weight of white seabass caught in the recreational fishery for two consecutive seasons, and (3) a 30% decline in recruitment indices for juvenile white seabass

compared to the prior 5-season running average (CDFG 2002)(CDFG 2011b). For the first criterion the 2009-2010 season landings increased 11% (218.9 MT; 482,660 lbs.) compared to the 5-season running average (196.7 MT; 433,621 lbs.). For the second criterion the number of fish caught in the 2009-2010 season increased 29% whereas the average weight of fish caught increased 21% (CDFG 2011b). The third criterion was not analyzed due to reduced funding to the Ocean Resources Enhancement and Hatchery Program (OREHP) and subsequent lack of a white seabass recruitment survey in 2009-2010 (CDFG 2011b).

## **Criterion 2: Impacts on other retained and bycatch stocks**

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

### **California yellowtail: California: Southern Northeast Pacific, Gillnet, Bottom**

**Subscore:: 1.916      Discard Rate: 0.95      C2 Rate: 1.820**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>HUMPBACK WHALE: CALIFORNIA/OREGON/WASHINGTON</b>	1.00: High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>WHITE SHARK</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>CALIFORNIA HALIBUT: SOUTHERN CALIFORNIA</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>CALIFORNIA YELLOWTAIL</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>SKATE (UNSPECIFIED)</b>	1.00: High	2.00: High Concern	3.67: Low Concern	<b>2.709</b>
<b>WHITE SEABASS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

### **California yellowtail: California: Southern Northeast Pacific, Gillnet, Drift**

**Subscore:: 1.916      Discard Rate: 0.95      C2 Rate: 1.820**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>HUMPBACK WHALE: CALIFORNIA/OREGON/WASHINGTON</b>	1.00: High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>WHITE SHARK</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>CALIFORNIA YELLOWTAIL</b>	2.00: Medium	3.00: Moderate	2.33: Moderate	<b>2.644</b>

		Concern	Concern	
<b>PACIFIC BARRACUDA</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>WHITE SEABASS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

**California yellowtail: California: Southern Northeast Pacific, Hook/line**

**Subscore:: 5.000      Discard Rate: 0.95      C2 Rate: 4.750**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>CALIFORNIA YELLOWTAIL</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>

**White seabass: California: Central Northeast Pacific, Hook/line**

**Subscore:: 5.000      Discard Rate: 0.95      C2 Rate: 4.070**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>WHITE SEABASS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

**White seabass: California: Southern Northeast Pacific, Gillnet, Bottom**

**Subscore:: 1.916      Discard Rate: 0.95      C2 Rate: 1.820**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>HUMPBACK WHALE: CALIFORNIA/OREGON/WASHINGTON</b>	1.00: High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>WHITE SHARK</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>CALIFORNIA HALIBUT: SOUTHERN CALIFORNIA</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>CALIFORNIA YELLOWTAIL</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>SKATE (UNSPECIFIED)</b>	1.00: High	2.00: High Concern	3.67: Low Concern	<b>2.709</b>

<b>WHITE SEABASS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>
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**White seabass: California: Southern Northeast Pacific, Gillnet, Drift**

**Subscore:: 1.916      Discard Rate: 0.95      C2 Rate: 1.820**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
<b>HUMPBCK WHALE: CALIFORNIA/OREGON/WASHINGTON</b>	1.00: High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>WHITE SHARK</b>	1.00: High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
<b>CALIFORNIA YELLOWTAIL</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>PACIFIC BARRACUDA</b>	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>WHITE SEABASS</b>	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

Humpback whale have the lowest scores overall, but are only subject to entanglement in the gillnet fisheries. They have a high inherent vulnerability and a high stock status concern because they are listed as endangered on the endangered species list. Humpback whale have low 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). Sea otters, while listed as threatened on the endangered species list, were not included as bycatch in the bottom gillnet fishery because the gillnet depth restrictions eliminated overlap of sea otters and the gillnet fishery 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. The hook and line fishery is very species selective and while bycatch does occur no species occur in large enough numbers to be included here. Additionally, hook and line fishermen make significant efforts to release unwanted bycatch alive including releasing them without removing them from the water.

### **Justification of Ranking**

*See criterion 1 for scoring definitions.*

## **CALIFORNIA HALIBUT: SOUTHERN CALIFORNIA**

### **2.1 - Inherent Vulnerability**

#### **California: Southern Northeast Pacific, Gillnet, Bottom**

**2.00**

**Medium**

The vulnerability of California halibut, *Paralichthys californicus*, is calculated by a productivity and susceptibility analysis (PSA) by averaging the scores of six productivity attributes. The average age at maturity is estimated at 4 years for females and between one and three years for males (Love and Brooks 1990). The maximum reported age is 30 years old (Pattison and McAllister 1990), however other studies have only found maximum ages of 19 (CDFG 2011a) and 13 (MacNair et al. 2001) for females and maximum male ages are 23 and 16 (Pattison and McAllister 1990) and 16 (CDFG 2011a). Several additional studies have shown that individuals over 10 years are uncommon (Sunada et al. 1990)(Pattison and McAllister 1990)(MacNair et al. 2001), therefore the average maximum age is likely less than 25 years old. The maximum size of California halibut is 150 cm (Love 1996) and the average size at maturity is 47 cm for females and 23 cm for males (Love and Brooks 1990). The reproductive strategy is broadcast spawning with as many as 1 million eggs released in one spawning event (CalCOFI 2012). Adult California halibut feed primarily on fishes including: northern anchovy (*Engraulis mordax*), topsmelt (*Atherinops affinis*), California killifish (*Fundulus parvipinnis*), various gobies, white croaker (*Genyonemus lineatus*), hornyhead turbot (*Pleuronichthys verticalis*), Pacific saury (*Cololabis saira*), Pacific herring (*Clupea pallasii*), sanddabs, and white seaperch (*Phanerodon furcatus*) with the occasional crustacean or squid (Allen 1990)(Bain and Bain 1971)(Haaker 1975)(Plummer et al. 1983). The trophic level is estimated at 4.5 (Froese and Pauly 2013). These six attributes average 2.0 which correspond to a moderate inherent vulnerability.

#### **Rationale:**

The fishbase score of 68 out of 100 (Froese and Pauly 2013) was not used for California halibut because it overstates the vulnerability. The PSA was determined to better represent California halibut inherent vulnerability.

### **2.2 - Stock Status**

#### **California: Southern Northeast Pacific, Gillnet, Bottom**

**3.00**

**Moderate Concern**

The first ever stock assessment for California halibut was completed in 2011. California halibut was assessed in two stocks: a southern stock, south of Point Conception, and a central stock, north of Point Conception (CDFG 2011a). The spawning biomass of the southern stock, affected by the white seabass set gillnet fishery, was estimated to be depleted to 14% of the unexploited spawning biomass level,

however the spawning biomass was estimated to be low since the start of the modeling period (1971) and to be above the level that would produce MSY (392 MT)(CDFG 2011a). For California halibut MSY is not an appropriate reference point (see detailed rationale and 2.3 for southern California halibut). For comparison, the overfished limit reference point for other Northeast Pacific flatfish is 12.5% of the unexploited spawning biomass, while 25% of the unexploited biomass is the biomass at MSY proxy (Haltuch et al. 2011)(Hicks and Wetzel 2011)(Kaplan and Helser 2007). If the reference points for other flatfish was used then southern California halibut is above the overfished limit. However, since no reference point has been determined the conservation concern for the southern stock is of moderate concern.

**Rationale:**

The southern stock spawning biomass has been estimated to be low since the start of the modeling time period (1971) (CDFG 2011a). The California halibut are prolific enough and have a high reproductive potential that when environmental conditions are favorable, biomass can increase relatively quickly in a short time (CDFG 2011a). The assumption is made that recruitment is independent of stock size, at least at the observed abundance levels, which is not contradicted by the data (CDFG 2011a). Recruitments since 1999 are estimated to have been low, which is supported by the data (CDFG 2011a). The MSY is estimated to occur at a very low fraction of the unexploited biomass (7-12% of the unexploited spawning biomass level) (CDFG 2011a).

## 2.3 - Fishing Mortality

### California: Southern Northeast Pacific, Gillnet, Bottom

#### 2.33 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 (392 MT)(CDFG 2011a). The current fishing mortality would have to be multiplied by 4.49 for the southern stock to achieve MSY (CDFG 2011a). However, no stock status reference points have been developed for California halibut (CDFG 2011a). The estimated MSY based reference points are inappropriate based on the biology of the California halibut and the assumption that recruitment is independent of stock size causing the spawning biomass associated with MSY to occur at a high depletion level (7-12% of the unexploited spawning biomass) (CDFG 2011a). The 25% proxy level might be a reasonable reference point (CDFG 2011a). The stock assessment states that although California halibut has sustained high fishing levels for decades, management action may be needed to reduce the risk of fishery collapse in southern California (CDFG 2011a). The fishing mortality for the southern stock is moderate based on the unknown fishing mortality in relation to an appropriate reference point.

## 2.4 - Discard Rate

### California: Southern Northeast Pacific, Gillnet, Bottom

**0.95**      **20-40%**

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 isn't the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available. 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%.

#### Rationale:

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

## HUMPBACK WHALE: CALIFORNIA/OREGON/WASHINGTON

### 2.1 - Inherent Vulnerability

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

**1.00**      **High**

Humpback whale, *Megaptera novaeangliae*, as all marine mammals, has a high inherent vulnerability.

### 2.2 - Stock Status

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

**1.00**      **Very High Concern**

Humpback whale has been listed as endangered under the ESA since 1970 (NMFS 2013a). It was last assessed in 2010 and the best estimate of population size was 2,043 (Carretta et al. 2011). The Potential Biological Removal (PBR) calculated from this population estimate is 11.3 whales per year. Threats to humpback whale are entanglement in fishing gear (mainly trap/pot gear with a smaller amount of gillnet

gear) and ship strikes. Humpback whale is of very high conservation concern.

## 2.3 - Fishing Mortality

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

3.67

**Low Concern**

Humpback whale has a PBR allocation for US waters of 11.3 whales per year (Carretta et al. 2013). Eighteen whales were observed entangled, alive or dead, in fishing gear from 2004-2008, eleven entangled in trap/pot gear (Carretta et al. 2013). The remaining seven were observed entangled in unknown fishing gear that may have included set and drift gillnets and an estimated 1.4 whales are taken annually with unknown fishing gear (Carretta et al. 2013). This species is still listed as endangered therefore it is automatically a strategic stock under the marine mammal protection act (MMPA), however it is not experiencing cumulative fishing mortality in excess of Potential Biological Removal (PBR)(Carretta et al. 2013). The estimated annual mortality and serious injury due to entanglement is 3.2 per year from commercial fisheries, which is less than the allowed PBR (11.3), but greater than 10% of the PBR; therefore total fishing mortality is not approaching zero, which is the goal (Carretta et al. 2013). The white seabass and California yellowtail set and drift gillnet fisheries are considered category two fisheries based on the effects on this stock (NMFS 2013b). Based on the category two ranking, a take in the fisheries of between 10-50% of the PBR (conservatively allocating all takes from unknown fishing gear to these fisheries), and the fact that the cumulative fishing mortality is less than PBR, humpback whales have a low conservation concern in the white seabass set and drift gillnet fisheries.

### Rationale:

A category two fishery in the NOAA list of fisheries means that the fishery has occasional interactions with marine mammals (NMFS 2013b). The list of fisheries documented one humpback whale as seriously injured in 2007 for the set gillnet fishery, which equals 1.7% of the stock's PBR of 11.3 (NMFS 2013b). The danger from the drift gillnet fishery is assumed to be analogous to the set gillnet fishery for humpback whales due to the similarity of the two fisheries(NMFS 2013b). Assigning all unknown entanglement mortalities and serious injuries to the white seabass set gillnet fishery is very conservative.

## 2.4 - Discard Rate

California: Southern Northeast Pacific, Gillnet, Bottom

0.95

**20-40%**

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 isn't the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available. 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%.

**Rationale:**

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

**California: Southern Northeast Pacific, Gillnet, Drift**

**0.95**      **20-40%**

The discard to landings ratio for drift gillnets targeting white seabass and California yellowtail have not been estimated. 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 8.89-35.56 cm (NMFS 2013b). With no other data, an estimate of the discards to landings ratio is 20-40%.

**PACIFIC BARRACUDA**

**2.1 - Inherent Vulnerability**

**California: Southern Northeast Pacific, Gillnet, Drift**

**2.00**      **Medium**

Pacific barracuda, *Sphyraena argentea*, was assessed using a PSA analysis with six scored attributes. It matures at 35-47.5 cm SL (a score of 2) and 2-3 years old (a score of 3) (Walford 1932)(Bottinelli and Allen 2007). The maximum estimated age is 18 years (a score of 2) (Bottinelli and Allen 2007). The maximum size is 145 cm (a score of 2) (Froese and Pauly 2013). The batch fecundity was estimated between 177,000 and over 510,000 eggs with multiple batches broadcast per year (a score of 3) (Bottinelli and Allen 2007). The trophic level was estimated at 4.5 +/- 0.80 SE (a score of 1) (Froese and Pauly 2013). The average of these attribute scores is 2.167 which corresponds to a medium inherent vulnerability.

**Rationale:**

The fishbase score of 69 out of 100 (Froese and Pauly 2013) was not used for Pacific barracuda because

it overstates the vulnerability. The PSA was determined to better represent Pacific barracuda inherent vulnerability.

## 2.2 - Stock Status

California: Southern Northeast Pacific, Gillnet, Drift

3.00

**Moderate Concern**

Pacific barracuda do not have a stock assessment therefore no reference points or estimates of biomass have been made. Due to the unknown stock status and the medium inherent vulnerability there is a moderate concern for the stock status.

## 2.3 - Fishing Mortality

California: Southern Northeast Pacific, Gillnet, Drift

2.33

**Moderate Concern**

There is currently no commercial fishery that targets Pacific barracuda. Since the purse seine ban in 1940 there has been very low fishing pressure on Pacific barracuda with almost all of the landings from recreational fishing (Bottinelli and Allen 2007). Fishing in US waters only occurs from Pt. Conception south the US-Mexico border (Bottinelli and Allen 2007). Legal size is 61.0 cm SL (28" TL) which is greater than the size at maturation (35-47.5 cm SL) and therefore allows a few years of spawning before legal size is reached (Walford 1932)(Bottinelli and Allen 2007). Reported NMFS landings for all net gear of Pacific barracuda was 17.4 MT in 2010, 32.6 MT in 2011, and 13.6 MT in 2012 (NMFS 2013d). Despite the low fishing pressure and relatively low recent landings there are no estimated catch limits for Pacific barracuda therefore the fishing mortality is considered of moderate concern.

## 2.4 - Discard Rate

California: Southern Northeast Pacific, Gillnet, Drift

0.95

**20-40%**

The discard to landings ratio for drift gillnets targeting white seabass and California yellowtail have not been estimated. 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 8.89-35.56 cm (NMFS 2013b). With no other data, an estimate of the discards to landings ratio is 20-40%.

## **SKATE (UNSPECIFIED)**

### **2.1 - Inherent Vulnerability**

California: Southern Northeast Pacific, Gillnet, Bottom

**1.00**      **High**

There are five common skate species that overlap with the California halibut distribution: big, *Beringraja binocularata*, sandpaper, *Bathyraja interrupta*, California, *Raja inornata*, longnose, *R. rhina*, and starry *R. stellulata* skates. The vulnerability scores of these species are 86, 59, 53, 55, and 53 (Froese and Pauly 2013). This group conservatively has high inherent vulnerability.

### **2.2 - Stock Status**

California: Southern Northeast Pacific, Gillnet, Bottom

**2.00**      **High Concern**

Within the unspecified skate category only one species has a stock assessment. The longnose skate was assessed in 2008 and the stock was estimated at 66% of the unfished stock level in 2007 (Gertseva and Schirripa 2008), but a more recent stock assessment is unavailable. The other four species have unknown stock statuses. The generally unknown statuses in combination with the high inherent vulnerability of this group results in a high conservation concern.

### **2.3 - Fishing Mortality**

California: Southern Northeast Pacific, Gillnet, Bottom

**3.67**      **Low Concern**

The fishing mortality for this unspecified skate category is unknown because no reference points have been estimated and the stocks have not been assessed. The one species, the longnose skate, with a stock assessment has a MSY proxy harvest rate that corresponds to a 4.3% exploitation rate; the exploitation rate estimated for 2007 was 1.25% (Gertseva and Schirripa 2008). The longnose skate is of very low conservation concern. The white seabass and California yellowtail set gillnet fishery is not the main fishery for this species, 97% of skate landings are from bottom trawl (Gertseva and Schirripa 2008). Thus, since the set gillnet fishery is not one of the primary anthropogenic contributors to mortality and does not target unspecified skates, they are of low concern.

## 2.4 - Discard Rate

### California: Southern Northeast Pacific, Gillnet, Bottom

**0.95**      **20-40%**

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 isn't the exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available. 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%.

#### Rationale:

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

## WHITE SHARK

### 2.1 - Inherent Vulnerability

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

**1.00**      **High**

White shark, *Carcharodon carcharias*, has an inherent vulnerability of 86 out of 100 (Froese and Pauly 2013), therefore it has a high inherent vulnerability.

### 2.2 - Stock Status

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

**2.00**      **High Concern**

There is no stock assessment for white shark, therefore there are no reference points to use to assess the stock status. The population size has been estimated at 219 mature and sub-adults for central California (Chapple et al. 2011), but there are no historic estimates to compare this to. 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 (Lowe et al. 2012). This suggests that more white sharks are present and that the population is increasing (Lowe et al. 2012). The increase could be in part due to the nearshore gillnet bans in 1994 and the white shark bans (Lowe et al. 2012). White sharks are listed as vulnerable with an unknown population trend by the IUCN red list of threatened species (IUCN 2013), and 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 2013c). White shark is currently being considered for California's endangered species list. Nevertheless with these population concerns, the stock status is of high concern.

## 2.3 - Fishing Mortality

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

2.33

**Moderate Concern**

The fishing mortality is unknown with respect to reference points because none are available for white shark. It is illegal to retain a white shark in California state and federal waters, although this does not preclude it from incidental catch. 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 2013c). The relatively low catch rate of white shark and the good post release survival from incidental catch suggest low fishing mortality, but what the population can withstand is unknown, therefore the fishing mortality is of moderate concern.

## 2.4 - Discard Rate

California: Southern Northeast Pacific, Gillnet, Bottom

0.95

**20-40%**

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 isn't the

exact ratio specific to the white seabass set gillnet fishery, but fishery specific data are not available. 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%.

**Rationale:**

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

**California: Southern Northeast Pacific, Gillnet, Drift**

**0.95**

**20-40%**

The discard to landings ratio for drift gillnets targeting white seabass and California yellowtail have not been estimated. 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 8.89-35.56 cm (NMFS 2013b). With no other data, an estimate of the discards to landings ratio is 20-40%.

### **Criterion 3: Management effectiveness**

Management is separated into management of retained species and management of non-retained species/bycatch. The final score for this criterion is the geometric mean of the two scores.

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
California: Central Northeast Pacific Hook/line	3.000	All Species Retained	Yellow(3.000)
California: Southern Northeast Pacific Gillnet, Bottom	3.000	3.000	Yellow(3.000)
California: Southern Northeast Pacific Gillnet, Drift	3.000	3.000	Yellow(3.000)
California: Southern Northeast Pacific Hook/line	3.000	All Species Retained	Yellow(3.000)

<b>Factor 3.1: Management of fishing impacts on retained species</b>							
Region / Method	Strategy	Recovery	Research	Advice	Enforce	Track	Inclusion
California: Central Northeast Pacific Hook/line	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective
California: Southern Northeast Pacific Gillnet, Bottom	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective
California: Southern Northeast Pacific Gillnet, Drift	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
California: Southern Northeast Pacific Hook/line	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Highly Effective	Highly Effective

#### **Justification of Ranking**

##### **Factor 3.1: Management of Fishing Impacts on Retained Species**

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'.

- 5 (Very Low Concern) = Rated as 'highly effective' for all seven subfactors considered
- 4 (Low Concern) = Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rated at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective'
- 0 (Critical) = No management exists when a clear need for management exists (i.e., fishery catches threatened, endangered, or high concern species) OR there is a high level of Illegal, Unregulated, and Unreported Fishing occurring.

### 3.1.0 - Critical?

California: Central Northeast Pacific, Hook/line

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

California: Southern Northeast Pacific, Hook/line

0.00

No

### Subfactor 3.1.1 - Management Strategy and Implementation

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

California: Central Northeast Pacific, Hook/line

2.00

Moderately Effective

There is no stock assessment for white seabass, but it has an annually reviewed fishery management plan (CDFG 2002)(CDFG 2011b). White seabass has a minimum size limit of 71.12 cm (28"), but the fishery is open year round (CDFG 2012). There are no appropriate reference points for this species

therefore the management strategy and implementation is moderately effective.

#### California: Southern Northeast Pacific, Gillnet, Bottom

##### 2.00 Moderately Effective

Gillnets are prohibited in waters less than 110-128 m (60-70 fms) (CalCOFI 2013)(CDFG 2012). Minimum mesh size restrictions are 15.24 cm (6") to fish white seabass and California yellowtail (CDFG 2012). The white seabass fishery is closed from March 15 through June 15 to protect spawning schools (CDFG 2011b) and no more than 0.227 MT (500 lbs.) of California yellowtail may be landed from May 1st to August 31st (CDFG 2012). A minimum size limit of 71.12 cm (28") is in place for both species (CDFG 2012). Based on these restrictions and the fact that no reference points are available, the management strategy of white seabass and California yellowtail bottom gillnets is moderately effective.

#### California: Southern Northeast Pacific, Gillnet, Drift

##### 2.00 Moderately Effective

Gillnets are prohibited in waters less than 110-128 m (60-70 fms) (CalCOFI 2013)(CDFG 2012). Mesh size restrictions are 15.24-35.56 cm (6-14") to fish white seabass and 8.89-35.56 (3.5-14") for California yellowtail (CDFG 2012). The white seabass fishery is closed from March 15 through June 15 to protect spawning schools (CDFG 2011b) and no more than 0.227 MT (500 lbs.) per vessel or 1.134 MT (2500lbs) for vessels with five or more persons of California yellowtail may be landed from May 1st to August 31st (CDFG 2012). A minimum size limit of 71.12 cm (28") is in place for both species (CDFG 2012). Based on these restrictions and the fact that no references points are available, the management strategy of white seabass and California yellowtail drift gillnets is moderately effective.

#### California: Southern Northeast Pacific, Hook/line

##### 2.00 Moderately Effective

There is no stock assessment available for California yellowtail. In any fishery, no more than 0.227 MT (500 lbs.) of California yellowtail may be landed from May 1st to August 31st (CDFG 2012). A minimum size limit of 71.12 cm (28") is in place (CDFG 2012). Based on these restrictions and the fact that no reference points are available, the management strategy of California yellowtail hook and line is moderately effective.

### Subfactor 3.1.2 - Recovery of Species of Concern

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

California: Central Northeast Pacific, Hook/line

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

California: Southern Northeast Pacific, Hook/line

3.00

**Highly Effective**

There are no overfished, depleted, endangered or threatened species targeted or retained in this fishery.

### Subfactor 3.1.3 - Scientific Research and Monitoring

*Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species. To receive a highly effective score, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

California: Central Northeast Pacific, Hook/line

2.00

**Moderately Effective**

There is no stock assessment for white seabass, but a fishery management plan was published in 2002 and experiences annual updates that maintain that the fishery is not overfished (CDFG 2002)(CDFG 2011b). This annual update is not a full stock assessment therefore the scientific research and monitoring is moderately effective.

California: Southern Northeast Pacific, Gillnet, Bottom

California: Southern Northeast Pacific, Gillnet, Drift

2.00

**Moderately Effective**

There is no stock assessment for white seabass, but a fishery management plan was published in 2002

and experiences annual updates that maintain that the fishery is not overfished (CDFG 2002)(CDFG 2011b). This annual update, while not a full stock assessment, indicates good scientific research and monitoring. California yellowtail on the other hand has no stock assessment or fishery management plan. Together the scientific research and monitoring of these two species is moderately effective.

#### California: Southern Northeast Pacific, Hook/line

##### 2.00 Moderately Effective

California yellowtail has no stock assessment or fishery management plan. The CDFW regularly collects fishery dependent information in both commercial and recreational yellowtail fisheries including data on annual landings, commercial gear types used, Commercial Passenger Fishing Vessels (CPFV) logbook information, etc. (California Code of Regulations 2011). These data are used in the commercial fisheries to monitor yearly commercial landings. 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). The scientific research and monitoring is moderately effective.

#### Rationale:

Additional recreational data collection is performed through the California Recreational Fisheries Survey and housed within the Recreational Fisheries Information Network (RecFIN)(CDFG 2011c).

#### Subfactor 3.1.4 - Management Record of Following Scientific Advice

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

#### California: Central Northeast Pacific, Hook/line

##### 3.00 Highly Effective

There are no reference points for white seabass, but the annual review of the fishery management indicates that it is not overfished (CDFG 2011b). Additionally there is a minimum size limit of 71.12 cm (28") in place (CDFG 2012). In the hook and line fishery, management appears to follow scientific advice.

#### California: Southern Northeast Pacific, Gillnet, Bottom

##### 3.00 Highly Effective

There are no reference points for white seabass, but the annual review of the fishery management

indicates that it is not experiencing overfishing (CDFG 2011b). There also are no reference points for California yellowtail. There is a minimum size limit of 71.12 cm (28") in place for both species and a minimum mesh size of 15.24 cm (6") (CDFG 2012). A long list of management changes starting with the prohibition of trammel nets in state waters in 1911, which were later reinstated, have been implemented to better manage this fishery (CDFG 2011a). In 1994 gillnets were prohibited from state waters and in 2002 prohibited in waters less than 110 m north of Point Arguello (CalCOFI 2012). In the bottom gillnet fishery management follows scientific advice.

#### California: Southern Northeast Pacific, Gillnet, Drift

**3.00**      **Highly Effective**

There are no reference points for white seabass, but the annual review of the fishery management indicates that it is not overfished (CDFG 2011b). There also are no reference points for California yellowtail. There is a minimum size limit of 71.12 cm (28") in place for both species and a mesh size requirement between 8.89-35.56 cm (3.5-14")(CDFG 2012). A long list of management changes starting with the prohibition of trammel nets in state waters in 1911, which were later reinstated, have been implemented to better manage this fishery (CDFG 2011a). In 1994 gillnets were prohibited from state waters and in 2002 prohibited in waters less than 110 m north of Point Arguello (CalCOFI 2012). In the drift gillnet fishery management follows scientific advice.

#### California: Southern Northeast Pacific, Hook/line

**3.00**      **Highly Effective**

There are no reference points for California yellowtail. There is a minimum size limit of 71.12 cm (28") in place (CDFG 2012). A 2001 report by the California Department of Fish and Game suggested that while the size of the California yellowtail stock is smaller than in the 1950s, it could still support substantial harvest pressure (CDFG 2001). The scientific advice of the hook and line fishery for California yellowtail is considered highly effective.

### **Subfactor 3.1.5 - Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.*

#### California: Central Northeast Pacific, Hook/line

**3.00 Highly Effective**

California Fish and Wildlife officers patrol and enforce regulations. Fishery-dependent monitoring of central and southern California ports by State Finfish Management Project and dockside sampling does occur. There is no federal observer coverage currently.

**California: Southern Northeast Pacific, Gillnet, Bottom****3.00 Highly Effective**

California Department of Fish and Wildlife officers patrol and enforce fishing regulations including areas where gillnets are prohibited. Additionally dockside sampling does occur. In 2010, 216 gillnet sets from both the California halibut and the white seabass fishery were observed, which equates to 12.5% of both fisheries (Carretta and Enriquez 2012). There is currently no federal observer coverage of this fishery. Enforcement for the gillnet fishery is considered highly effective.

**California: Southern Northeast Pacific, Gillnet, Drift****3.00 Highly Effective**

California Department of Fish and Wildlife officers patrol and enforce fishing regulations including areas where gillnets are prohibited. Additionally dockside sampling does occur. There is currently no federal observer coverage of this fishery. Enforcement for the drift gillnet fishery is considered highly effective.

**California: Southern Northeast Pacific, Hook/line****3.00 Highly Effective**

California Fish and Wildlife officers patrol and enforce regulations. Fishery-dependent monitoring of central and southern California ports by State Finfish Management Project and dockside sampling does occur. There is no federal observer coverage currently.

**Subfactor 3.1.6 – Management Track Record**

*Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels. A highly effective rating will be given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*

### California: Central Northeast Pacific, Hook/line

**3.00**      **Highly Effective**

With no stock assessment for white seabass it is difficult to know what the stock abundance is, but the annual review of the fishery management plan determined that none of the points of concern were met in the 2009-2010 fishing season (CDFG 2011b). These points of concern examines if catch exceeds harvest guideline or quota, stock experiences changes in life history characters, an overfishing condition exists or is imminent, white seabass food availability, and any new information regarding white seabass or any error in previous assessments (CDFG 2011b). In the early 1980s the white seabass fishery had collapsed to 10% of its historic catch, but the stock has since recovered (Allen et al. 2007). The track record is highly effective.

### California: Southern Northeast Pacific, Gillnet, Bottom

**3.00**      **Highly Effective**

With no stock assessment for white seabass it is difficult to know what the stock abundance is, but the annual review of the fishery management plan determined that none of the points of concern were met in the 2009-2010 fishing season (CDFG 2011b). These points of concern examine if catch exceeds harvest guidelines or quotas, if the stock experiences changes in life history characters, if an overfishing condition exists or is imminent, the amount of white seabass food availability, and if any new information regarding white seabass is available or if any error in previous assessments occurred (CDFG 2011b). In the early 1980s the white seabass fishery had collapsed to 10% of its historic catch, but the stock has since recovered (Allen et al. 2007). There is no stock assessment or fishery management plan for California yellowtail, but CDFG suggested that even though the stock is smaller than in the 1950s it still could support substantial harvest pressure (CDFG 2001). Despite the lack of data on California yellowtail, it is a small portion of the bottom gillnet fishery therefore in combination with white seabass, the track record for this fishery is highly effective.

### California: Southern Northeast Pacific, Gillnet, Drift

**2.00**      **Moderately Effective**

With no stock assessment for white seabass it is difficult to know what the stock abundance is, but the annual review of the fishery management plan determined that none of the points of concern were met in the 2009-2010 fishing season (CDFG 2011b). These points of concern examines if catch exceeds harvest guidelines or quotas, if the stock experiences changes in life history characters, if an overfishing condition exists or is imminent, the amount of white seabass food availability, and if any new information regarding white seabass is available or if any error in previous assessments occurred (CDFG 2011b). In the early 1980s the white seabass fishery had collapsed to 10% of its historic catch, but the

stock has since recovered (Allen et al. 2007). There is no stock assessment or fishery management plan for California yellowtail, but CDFG suggested that even though the stock is smaller than in the 1950s it still could support substantial harvest pressure (CDFG 2001). Due to the lack of data on California yellowtail and since it is significant catch in this fishery, the track record for this fishery is moderately effective.

#### California: Southern Northeast Pacific, Hook/line

3.00

**Highly Effective**

There is no stock assessment or fishery management plan for California yellowtail, but CDFG suggested that even though the stock is smaller than in the 1950s it still could support substantial harvest pressure (CDFG 2001). Despite the lack of data on California yellowtail, it has low landings in the southern California hook and line fishery therefore, the track record for this fishery is highly effective.

#### Subfactor 3.1.7 - Stakeholder Inclusion

*Considerations: Are stakeholders involved/included in the decision-making process. Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g. fishermen, conservation groups, etc.). A highly effective will be given if the management process is transparent and includes stakeholder input.*

#### California: Central Northeast Pacific, Hook/line

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

#### California: Southern Northeast Pacific, Hook/line

3.00

**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. 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 highly effective.

<b>Factor 3.2: Management of fishing impacts on bycatch species</b>				
<b>Region / Method</b>	<b>Strategy</b>	<b>Research</b>	<b>Following of Scientific Advice</b>	<b>Enforcement of Regulations</b>
<b>California: Central Northeast Pacific Hook/line</b>	No	Moderately Effective	Highly Effective	Highly Effective
<b>California: Southern Northeast Pacific Gillnet, Bottom</b>	No	Moderately Effective	Moderately Effective	Highly Effective
<b>California: Southern Northeast Pacific Gillnet, Drift</b>	No	Moderately Effective	Moderately Effective	Highly Effective
<b>California: Southern Northeast Pacific Hook/line</b>	No	Moderately Effective	Highly Effective	Highly Effective

### Justification of Ranking

#### Factor 3.2: Management of Fishing Impacts on Bycatch Species

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

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

#### 3.2.0 - All Species Retained?

California: Central Northeast Pacific, Hook/line

1.00

Yes

Hook and line fishing is highly selective for the target species. Fishes landed besides 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 here because they have their own fishery. Please refer to the California halibut Seafood Watch Report for more.

#### California: Southern Northeast Pacific, Gillnet, Bottom

**0.00**    **No**

#### California: Southern Northeast Pacific, Gillnet, Drift

**0.00**    **No**

#### California: Southern Northeast Pacific, Hook/line

**1.00**    **Yes**

Hook and line fishing is highly selective for the target species. Fishes landed besides the target generally occur in low numbers (>5% of catch)(Bellman et al. 2012). Bycatch from the California yellowtail hook and line fishery is assumed to be low and incidentally caught species are released alive with high post release survival.

### 3.2.0 - Critical?

#### California: Central Northeast Pacific, Hook/line

**0.00**    **No**

#### California: Southern Northeast Pacific, Gillnet, Bottom

0.00

No

**California: Southern Northeast Pacific, Gillnet, Drift**

0.00

No

**Subfactor 3.2.1 - Management Strategy and Implementation**

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

**California: Central Northeast Pacific, Hook/line**

3.00

Highly Effective

**California: Southern Northeast Pacific, Gillnet, Bottom**

2.00

Moderately Effective

Gillnets are prohibited in waters less than 110-128 m (60-70 fms), which includes state waters (0-3 nm) and effectively reduces bycatch of shallower living animals, including sea otters and seabirds (CalCOFI 2013)(Carretta et al. 2013). Minimum mesh size restrictions are 15.24 cm (6") to fish white seabass and California yellowtail (CDFG 2012). 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 2011a). There is a concern for white shark bycatch in gillnets, but the nets are already size selective where large individuals are rarely caught in this fishery (Lowe et al. 2012). The gillnet depth restrictions eliminated bycatch of sea otters, while humpback whale bycatch is also low with low mortality of entangled whales (Carretta et al. 2013). Only one skate species of six has a stock assessment, but 97% of skate catch is from the groundfish bottom trawl fishery (Gertseva and Schirripa 2008). Based on these restrictions the bycatch management strategy of white seabass and California yellowtail bottom gillnets is moderately effective.

### California: Southern Northeast Pacific, Gillnet, Drift

#### 2.00 Moderately Effective

Gillnets are prohibited in waters less than 110-128 m (60-70 fms), which includes state waters (0-3 nm) and effectively reduces bycatch of shallower living animals, including sea otters and seabirds (CalCOFI 2012)(Carretta et al. 2013). Mesh size restrictions are 15.24-35.56 cm (6-14") to fish white seabass and 8.89-35.56 (3.5-14") for California yellowtail (CDFG 2012). California halibut bycatch has a minimum size of 55.9 cm (22") (CalCOFI 2012) and a recent stock assessment (CDFG 2011a). There is a concern for white shark bycatch in gillnets, but the nets are already size selective where large individuals are rarely caught in this fishery (Lowe et al. 2012). Humpback whale bycatch is low with low mortality of entangled whales (Carretta et al. 2013). There is no stock assessment for California barracuda. Based on these restrictions the bycatch management strategy of white seabass and California yellowtail drift gillnets is moderately effective.

### Subfactor 3.2.2 - Scientific Research and Monitoring

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

### California: Southern Northeast Pacific, Gillnet, Bottom

#### 2.00 Moderately Effective

There has been extensive research conducted on the endangered humpback whale and threatened sea otter. Both species have up-to-date stock assessments with set mortality limits and goals of no annual mortality from fishing gear (Carretta et al. 2013). White sharks do not have a stock assessment and estimates of the northeastern Pacific population have only recently been made (Chapple et al. 2011). The northeastern population is recognized as a genetically distinct group that does not interbreed with other white shark populations (Jorgensen et al. 2010). Thus, without historic population estimates to compare new estimates with and without a stock assessment the status of northeastern Pacific white sharks over time is unknown. Currently there are large efforts to improve our knowledge base for northeastern Pacific white sharks including fishing impacts and population size (Chapple et al. 2011)(Lowe et al. 2012). The California halibut has a current stock assessment as well (CDFG 2011a). Unspecified skates lack stock assessments and reference points except for the longnose skate, but are undergoing assessment with data-poor methods and research exists on their life history characteristics. Overall some bycatch species of the bottom gillnet fishery are well-studied and others are moderately studied. Observer coverage was 1% in 2006, 17% in 2007 and 0% in 2004, 2005, and 2008 (NMFS

2013b). In 2011 there were 171 sets observed and vessels must maintain logbooks (T. Tanaka pers. comm.). The research and monitoring is moderately effective for this fishery.

#### California: Southern Northeast Pacific, Gillnet, Drift

##### 2.00 Moderately Effective

There has been extensive research conducted on the endangered humpback whale. It has an up-to-date stock assessment with set mortality limits and goals of no annual mortality from fishing gear (Carretta et al. 2013). White sharks do not have a stock assessment and estimates of the northeastern Pacific population have only recently been made (Chapple et al. 2011). The northeastern population is recognized as a genetically distinct group that does not interbreed with other white shark populations (Jorgensen et al. 2010). Thus, without historic population estimates to compare new estimates with and without a stock assessment the status of northeastern Pacific white sharks over time is unknown. Currently there are large efforts to improve our knowledge base for northeastern Pacific white sharks including fishing impacts and population size (Chapple et al. 2011)(Lowe et al. 2012). The California halibut has a current stock assessment as well (CDFG 2011a). Overall some bycatch species of the drift gillnet fishery are well-studied and others are moderately studied. Observer coverage was 11.5% in 2002, 10.4% in 2003 and 17.6% with no observer coverage since (NMFS 2013b). The research and monitoring is moderately effective for this fishery.

#### Subfactor 3.2.3 - Management Record of Following Scientific Advice

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

#### California: Southern Northeast Pacific, Gillnet, Bottom

#### California: Southern Northeast Pacific, Gillnet, Drift

##### 3.00 Highly Effective

The most at-risk bycatch species for the California gillnet fishery have had extensive research conducted and annual mortality limits (PBR) passed from stock assessments into management successfully (Carretta et al. 2013). Fish bycatch may or may not have available stock assessments or reference points available for them, but where data are abundant, management follows scientific advice. When possible the scientific advice is followed therefore it is highly effective.

**Subfactor 3.2.4 - Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.*

**California: Southern Northeast Pacific, Gillnet, Bottom****2.00**      **Moderately Effective**

CDFW officers' conduct patrols to enforce fishing regulations. Additionally, CDFW scientists conduct dockside sampling. Enforcement for the bottom gillnet fishery is considered moderately effective.

**California: Southern Northeast Pacific, Gillnet, Drift****2.00**      **Moderately Effective**

CDFW officers' conduct patrols to enforce fishing regulations. Additionally, CDFW scientists conduct dockside sampling. Enforcement for the drift gillnet fishery is considered moderately 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 (plus the mitigation of gear impacts score) and the EBFM score.*

<b>Region / Method</b>	<b>Gear Type and Substrate</b>	<b>Mitigation of Gear Impacts</b>	<b>EBFM</b>	<b>Overall Recomm.</b>
<b>California: Central Northeast Pacific Hook/line</b>	4.00:Very Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	<b>Green (3.464)</b>
<b>California: Southern Northeast Pacific Gillnet, Bottom</b>	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Yellow (3.123)</b>
<b>California: Southern Northeast Pacific Gillnet, Drift</b>	5.00:None	0.00:Not Applicable	3.00:Moderate Concern	<b>Green (3.873)</b>
<b>California: Southern Northeast Pacific Hook/line</b>	4.00:Very Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	<b>Green (3.464)</b>

The impacts of these gears on the substrate vary. Drift gillnet has no impact and therefore no mitigation of gear impacts on the habitat. Hook and line gear has a very low impact on the substrate, but no effective mitigation of this impact. Bottom gillnet has a low impact on the substrate due to the limited area they are operated in (south of Point Conception) and they are operated over soft sediment. There is minimal mitigation in place for bottom gillnet based on the gillnet bans in waters less than 110 m. There is no evidence that exceptional species are caught in any of these gear types, but there also is no evaluation of ecosystem impacts underway either. Overall drift gillnet and hook and line gear have low habitat and ecosystem impacts, while bottom gillnet has moderate impacts.

### **Justification of Ranking**

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

- 5 (None) = Fishing gear does not contact the bottom
- 4 (Very Low) = Vertical Line Gear
- 3 (Low) = Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on

resilient mud/sand habitats. Midwater trawl that is known to contact bottom *occasionally* (<25% of the time) or purse seine known to commonly contact bottom

- 2 (Moderate) = Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand;
- 1 (High) = Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g. cobble or boulder).
- 0 (Very High) = Dredge or trawl fished on biogenic habitat, e.g. deep-sea corals, eelgrass and maerl.

*Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive plausible habitat type.*

#### California: Central Northeast Pacific, Hook/line

**4.00**      **Very Low Concern**

Hook and line gear presents a vertical line in the water that has minimal impact on the seafloor resulting in a very low conservation concern. Hook and line fishermen in Monterey Bay, California work 3-6 rods in the California halibut fishery (a similar fishery) from a small boat and target large areas of sandy bottom surrounded by small reefs, rocks, or other benthic structure (Frey et al. 2012).

#### California: Southern Northeast Pacific, Gillnet, Bottom

**3.00**      **Low Concern**

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 set gillnet fishery is of low conservation concern.

#### California: Southern Northeast Pacific, Gillnet, Drift

**5.00**      **None**

Drift gillnets do not contact the bottom during fishing therefore they have no impact on the seafloor.

#### California: Southern Northeast Pacific, Hook/line

**4.00**      **Very Low Concern**

Hook and line gear presents a vertical line in the water that has minimal impact on the seafloor resulting

in a very low conservation concern.

#### Factor 4.2 - Mitigation of Gear Impacts

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

#### California: Central Northeast Pacific, Hook/line

##### 0.00 No Effective Mitigation

Commercial hook and line 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: Southern Northeast Pacific, Gillnet, Bottom

##### 0.25 Minimal Mitigation

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). Additionally, 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). There is minimal mitigation in place of set gillnet impacts.

**California: Southern Northeast Pacific, Gillnet, Drift****0.00****Not Applicable****California: Southern Northeast Pacific, Hook/line****0.00****No Effective Mitigation**

Commercial hook and line fishing for California yellowtail 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.

**Factor 4.3 – Ecosystem-Based Fisheries Management**

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

**California: Central Northeast Pacific, Hook/line****3.00****Moderate Concern**

There is no evidence that the white seabass hook and line fishery catches exceptional species, species that play a disproportionately important role relative to their biomass, and there is no evidence that an assessment of the management of ecosystem impacts is underway. Therefore, the ecosystem based fishery mortality is of moderate concern.

**California: Southern Northeast Pacific, Gillnet, Bottom****3.00****Moderate Concern**

There is no evidence that the white seabass and California yellowtail bottom gillnet fishery catch exceptional species, species that play a disproportionately important role relative to their biomass, and there is no evidence that an assessment of the management of ecosystem impacts is underway. Therefore, the ecosystem based fishery mortality is of moderate concern.

**California: Southern Northeast Pacific, Gillnet, Drift****3.00****Moderate Concern**

There is no evidence that the white seabass and California yellowtail drift gillnet fishery catch exceptional species, species that play a disproportionately important role relative to their biomass, and there is no evidence that an assessment of the management of ecosystem impacts is underway. Therefore, the ecosystem based fishery mortality is of moderate concern.

**California: Southern Northeast Pacific, Hook/line****3.00****Moderate Concern**

There is no evidence that the California yellowtail hook and line fishery catches exceptional species, species that play a disproportionately important role relative to their biomass, and there is no evidence that an assessment of the management of ecosystem impacts is underway. Therefore, the ecosystem based fishery mortality is of moderate concern.

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

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

### Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation.

## **Guiding Principles**

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

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

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

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

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

**Best Choices/Green:** Are well managed and caught or farmed in environmentally friendly ways.

**Good Alternatives/Yellow:** Buy, but be aware there are concerns with how they're caught or farmed.

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

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<sup>1</sup> "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.