

# Monterey Bay Aquarium Seafood Watch®

## California flounder

*Paralichthys californicus*



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## United States of America/Eastern Central Pacific

### Set gillnets, Bottom trawls, Trolling lines

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#### **Disclaimer**

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

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

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## **About Seafood Watch**

Monterey Bay Aquarium's Seafood Watch program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from [www.seafoodwatch.org](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 on the regional pocket guides is supported by a Seafood Watch Assessment. Each assessment synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying assessments will be updated to reflect these changes.

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

## **Guiding Principles**

Seafood Watch defines sustainable seafood as originating from sources, whether fished<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 fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

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

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

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

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

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

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

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

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

## **Summary**

California flounder (*Paralichthys californicus*), often called California halibut, is found from the Quillayute River in Washington state to Baja California Sur in Mexico, but is most common south of Bodega Bay, California. This report addresses the bottom gillnet, troll line, and bottom trawl fisheries for this species in California.

The first ever, and most recent, California flounder stock assessment was published in 2011; it identifies two stocks: a southern and a central stock. Both stocks are fished with bottom trawl and troll lines, although only the southern stock is fished with bottom gillnets. The southern stock was estimated as depleted to 14% of the unexploited biomass, but the biomass has remained constant since the 1970s. This is of moderate concern, since there are no biological reference points. The central stock was estimated at 122% of the unexploited biomass and is of low concern. The fishing mortality for both stocks was estimated below the level that would produce maximum sustainable yield (MSY), although the appropriateness of MSY as a reference point is questionable. Because of the unknown fishing mortality in relation to an appropriate reference point, the fishing mortality is of moderate concern for both stocks.

The lowest-scoring species incidentally caught in the gillnet fishery is the white shark. Due to the lack of information on abundance and fishing mortality—despite known interactions of white sharks and gillnets in the areas where the halibut fishery operates—white shark is ranked as a high concern. Although the humpback whale was the lowest-scoring bycatch species in the previous California flounder report for the gillnet fishery, fishing mortality has downgraded the level of concern. Sea otter, though listed as threatened under the U.S. Endangered Species Act (ESA), was not included as bycatch in the California flounder gillnet fishery because the recent gillnet depth restrictions eliminated overlap of sea otter habitat and the gillnet fishery. Although there has been no observer coverage since 2011, the gillnet ban in shallow waters has resulted in sea otter entanglement that is at or near zero. The green sturgeon and dungeness crab have the lowest scores overall for the bottom trawl fishery. The green sturgeon was recently listed as threatened under the ESA, and there is very little information about the dungeness crab stock status. The bay ray was the lowest-scoring species in the previous reports, but observer data from the past 5 years do not indicate that the bay ray is caught as bycatch in large numbers. The bottom trawl fishery also experiences a wide variety of bycatch (36 groundfish species; 23 shark, skate, and ray species; and 60 other finfish and invertebrates in 2011) that consist of less than 5% of bottom trawl catch in the halibut fishery. They are not of conservation concern, and therefore not assessed as bycatch species in this report. An exception is a large amount of unidentified jellyfish bycatch, but it is not believed to be of conservation concern and is not included. The troll line fishery is very selective and though bycatch does occur, no species makes up greater than 5% of catch other than halibut; thus, there are no bycatch species in the troll line fishery. Troll line fishers also make significant efforts to release unwanted bycatch alive, including releasing them without removing them from the water.

Management restrictions on gear use for the California flounder fisheries started in 1911. A stock assessment for California flounder was first published in 2011, and another is currently underway along with several ongoing monitoring programs. Management of all fisheries is considered moderately effective, since the fishery lacks reference points, quotas, or a strategy to ensure the southern stock is maintained at a sustainable level, but has regulations (minimum size limit) that allow for at least one year of female spawning before they become susceptible to the fishery. Management also incorporates effective monitoring, enforcement, scientific advice, and stakeholder input. Overall management of retained and discarded species is moderate for all California flounder fisheries. The trawl fishery catches a wide diversity of species, but has many regulations to help constrain bycatch of species of concern. Bycatch stocks that are threatened or endangered have up-to-date assessments, but several other bycatch species do not have assessments, including the white shark.

Bottom trawls impact the seafloor substrate, but they operate predominantly over soft sediment and have robust mitigation measures, leading to a moderate concern score for habitat impacts. The troll line fishery has the lowest impact on the substrate, and though the gillnet fishery does contact the substrate on soft sediments,

it also has strong mitigation of habitat impacts through depth restrictions and a minimum mesh size. There are no ecosystem-based assessments for this fishery.

## **Final Seafood Recommendations**

<b>SPECIES   FISHERY</b>	<b>CRITERION 1:</b> Impacts on the Species	<b>CRITERION 2:</b> Impacts on Other Species	<b>CRITERION 3:</b> Management Effectiveness	<b>CRITERION 4:</b> Habitat and Ecosystem	<b>OVERALL RECOMMENDATION</b>
<b>California flounder   Central California</b> United States of America/Eastern Central Pacific   Trolling lines   United States of America   Central California	Green (4.284)	Green (5.000)	Yellow (3.000)	Green (3.873)	<b>Best Choice (3.971)</b>
<b>California flounder   Southern California</b> United States of America/Eastern Central Pacific   Bottom trawls   United States of America   Southern California	Yellow (2.644)	Yellow (2.559)	Yellow (3.000)	Yellow (2.739)	<b>Good Alternative (2.730)</b>
<b>California flounder   Southern California</b> United States of America/Eastern Central Pacific   Set gillnets   United States of America   Southern California	Yellow (2.644)	Red (1.299)	Yellow (3.000)	Green (3.464)	<b>Good Alternative (2.444)</b>

<b>California flounder   Southern California</b> United States of America/Eastern Central Pacific   Trolling lines   United States of America   Southern California	Yellow (2.644)	Green (5.000)	Yellow (3.000)	Green (3.873)	<b>(3.520)</b>
<b>California flounder   Central California</b> United States of America/Eastern Central Pacific   Bottom trawls   United States of America   Central California	Green (4.284)	Red (0.750)	Yellow (3.000)	Yellow (2.739)	<b>Good Alternative (2.266)</b>

## Scoring Guide

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

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

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern<sup>2</sup>, and no more than one Red Criterion, and no Critical scores
- **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

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

# **Introduction**

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

California flounder (*Paralichthys californicus*) is found from the Quillayute River in Washington state to Baja California Sur in Mexico, but is most common south of Bodega Bay, California. This report addresses the bottom gillnet, troll line, and bottom trawl fisheries for this species in California.

## **Species Overview**

California flounder (*Paralichthys californicus*) inhabits the waters of the eastern North Pacific from the Quillayute River in Washington state to Baja California Sur in Mexico, but is most common south of Bodega Bay, California (Love 1996). It can attain 1.5 m in length, 32 kg in weight, and is most commonly found on soft bottoms (Love 1996). Males can become sexually mature as young as 1 year of age, and 100% of males are mature by age 3 (Lesyna and Barnes 2016). Females can become mature as early as age 3, 100% of females are mature by age 4, and they can live up to 30 years (Love and Brooks 1990)(Lesyna and Barnes 2016). The California flounder is oviparous with broadcast spawning. Females may produce up to one million eggs per spawning event, but successful recruitment is dependent on favorable environmental conditions and the availability of suitable nursery habitat (CalCOFI 2012).

Three gear types are used to fish commercially for California flounder: bottom trawl, troll line, and bottom gillnet. Both bottom trawl and troll line are operated throughout California (mainly south of Bodega Bay), and the bottom gillnet operates south of Point Conception (CalCOFI 2012). Recreational fishing, which will not be addressed in this report, is conducted with troll line only. The California Department of Fish and Wildlife (CDFW) and California Fish and Game Commission manage the California flounder fisheries, including the limited entry (LE) California flounder bottom trawl fishery. Trawl vessels with a Federal West Coast Groundfish Individual Fishing Quota (IFQ) permit that do not have a California limited entry bottom trawl permit may land an incidental 150 pounds of California flounder per groundfish trip. These trips are monitored by the National Marine Fisheries Service (NMFS). The management of the California flounder fisheries has been evolving since the early 1900s (CDFW 2011a). But this species is not managed under a fishery management plan pursuant to the California Marine Life Management Act, and there is no periodic review of management measures (CDFW 2011a). Today, bottom trawls are only permitted in state waters within the California Halibut Trawl Grounds (CHTG; Figure 1). The gillnet fishery also is restricted in access (CDFW and CalCOFI 2011a)(CDFW and CalCOFI 2012). Trawl gear recently has predominated due to increased gillnet restrictions, lack of regulations, and open access.

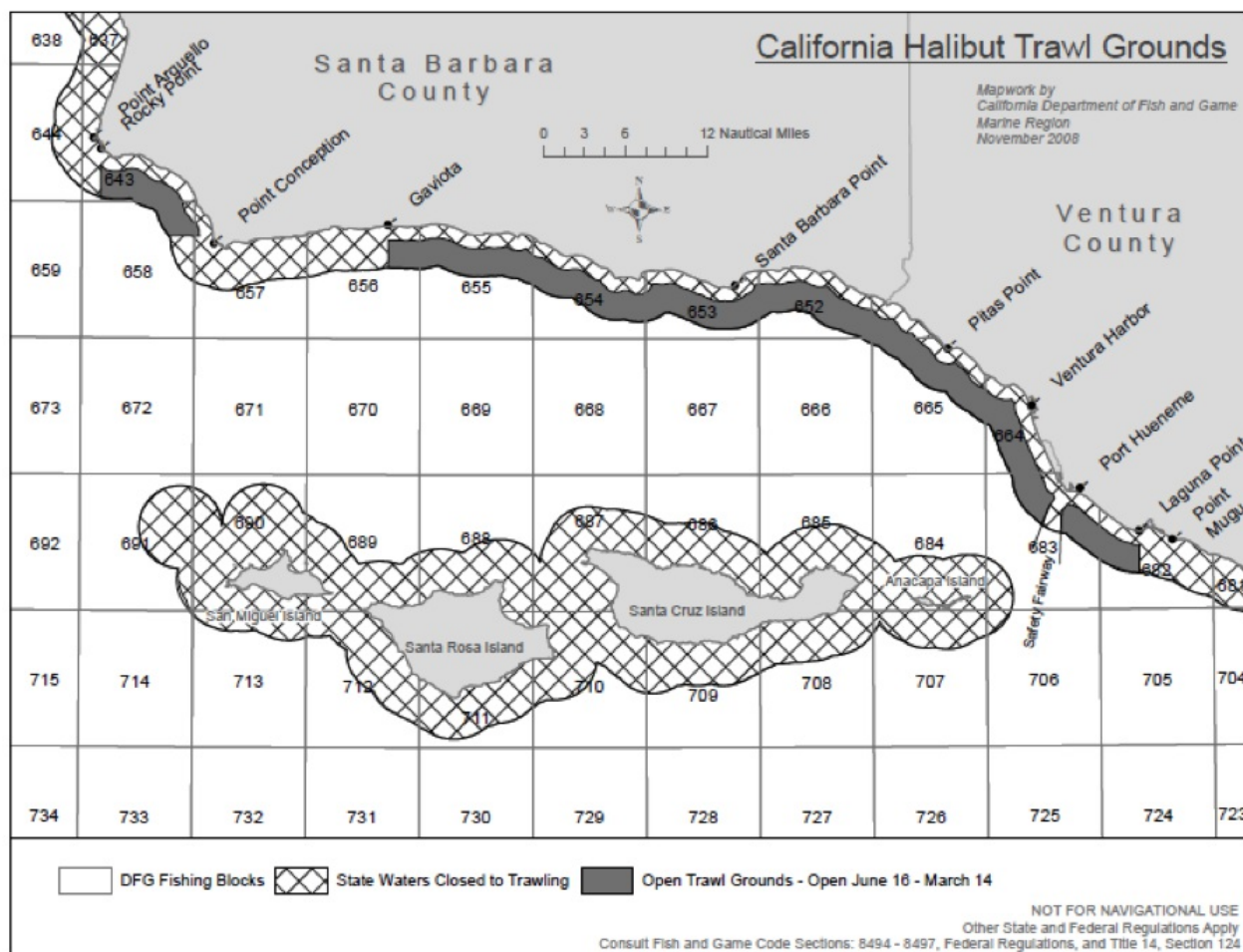


Figure 1 Map of the area within state waters where trawling is legal, also known as the California halibut trawl grounds (CDFW 2016).

## Production Statistics

Total California flounder landings in 2014 were 387,000 lb; 149,000 lb were from troll line gear (38% of landings), 175,500 lb from bottom trawl gear (45%), and 37,000 lb from bottom gillnet gear (9.5%) (Travis Tanaka, pers. comm., 2017)(CDFW 2016). The coast of California and Baja California are the only locations of California flounder production worldwide. Overall production has decreased over time (Figure 2) and shifted from gillnet-dominated to bottom trawl-dominated, and the share of troll-caught landings as a percentage of total landings has grown in recent years (Figure 3). Commercial catch peaked in the 1910s and 1940s, especially south of Point Conception (Figure 2).

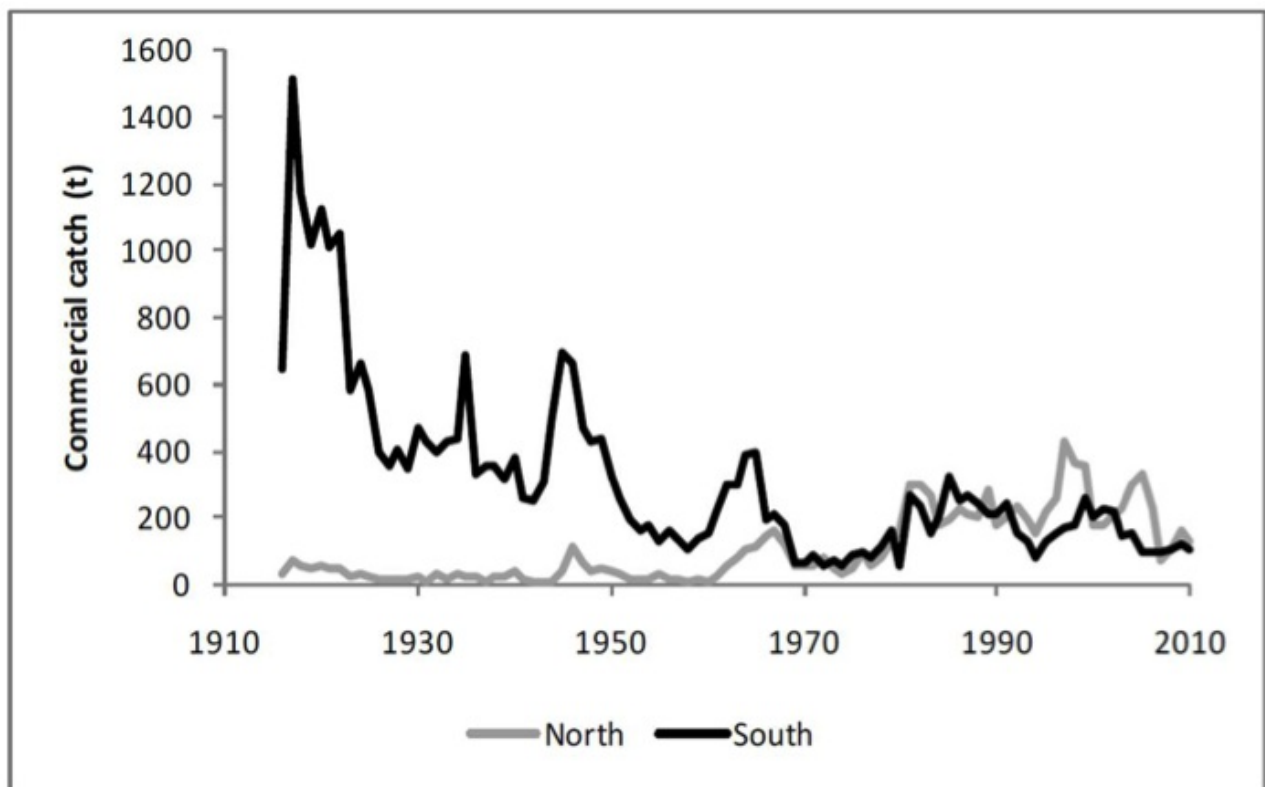


Figure 2 Commercial catch (MT) from 1915 to 2010 north and south of Point Conception (CDFW 2011a).

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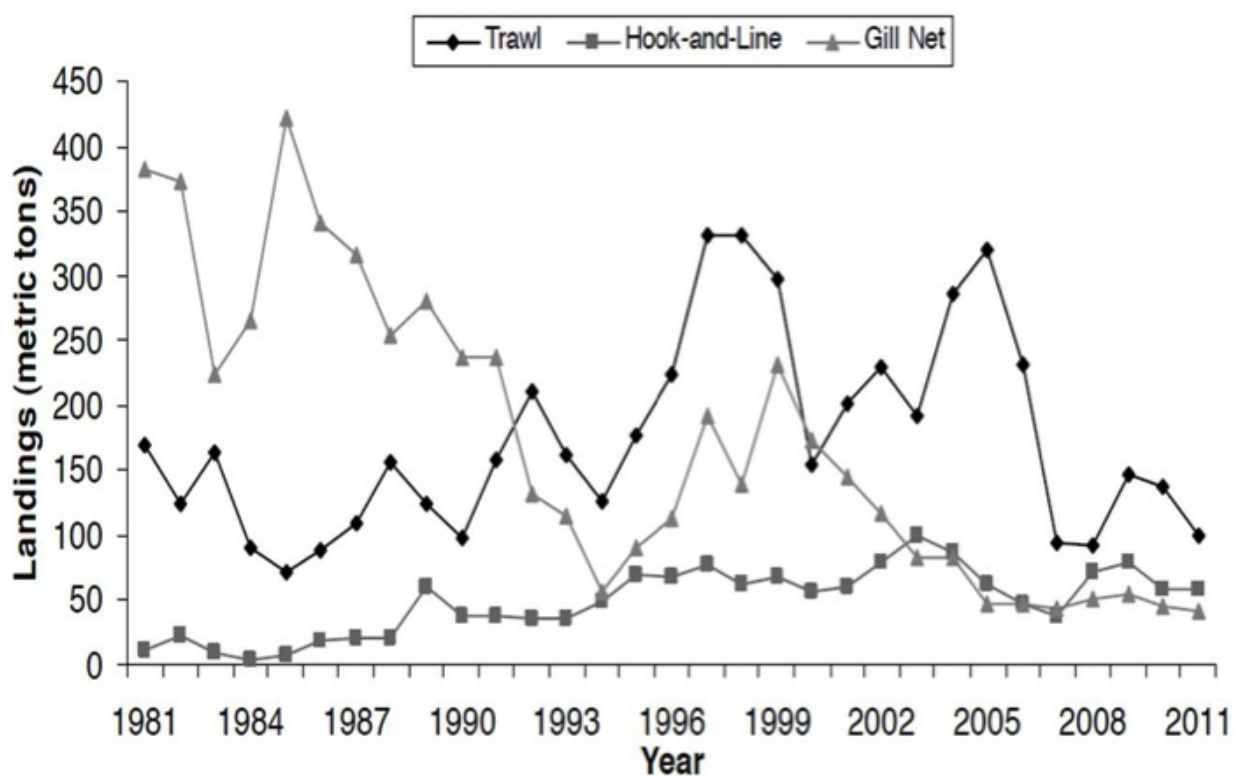


Figure 3 Commercial landings of California flounder by gear type from 1981 to 2011 (CalCOFI 2012).

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

California flounder on the U.S. market is mainly fished domestically, and imports of halibut are classified as "not

specified halibut” that likely include other species. There were 15 metric tons (MT) of “not specified halibut” imported from Mexico in 2015 (NMFS 2016). Other non-specified halibut imports were from China, Japan, South Korea, Thailand, Australia, Canada, and the Netherlands, but it is unlikely these imports included California flounder.

### **Common and market names.**

The common name is California flounder. The market name is halibut, and other vernacular names include bastard halibut and Monterey halibut (FDA 2016).

### **Primary product forms**

California flounder is primarily sold fresh as fillets and steaks. There is also a small live halibut fishery in southern California (Love 1996).

## Assessment

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

### Criterion 1: Impacts on the Species Under Assessment

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

- Score  $>3.2$ =Green or Low Concern
- Score  $>2.2$  and  $\leq 3.2$ =Yellow or Moderate Concern
- Score  $\leq 2.2$ =Red or High Concern

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

#### Guiding Principles

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

#### Criterion 1 Summary

CALIFORNIA FLOUNDER			
Region   Method	Abundance	Fishing Mortality	Score
<b>United States of America/ Eastern Central Pacific   Bottom trawls</b> United States of America   Southern California	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
<b>United States of America/ Eastern Central Pacific   Set gillnets</b> United States of America   Southern California	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)
<b>United States of America/ Eastern Central Pacific   Trolling lines</b> United States of America   Southern California	2.33: Moderate Concern	3.00: Moderate Concern	Yellow (2.644)

CALIFORNIA FLOUNDER			
Region   Method	Abundance	Fishing Mortality	Score
<b>United States of America/ Eastern Central Pacific   Bottom trawls</b> United States of America   Central California	3.67: Low Concern	5.00: Low Concern	Green (4.284)
<b>United States of America/ Eastern Central Pacific   Trolling lines</b> United States of America   Central California	3.67: Low Concern	5.00: Low Concern	Green (4.284)

## Criterion 1 Assessment

### SCORING GUIDELINES

#### Factor 1.1 - Abundance

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

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

#### Factor 1.2 - Fishing Mortality

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

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

### CALIFORNIA FLOUNDER | CENTRAL CALIFORNIA

#### Factor 1.1 - Abundance

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Central California | Central California

### Low Concern

The first ever stock assessment for California flounder was completed in 2011. California flounder was assessed as two stocks: a southern stock south of Point Conception, and a central stock north of Point Conception (CDFW 2011a); however, there is no evidence of genetically different stocks throughout its geographic range (Craig et al. 2011). The spawning biomass of the central stock was estimated at 832 MT, which had increased substantially since 1980 due to high recruitment. In 2011, stock abundance was estimated at 122% of the unexploited spawning biomass level (Figure 4) (CDFW 2011a). Biomass at maximum sustainable yield was estimated to be 950 MT, and biomass/virgin spawning biomass ( $B_0$ ) is greater than 1 (1.22). But there is some concern that the estimated MSY-based reference points are inappropriate based on the biology of the California flounder, and the assumption that recruitment is independent of stock size causes the spawning biomass associated with MSY to occur at a high depletion level (7% to 12% of the unexploited spawning biomass) (CDFW 2011a). Since the stock is healthy, but the stock assessment is nine years old, a score of "low" concern (rather than "very low") is given.

### Justification:

The central stock population is estimated to have increased rapidly starting in 1995 due to large recruitments, which appear to occur in a cyclical pattern (Figure 4) (CDFW 2011a). Because there were some technical issues with the models, the parameter estimates may not be reliable, but the general conclusions remain consistent for the different estimated parameters (CDFW 2011a).

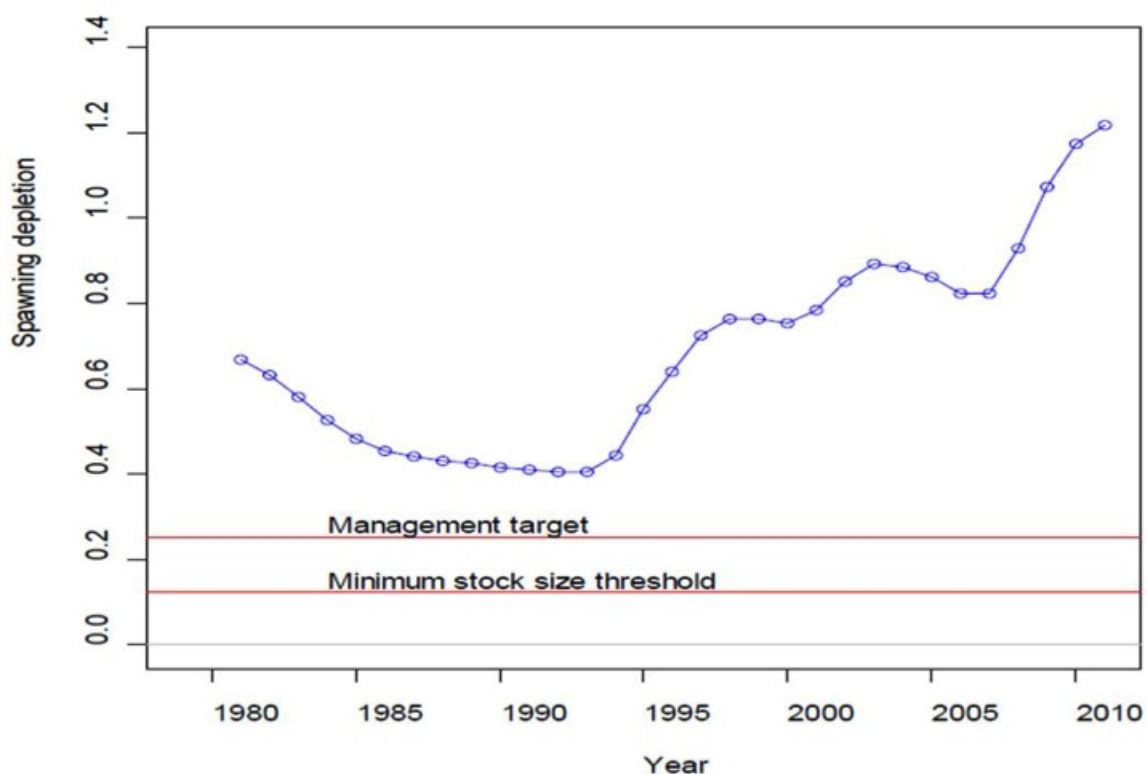


Figure 4 Central stock spawning biomass depletion over time (CDFW 2011a).

## Factor 1.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Central California | Central California

#### Low Concern

The central stock has an estimated fishing mortality far below  $F_{MSY}$  (CDFW 2011a). But the actual fishing mortality reference points are unavailable (CDFW 2011a). The estimated MSY-based reference points are inappropriate based on the biology of the California flounder, and the assumption that recruitment is independent of stock size causes the spawning biomass associated with MSY to occur at a high depletion level (7% to 12% of the unexploited spawning biomass) (CDFW 2011a). The 25% proxy level might be a reasonable reference point (CDFW 2011a). Regardless, the stock assessment concluded that fishing does not constrain or limit the central California population (CDFW 2011a). Commercial catches have increased in recent years (from 374,401 lbs in 2013 to 551,265 lbs in 2018)(CDFW 2019). Regardless, the stock assessment concluded that fishing does not constrain or limit the central California population (CDFW 2011a); therefore, the fishing mortality for the central stock is deemed to be "low" concern.

#### Justification:

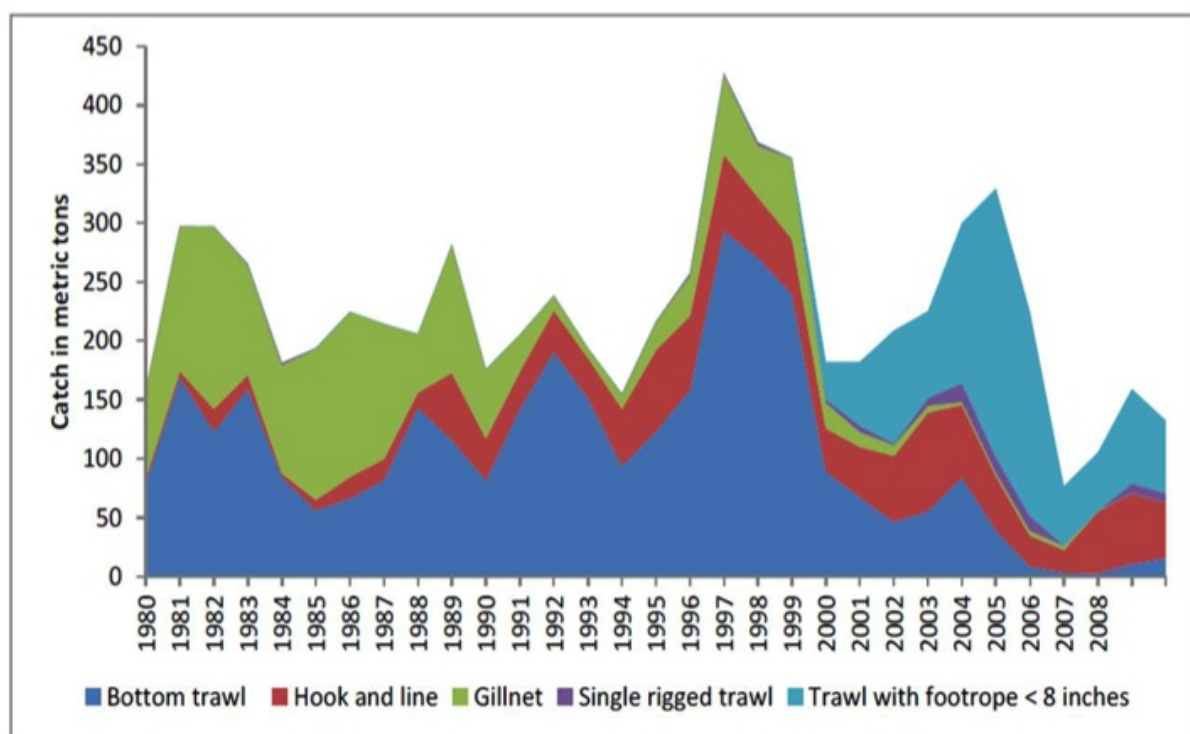


Figure 5 Catch by gear north of Point Conception (CDFW 2011a).

## CALIFORNIA FLOUNDER | SOUTHERN CALIFORNIA

### Factor 1.1 - Abundance

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Southern California | Southern California

### Moderate Concern

The 2011 assessment estimated that the spawning biomass of the southern stock had been depleted to 14% of the unexploited spawning biomass level; however, there are no accepted reference points for this stock for comparison. The spawning biomass has been estimated at approximately 14% of the unexploited spawning biomass level since the start of the modeling period (1971), but above the level that would produce MSY (Figure 5) (CDFW 2011a). MSY is 329 MT and the  $B_{MSY}$  from 2011/virgin  $B_{MSY}$  is 2.19 (CDFW 2011a). But biomass at MSY is lower than other Pacific flatfish (25% of the groundfish FMP); therefore,  $B_{MSY}$  may not be set at the appropriate level for the fishery (Kaplan and Helser 2007)(Haltuch et al. 2011)(Hicks and Wetzel 2011). Since the reference points may not be set at an appropriate level and the stock status is unknown, the abundance of the southern stock has been deemed to be of "moderate" concern.

### Justification:

The southern stock spawning biomass was estimated at approximately 14% of the unexploited spawning biomass level since the start of the modeling period (1971; Figure 5) (CDFW 2011a). California flounder are prolific and have a high reproductive potential; thus, when environmental conditions are favorable, biomass can increase relatively quickly (CDFW 2011a). The model assumes that recruitment is independent of stock size, at least at the observed abundance levels, which appears to be supported by the data (CDFW 2011a). The data also support model estimates of low recruitment since 1999 (CDFW 2011a).

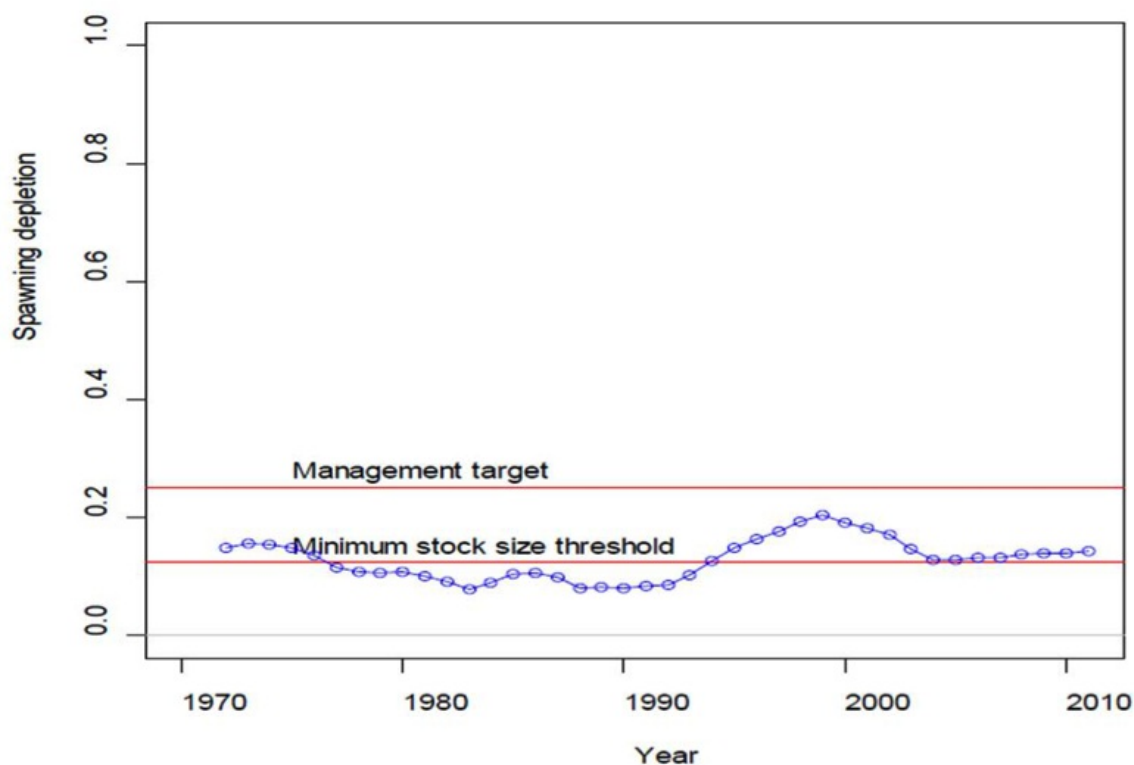


Figure 6 Southern stock spawning biomass depletion over time (CDFW 2011a).

## Factor 1.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Southern California | Southern California

#### Moderate Concern

The southern stock has an estimated fishing mortality below  $F_{MSY}$  (CDFW 2011a). Yet, there is a lot of uncertainty surrounding the fishing mortality estimates in comparison to a reference point, and the actual values for  $F$  and  $F_{MSY}$  are unavailable (CDFW 2011a). There has not been an increase in fishing effort since 2005, and the stock appears to have sustained high fishing levels for decades (Lowe et al. 2012). But due to the uncertainty about the stock, management action may be needed to ensure that fishing mortality does not negatively impact the southern stock (CDFW 2011a). Because fishing mortality appears to be below  $F_{MSY}$  but there is a lot of uncertainty around the fishing mortality estimates, the southern stock is of "moderate" concern.

#### Justification:

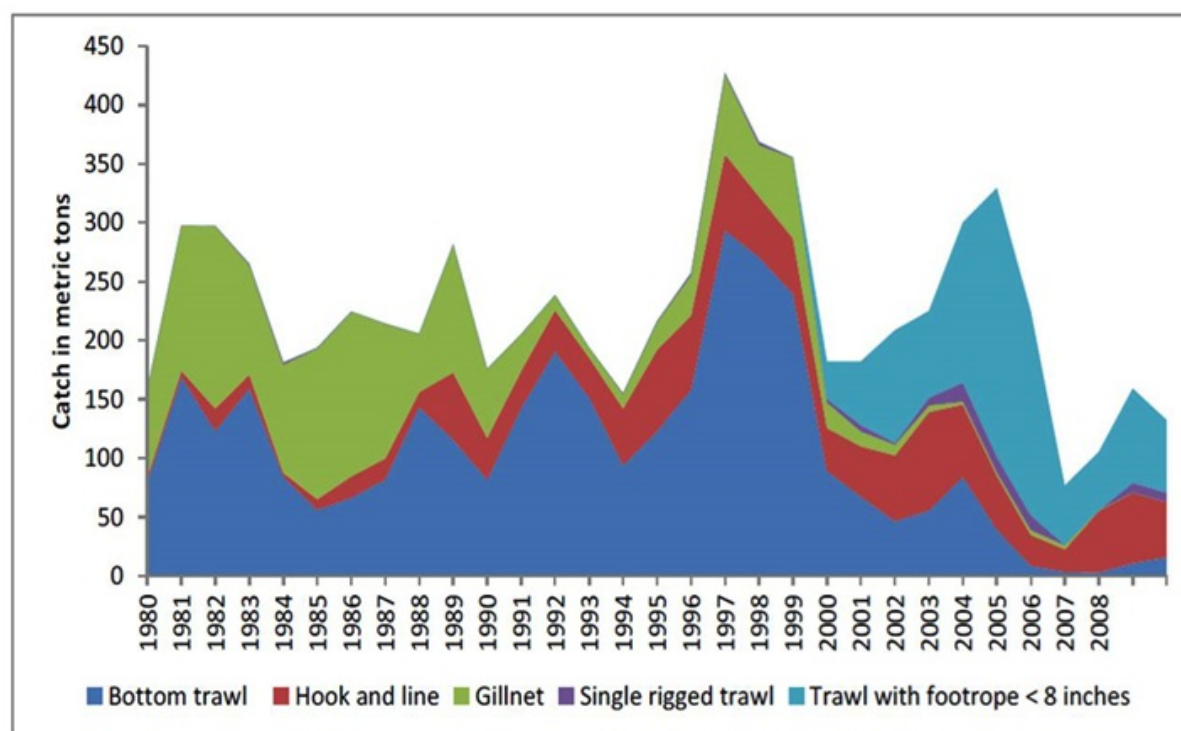


Figure 7 Catch by gear type south of Point Conception (CDFW 2011a).

## Criterion 2: Impacts on Other Species

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

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

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

### Guiding Principles

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

### Criterion 2 Summary

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

<b>CALIFORNIA FLOUNDER</b> United States Of America/Eastern Central Pacific   Bottom Trawls   United States Of America   Central California   Central California					
<b>Subscore:</b>	<b>1.000</b>	<b>Discard Rate:</b>	<b>0.75</b>	<b>C2 Rate:</b>	<b>0.750</b>
Species   Stock	Abundance	Fishing Mortality	Subscore		
Green sturgeon   Central California	1.00:High Concern	1.00:High Concern	Red (1.000)		
Dungeness crab   Central California	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)		
Big skate   Central California	3.67:Low Concern	5.00:Low Concern	Green (4.284)		
Spiny dogfish   Central California	3.67:Low Concern	5.00:Low Concern	Green (4.284)		
Pacific sanddab   Central California	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)		

<b>CALIFORNIA FLOUNDER</b> United States Of America/Eastern Central Pacific   Bottom Trawls   United States Of America   Southern California   Southern California					
<b>Subscore:</b>	<b>3.413</b>	<b>Discard Rate:</b>	<b>0.75</b>	<b>C2 Rate:</b>	<b>2.559</b>
Species   Stock	Abundance	Fishing Mortality	Subscore		
Dungeness crab   Southern California	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)		
Big skate   Southern California	3.67:Low Concern	5.00:Low Concern	Green (4.284)		
Spiny dogfish   Southern California	3.67:Low Concern	5.00:Low Concern	Green (4.284)		
Pacific sanddab   Southern California	5.00:Very Low Concern	5.00:Low Concern	Green (5.000)		

<b>CALIFORNIA FLOUNDER</b> United States Of America/Eastern Central Pacific   Set Gillnets   United States Of America   Southern California   Southern California					
<b>Subscore:</b>	<b>1.732</b>	<b>Discard Rate:</b>	<b>0.75</b>	<b>C2 Rate:</b>	<b>1.299</b>
Species   Stock	Abundance	Fishing Mortality	Subscore		
White shark   Southern California	1.00:High Concern	3.00:Moderate Concern	Red (1.732)		
Humpback whale   Southern California	1.00:High Concern	5.00:Low Concern	Yellow (2.236)		
White seabass   Southern California	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Pacific chub mackerel   Southern California	2.33:Moderate Concern	5.00:Low Concern	Green (3.413)		

CALIFORNIA FLOUNDER					
United States Of America/Eastern Central Pacific   Trolling Lines   United States Of America   Central California   Central California					
Subscore:	5.000	Discard Rate:	1.00	C2 Rate:	5.000
Species   Stock		Abundance	Fishing Mortality		Subscore
No other main species caught					

CALIFORNIA FLOUNDER					
United States Of America/Eastern Central Pacific   Trolling Lines   United States Of America   Southern California   Southern California					
Subscore:	5.000	Discard Rate:	1.00	C2 Rate:	5.000
Species   Stock		Abundance	Fishing Mortality		Subscore

No other main species caught

## **Gillnet**

Bycatch data in the California set gillnet fishery come from three years of observer data: 2007, 2010, and 2011 (Charles Villafana, pers. comm., 2017). A variety of species are caught incidentally in the California flounder set gillnet fishery, including white seabass, Pacific mackerel, spotted ratfish, spiny dogfish, brown smoothhound shark, pacific angel shark, and many others. White seabass and Pacific mackerel are the only incidentally caught species that make up over 5% of catch in the California flounder gillnet fishery. Although there was only one white shark interaction observed in 2010, white shark and humpback whale are included as main species due to the white shark's known interaction with the California flounder gillnet fishery and its low stock status, and the humpback whale's endangered and threatened status under the U.S. Endangered Species Act. The white shark is the lowest-scoring species in the gillnet fishery because its population status is unknown, but it is highly vulnerable; there are known interactions with the California flounder gillnet fishery. The humpback whale remains a species of high concern due to the endangered and threatened statuses of the two Distinct Population Segments (DPS) that overlap with California flounder fishing grounds. Sea otter, though listed as threatened under the U.S. Endangered Species Act (ESA), was not included as bycatch in the California flounder gillnet fishery because recent gillnet depth restrictions eliminated overlap of sea otter habitat and the gillnet fishery. This nearly eliminated sea otter entanglements in gillnets.

## **Bottom Trawl**

The green sturgeon and dungeness crab have the lowest scores for the bottom trawl fishery. The green sturgeon was recently listed as threatened under the ESA, and there is very little information about the status of the dungeness crab stock. This fishery has the highest discard rate of any observed fishery in the U.S.

## **Trolling Lines**

The troll line fishery is very selective; although bycatch does occur, no species appear in large enough numbers to be included here. Also, troll line fishers make significant efforts to release unwanted bycatch alive. This includes releasing them without removing them from the water.

## **Criterion 2 Assessment**

### SCORING GUIDELINES

#### **Factor 2.1 - Abundance**

*(same as Factor 1.1 above)*

#### **Factor 2.2 - Fishing Mortality**

*(same as Factor 1.2 above)*

### WHITE SHARK | SOUTHERN CALIFORNIA

#### **Factor 2.1 - Abundance**

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

### High Concern

There is no stock assessment available for white shark; therefore, there are no biological reference points. Lowe *et al.* (2012) suggests that there are large numbers of white shark present, particularly young of the year (YOY), and the population appears to be stable or increasing (Lowe 2012)(Bonham 2014). The increase could be in part due to the nearshore gillnet ban in 1994 and the prohibition of white shark catch (Lowe et al. 2012). White shark is listed as "Vulnerable" with an unknown population trend by the IUCN Red List of Threatened Species (IUCN 2012). It was recently proposed for listing as threatened or endangered on U.S. Endangered Species lists, but the status review determined that the population was most likely at a low to very low risk of extinction and that a listing was not warranted (NMFS 2013). Nevertheless, because the stock status is unknown (relative to reference points), but sharks are considered highly vulnerable, the stock status is of "high" concern.

## Factor 2.2 - Fishing Mortality

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

### Moderate Concern

The fishing mortality is unknown with respect to a reference point because no reference points are available for white shark. It is illegal to retain white shark in California and federal waters, although this does not preclude it from incidental catch. YOY and juvenile white sharks are released alive from gillnets in 33% to 50% of encounters, and are believed to exhibit fairly high post-release survival (Lowe et al. 2012). Post-release survival increases with decreasing soak time (Lyons et al. 2013). Most of the white sharks caught in bottom gillnet gear are YOY and juveniles (Lowe et al. 2012). From 2006 to 2009, there were 47 documented white shark captures in southern California set gillnets, such as those used by the California flounder fishery (56 total captures in all gillnets) (Lyons et al. 2013). One white shark was caught and discarded dead in the California flounder fishery in 1991 (Larese 2009). The recent status review estimated the average annual bycatch from 2001 to 2011 in California as 28 individuals with 16 mortalities per year (Bonham 2014). It is unknown how fishery-related mortalities compare to what the population can withstand; the BRT determined that shark bycatch across fisheries in CA and Mexico posed a moderate risk to the white shark population (NMFS 2013). Therefore, the fishing mortality is of "moderate" concern.

### Justification:

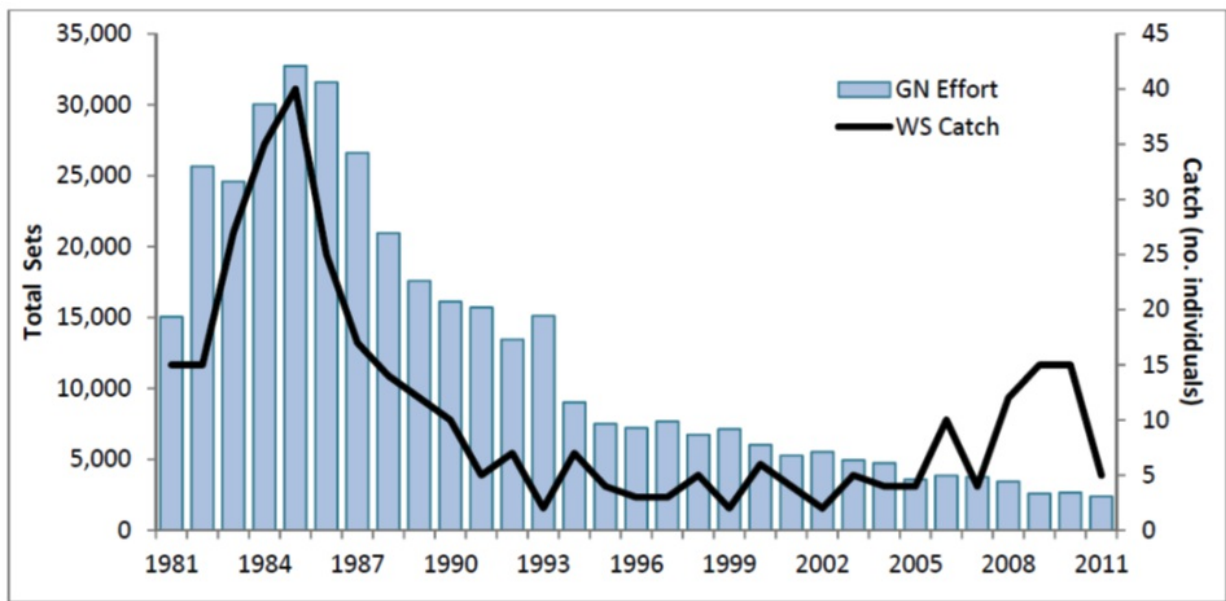


Figure 8 Reported white shark catch in West Coast commercial gill net fisheries 1981–2011 (NMFS 2013).

### Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

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

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

##### ≥ 100%

There are only three years of observer data for the California flounder gillnet fishery: 2007, 2010, and 2011. The most recent observer data available for the California flounder gillnet fishery are from 2011, where dead discards are 56% of landings during a total of 171 set gillnet sets (NMFS 2011). A report by Oceana used the same observer data to estimate discards in the California flounder fishery, but they used total discards (alive and dead), including seabirds and marine mammals. Combining the three years, they estimated that dead discards were 65% of total catch and therefore 186% of landings (Keledjian et al. 2014).

#### DUNGENESS CRAB | SOUTHERN CALIFORNIA

### Factor 2.1 - Abundance

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

**Moderate Concern**

There is no stock assessment available for Dungeness crabs. Population size depends on the recruitment success of larvae, which is driven by atmospheric forcing (Shanks and Roegner 2007). Since 1960, annual landings have provided a reasonable notion of abundance of legal-sized males because, over many years, fisheries have caught 80 to 90 percent of all available legal-sized males (Lee et al. 2001). Females must be discarded and are rarely caught since they generally do not exceed the minimum carapace width. But they may be experiencing reduced egg production (potentially 2% to 25%) because females mate with males larger than themselves and the fishery is removing a large portion of large males (Hankin et al. 1997)(Lee et al. 2001). According to the Seafood Watch standards, because there is no evidence that the stock is above or below reference points and the inherent vulnerability is medium, the stock status is of "moderate" concern.

**Justification:**

Dungeness crab has a medium inherent vulnerability (score of 2.77) due to its early age at sexual maturity, high fecundity, and short lifespan. Detailed scoring of each attribute is shown below.

<b>Productivity Attribute</b>	<b>Relevant Information</b>	<b>Score (1 = low risk, 2 = medium risk, 3 = high risk)</b>
Average age at maturity	3 years of age (ODFW 2016)	1
Average maximum age	Dungeness crab maximum age is 10 years (ODFW 2016)	2
Fecundity	2 million eggs per year (Higgins et al. 1997)	1
Average maximum size (fish only)		
Average size at maturity (fish only)		
Reproductive strategy	Egg brooder	2
Trophic level	Unknown	Unknown
Density dependence (invertebrates only)	Unknown	

<b>Susceptibility Attribute</b>	<b>Relevant Information</b>	<b>Score (1 = low risk, 2 = medium risk, 3 = high risk)</b>
<b>Areal overlap</b>	Unknown amount of crab habitat unfished	3

<b>Vertical overlap</b>	Crab fished only on the bottom, but there is no evidence that a greater than 33% of vertical habitat is unfished.	3
<b>Selectivity of fishery</b>	Species is targeted and conditions under high risk do not apply	2
<b>Post-capture mortality</b>	Unknown	3

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

There is no stock assessment with reference points for Dungeness crab in California, but the main fishery caught over 16 million pounds (7,500 MT) statewide in the 2014–2015 season (CA Department of Fish and Wildlife (CDFW 2016). Dungeness crab fisheries are considered sustainable because crabs reach maturity at a low age and the fishery removes only the large males from the population. Although catch varies from year to year, it is largely considered a direct result of changes in the environment, and not fishing pressure (CDFW 2011b). Catch in the California flounder bottom trawl fishery, where 100% is discarded, was 112 MT in 2014 and 146 MT in 2013 (NWFSC 2016). The Dungeness crab catch in the California flounder bottom trawl fishery represented 1.4% of the fishery in 2014; therefore, the fishery is not a substantial contributor to Dungeness crab fishing mortality and is of “low” concern.

## Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

#### RATIO OF BAIT + DISCARDS/LANDINGS FACTOR 2.3 SCORE

<100%	1
>=100	0.75

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## GREEN STURGEON | CENTRAL CALIFORNIA

### Factor 2.1 - Abundance

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

### High Concern

In 2006, the National Marine Fisheries Service (NMFS) listed the Southern Distinct Population Segment (DPS) of North American green sturgeon as threatened under the ESA (NMFS 2015). The Southern DPS range is from Northern Washington to San Francisco, California, and very few sturgeon have been found south of San Francisco Bay (Lee et al. 2015). The Southern DPS was estimated at 1,348 (+/-524) spawning adults in 2014, an increase from the previous year (338 +/-61 individuals) and from the original year of the survey (164 +/-47 individuals in 2010). But the abundance survey was conducted using dual frequency identification sonar, so it is not 100% certain that all fish counted were green sturgeon. Using two different population models, the entire population of the Southern DPS is estimated to be 40,000 sub-adults throughout their range; however, this estimate has not yet been peer reviewed and is preliminary (NMFS 2015). Since there are no previous estimates of abundance, it is difficult to estimate whether the population is increasing or decreasing, but because they are threatened, abundance is ranked as "high" concern.

### Factor 2.2 - Fishing Mortality

## UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

### High Concern

Fishing mortality is considered a major threat to the Southern DPS of green sturgeon, although fishing mortality has decreased since green sturgeon was listed as threatened in 2006. In large part, this decline is a result of the prohibition against intentional take of green sturgeon in California, Oregon, and Washington (NMFS 2015). In California, the state prohibits all take (hunt, pursue, catch, capture, or kill) of green sturgeon (NMFS 2015). Due to the decline of targeted fishing, illegal poaching and incidental catch of green sturgeon are their main threats; however, there are no reliable estimates of mortality due to poaching. In California, recreational anglers submit voluntary report cards on annual green sturgeon encounters; in 2013, 2,257

sturgeon were encountered by the recreational fishery and 168 were released.

In 2012, bycatch of the Southern DPS green sturgeon in the California flounder trawl fishery was estimated as somewhere between 86 to 289 individuals (NMFS 2015). An updated assessment in 2015 found that bycatch estimates of the Southern DPS of green sturgeon ranged from 27 to 707.4 fish per year, a much wider range and likely an increase (Lee et al. 2015). When the Southern DPS of green sturgeon was listed as threatened, fishing mortality was considered to be a major factor, even though the exact nature of fishing mortality on the population is unknown. Therefore, fishing mortality is ranked as “high” concern.

## Factor 2.3 - Modifying Factor: Discards and Bait Use

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

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

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

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## Criterion 3: Management Effectiveness

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

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

The Criterion 3 rating is determined as follows:

- Score  $>3.2$  = Green or Low Concern
- Score  $>2.2$  and  $\leq 3.2$  = Yellow or Moderate Concern
- Score  $\leq 2.2$  = Red or High Concern

Rating is Critical if Management Strategy and Implementation is Critical.

### GUIDING PRINCIPLE

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

### Criterion 3 Summary

Fishery	Management Strategy	Bycatch Strategy	Research and Monitoring	Enforcement	Stakeholder Inclusion	Score
Fishery 1: United States of America/Eastern Central Pacific   Bottom trawls   United States of America   Central California   Central California	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.000)
Fishery 2: United States of America/Eastern Central Pacific   Bottom trawls   United States of America   Southern California   Southern California	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.000)

Fishery 3: United States of America/Eastern Central Pacific   Set gillnets   United States of America   Southern California   Southern California	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.000)
Fishery 4: United States of America/Eastern Central Pacific   Trolling lines   United States of America   Central California   Central California	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.000)
Fishery 5: United States of America/Eastern Central Pacific   Trolling lines   United States of America   Southern California   Southern California	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective	Highly Effective	Yellow (3.000)

## Criterion 3 Assessment

### Factor 3.1 - Management Strategy and Implementation

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

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

#### **Moderately Effective**

The first ever stock assessment for California flounder was published in July 2011 (CDFW 2011a). There is no closed fishing season for troll line, but a minimum size requirement of 55.9 cm (22 in) (CalCOFI 2012). Gillnetting is prohibited within state waters (0–3 nm) and has a minimum depth of 110 m (60 fathoms) north of Point Arguello (CDFW 2011a). Minimum gillnet mesh size is 216 mm (8.5 in) and the maximum daily gillnet length is 2,743 m (9,000 ft) (CDFW 2012a). There is also a minimum size requirement of 55.9 cm (22

in) for halibut.

The California flounder bottom trawl fishery consists of a limited entry (LE) fishery and an open access fishery in which vessels with West Coast Groundfish permits can land 150 lb of California flounder incidentally while on a groundfish trip. The IFQ program has 100% observer coverage; therefore, groundfish trips that catch halibut are well documented. In the open access fishery, there has not been observer coverage since 2011, and although the state would like to again implement an observer coverage program, there is no funding for it at this time (Travis Tanaka, pers. comm., 2017). In state waters, trawling is prohibited (0–3 nm), except in the California Halibut Trawl Grounds (CHTG) in southern California (CDFW 2008). The CHTG is 150 square nautical miles, from Point Arguello to Point Mugu, 1–3 nm from the coast, and requires a state permit (CDFW 2008). Within the CHTG there are closed areas and a closed season from March 15th through June 15th that protects spawning California flounder, a minimum size limit of 55.9 cm (22 in.), and a 227-kg (500-lb) catch limit of other fish (NWFSC 2010). Gear restrictions within the CHTG allow only paranzella, or "light-touch," trawl gear that has a minimum cod-end mesh of 19 cm (7.5 in), a headrope less than 27.4 m (90 ft), webbing greater than 7 mm in diameter and trawl doors less than 227 kg with no rollers or bobbins.

Male fish over 55.9 cm long are 4 to 6 years old, and female fish are 5 to 6 years old (Travis Tanaka, pers. comm., 2017)(MacNair et al. 2001). The smallest mature male was measured at 25.7 cm (1 year), 50% of males were mature by 27.0 cm (1.1 year), and 100% were mature by 29.0 cm (3 years). The smallest mature female was measured at 46.6 cm (2 years), 50% of females were mature by 47.3 cm (2.6 years), and 100% were mature by 51.3 cm (4 years), according to histological criteria (Lesyna and Barnes 2016). The stock assessment does not include reference points that are appropriate to manage the California flounder fishery, nor any quotas or harvest control rules to ensure abundance is maintained. There is no accountability for stock declines and there are no regulations currently in place that ensure action is taken if the stock falls below sustainable levels. There are both mesh size and gillnet length restrictions as well as area restrictions on gillnet sets in place. But, based on the lack of appropriate reference points, harvest control rules, and the continued low abundance in the southern stock, the management strategy and implementation is "moderately effective."

### Factor 3.2 - Bycatch Strategy

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

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

#### Moderately Effective

There are some regulations for the California flounder trawl fishery that are designed to minimize bycatch and discard mortality (Somers et al. 2014), including the 227 kg non-halibut bycatch limit (CDFW 2008). To reduce bycatch and undersized halibut catch, the cod-end mesh minimum-size restriction for the limited-entry fishery is 114.3 mm (4.5 in) and for the CHTG, the only area in state waters where bottom trawl fishing is allowed, it is 190.5 mm (7.5 in). Yet, considering the bycatch ratio is so high in the bottom trawl fishery, the current regulations are insufficient to limit bycatch. The limited entry fishery is a part of the West Coast Ground Fish Management Plan, which has 100% observer coverage. The open-access state fishery has had observer coverage in the past, but there is no ongoing coverage due to lack of funding (Travis Tanaka, pers. comm.,

2017). But, since California flounder is often caught alongside other groundfish, it is difficult to estimate the nature of discards in the limited entry halibut fishery alone. Though there are minimum mesh size restrictions, gear requirements, and closed areas, there are no specific management measures in place to minimize bycatch in the bottom trawl fishery. Therefore, bycatch management is considered “moderately effective.”

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

##### **Moderately Effective**

Bycatch in the California flounder gillnet fishery is substantial and a concern for many species where the fishery operates. Due to the concern over gillnet bycatch, gillnets were prohibited in shallow waters less than 110 to 128 m (60 to 70 fathoms), which reduced bycatch of shallower living animals, including sea otter and seabirds (Carretta and Enriquez 2012). Also, there are minimum mesh size and maximum daily length requirements (216 mm [8.5 in] and 2,743 m [9,000 ft], respectively) (CDFW 2012a). Other restrictions include specific depth and location prohibitions as outlined in the California commercial fishing digest (CDFW 2012a). The gillnet ban in shallow waters decreased bycatch, but where gillnets are still fished, bycatch of white shark and marine mammal is still a concern. Approximately 65% of catch is discarded, including marine mammals, seabirds, sharks and rays, and fish (Keledjian et al. 2014). Since the shallow water gillnet ban was enacted, the age composition of white sharks caught in set gillnets has changed and the proportion of young of the year (YOY) sharks has increased by 16%. This appears to be because set gillnets were only allowed in selective areas where YOY sharks were more abundant. In addition, there have been only three years of observer coverage in the set gillnet fishery: 2007, 2010, and 2011, and there is a tentative, unconfirmed observer study scheduled for 2017. With assistance from Oceana, the CDFG's Marine Resource Committee established a bycatch and incidental take workgroup in 2016, to address bycatch concerns state-wide, but it has only recently been formed and has not yet taken any action (CDFW 2016). Bycatch management is ranked as “moderately effective” (not ineffective) due to the implementation of the shallow water gillnet ban, which has dramatically reduced bycatch of species of concern, including sea otter and seabirds.

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

##### **Highly Effective**

Troll line gear is very selective for the targeted species in general and stress on bycatch is less than other gears (e.g., bottom trawls), especially since fishers remove undesired fish from the line immediately (Frey et al. 2012). Limits on bycatch are outlined in the California commercial fisher's digest and mainly consist of specific species limitations and general provisions (CDFW 2012a). Due to the selectivity of the fishery and the species-specific regulations for sensitive species, the bycatch management in the troll line fishery is “highly effective.”

### **Factor 3.3 - Scientific Research and Monitoring**

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

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

**Moderately Effective**

Several monitoring programs exist for California flounder. The State Finfish Management Project (SFMP) obtains basic length, weight, age, and reproductive information from sampled landings in central and southern California ports (CDFW 2013). Three fishery-independent trawl surveys were conducted: two in Monterey Bay in 2007 and 2010 and one in the Santa Barbara Channel in 2008, to obtain basic biological information on legal and sub-legal California flounder as well as associated bycatch species (CDFW 2013). In San Francisco Bay, a hooking mortality study was performed in 2008 and 2009, and a study on age and length at maturity was conducted from 2010 to 2012 and was extended to 2014 (CDFW 2013). The statewide stock assessment, conducted in 2011, collected and summarized recent and historic data with another assessment planned within the decade (CalCOFI 2012). Fishery monitoring is also conducted using logbooks and market receipts. The state managed trawl fishery has limited entry, and the federal portion of the fishery has 100% observer coverage. The state-only fishery does have some observer coverage, but it is limited and dependent on funding. In addition, due to lack of funding, CFGC has not conducted a periodic review of observer data to determine whether bycatch is minimal, as required by FGC Section 8495(d), which states: "(d) Commencing January 1, 2008, the commission shall review information every three years from the federal groundfish observer program and other available research and monitoring information it determines relevant, and shall close any areas in the California flounder trawl grounds where it finds that the use of trawl gear does not minimize bycatch, is likely damaging sea floor habitat, is adversely affecting ecosystem health, or impedes reasonable restoration of kelp, coral, or other biogenic habitats." Therefore, limited information is known about bycatch of fish, marine mammals, and sharks. Due to the lack of fishery independent surveys, the lack of an updated assessment, and low precision in the stock assessment estimates, as well as the limited information on bycatch, scientific research and monitoring is ranked as "moderately effective."

**Factor 3.4 - Enforcement of Management Regulations**

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

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

**UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

**Highly Effective**

Fishers are required to obtain a state of California permit. The limited-entry California flounder trawl fisheries are subject to the West Coast Groundfish IFQ Observer Program (Somers et al. 2014). The IFQ groundfish regulations also require the limited-entry fishery to have a vessel monitoring system for enforcement purposes (Somers et al. 2014). The fishery-dependent monitoring of central and southern California ports by SFMP also

facilitates the enforcement of management regulations. With required observer coverage and vessel monitoring systems for the limited-entry fishery, the enforcement is considered “highly effective.”

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

##### **Highly Effective**

California Department of Fish and Wildlife officers patrol and enforce fishing regulations, including in areas where gillnets are prohibited. Dockside sampling also occurs. In 2010, 216 gillnet sets from both the California flounder 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.”

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

##### **Highly Effective**

The fishery-dependent monitoring of central and southern California ports by SFMP facilitates the enforcement of management regulations, including logbook submissions by vessels (CDFW 2013). California Fish and Wildlife officers patrol and enforce regulations and dockside sampling does occur. Therefore, enforcement is ranked as “highly effective.”

### **Factor 3.5 - Stakeholder Inclusion**

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

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

##### **Highly Effective**

The results of the 2011 stock assessment were reviewed by an independent, peer-review panel (CalCOFI 2012). California’s Joint Legislative Committee on Fisheries and Aquaculture has hosted a Fisheries Forum since 1973 at the State Capitol in Sacramento. The forums allow those involved in commercial and recreational fisheries to speak directly to their representatives about statewide commercial and sport fishery

issues and fisheries research (CDFW 2012b). The results of the 2011 stock assessment were reviewed by an independent, peer-review panel. The California Fish and Game Commission regulatory process also allows for multiple levels of input and participation. The inclusion of stockholders is considered "highly effective."

## Criterion 4: Impacts on the Habitat and Ecosystem

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

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

### GUIDING PRINCIPLES

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

*Rating cannot be Critical for Criterion 4.*

### Criterion 4 Summary

Region   Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
<b>United States of America/Eastern Central Pacific   Bottom trawls</b> United States of America   Central California	2	+0.5	Moderate Concern	Yellow (2.739)
<b>United States of America/Eastern Central Pacific   Bottom trawls</b> United States of America   Southern California	2	+0.5	Moderate Concern	Yellow (2.739)
<b>United States of America/Eastern Central Pacific   Set gillnets</b> United States of America   Southern California	3	+1	Moderate Concern	Green (3.464)
<b>United States of America/Eastern Central Pacific   Trolling lines</b> United States of America   Central California	5	0	Moderate Concern	Green (3.873)
<b>United States of America/Eastern Central Pacific   Trolling lines</b> United States of America   Southern California	5	0	Moderate Concern	Green (3.873)

## Criterion 4 Assessment

### SCORING GUIDELINES

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

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

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

#### **Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts**

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

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

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

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

- 5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do

*not have negative ecological effects.*

- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

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

### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **2**

The California flounder bottom trawl fishery operates mainly over soft sediments (CDFW 2008), and has a light to moderate impact on bottom habitat. The CHTG comprises approximately 86% soft substrate and 14% hard substrate, but logbook data indicate that trawlers generally avoid the hard substrate within the CHTG (CDFW 2008). In federal waters (3 to 200 nm from the coast), the substrate types trawled are generally unknown, but are likely soft sediment based on the California flounder's habitat preferences. A 2014 study on a light-touch trawl showed that the trawl was not in constant contact with the bottom. It is specially designed to have minimal bottom impact by not having any rollers or bobbins, and has a generally lighter net and doors than a regular trawl (NOAA and CDFW 2014).

### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

#### **3**

Gillnets for California flounder are operated solely south of Point Conception, and likely over soft sediment with minimal boulder or reef where California flounder is known to reside (Love 1996). Set gillnets can cause damage to corals and sea kelp, but an aerial survey found little kelp and coral structures in the region where the fishery operates (CDFW 2008)(Shester and Micheli 2011). For this reason, the gillnet fishery has a low impact on bottom habitat.

### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

#### **5**

Troll line gear suspends a vertical line in the water that has minimal impact on the seafloor, resulting in a very low impact on bottom habitat. For example, troll line fishers for California flounder working from Santa Cruz, California work three to six rods from a small boat and target large areas of sandy bottom surrounded by small reefs, rocks, or other benthic structure (Frey et al. 2012).

## Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

#### +0.5

California flounder occur in very shallow waters, most commonly from 1.5 to 55 m (Love 1996). Trawling within state waters (0 to 3 nm from shore) is illegal, except for trawling within the CHTG, a 150-square-nm area between Point Arguello and Point Mugu (CDFW 2008). This means that a very large proportion of California flounder habitat is protected from trawling. Trawling is allowed outside of 3 nm, but there are area closures such as rockfish conservation areas, bottom trawl closed areas, bottom contact closed areas, and marine protected areas (NOAA and CDFW 2014). Other areas of high concern (e.g., rocky reefs and kelp forests) make up a small percentage of California flounder habitat available for trawling. For example, the Monterey Bay National Marine Sanctuary (MBNMS), encompassing 12,783 km<sup>2</sup> and hard substrate from 0 to 100 m, is only 336 km<sup>2</sup> or 2.6% of the total area (Brown 2013).

Based on the closure of state waters to trawling and the shallow depth distribution of California flounder, a substantial portion of California flounder habitat is protected from trawling, therefore "moderate mitigation" is in effect.

#### Justification:

Amendment 28 to the Groundfish FMP went into effect in early 2020; this rule change was made to protect groundfish essential fish habitat (EFH). Provisions include the closure of over 12,000 mi<sup>2</sup> to all bottom contact groundfish gear in waters deeper than 3,500 m and reopening of roughly 200 mi<sup>2</sup> to groundfish bottom trawling (NMFS 2019b). However, less than 2% of groundfish landings originated in the newly closed area, and the depths covered is outside the range of California flounder habitat (ibid).

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### +1

In 2002, gillnets were prohibited in waters less than 110 m (60 fathoms) in central California to protect seabird and sea otter populations. This effectively ended the California flounder gillnet fishery north of Point Conception (CalCOFI 2012). Gillnet catch has steadily declined since then, and in 2011 only comprised 21% of the total (CalCOFI 2012). Since all effort is now south of Point Conception (CalCOFI 2012), the 110 m restriction significantly reduced the fishing effort and fishable area. The area where gillnet fishing is now prohibited is likely 50% or more of California flounder habitat in California. Also, the gillnet fishery has been a limited-entry fishery since 1986; new permits may not be issued and transferring existing permits is restricted (Travis Tanaka, pers. comm., 2017}. Based on the reduction of fishable areas and subsequent effort reduction, the California flounder gillnet has "strong mitigation."

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Central California | Central California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Trolling Lines | United States Of America | Southern California | Southern California

## 0

Commercial troll line fishing for California flounder can be conducted by any fisher with a commercial fishing license. There are only restrictions on gear in San Francisco Bay—where fishers can use no more than six lines with two hooks per line—and no other specific area restrictions for troll line gear except those areas where no fishing is allowed (e.g., state marine reserves). As a result, there is no mitigation of troll line impacts on the substrate. No mitigations are needed because the fishery does not impact the seafloor habitat; therefore, mitigation score is “not applicable.”

### Factor 4.3 - Ecosystem-Based Fisheries Management

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Set Gillnets | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Central California | Central California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Trolling Lines | United States Of America | Southern California | Southern California

#### **Moderate Concern**

There is no evidence that the California flounder fishery has a significant impact on other species in the California current ecosystem. A study on the Northern California current ecosystem found significant trophic interactions among larger fish such as rockfish, round fish, and flatfish such as California flounder. The most significant impact of California flounder to the ecosystem is control of lower trophic levels through predation (Field et al. 2006). Inclusion of California flounder as a bycatch (and retained) species by groundfish fishers in the Coast Ground Fish Fishery Management Plan is the first step toward creating an inclusive fisheries management strategy that considers multiple fisheries together as they are found in the California current ecosystem. California flounder is also one of five fisheries included in the ecological risk-assessment project as a part of the Marine Life Management Act (MLMA) Master Plan Update. The Ecological Risk Assessment is a prioritization tool for fisheries management that uses ecosystem-based management (California Ocean Trust 2017). But managing multiple fisheries together does not necessarily mean the trophic interactions among them have been considered in the development and implementation of the management plan. There is no evidence that an assessment of the management of ecosystem impacts of the California flounder fishery has been conducted or is planned; however, there is also not a high likelihood of detrimental impacts to the food web. Therefore, the ecosystem based fishery mortality is of “moderate” concern.

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## Appendix A: Extra By Catch Species

### WHITE SEABASS | SOUTHERN CALIFORNIA

#### Factor 2.1 - Abundance

##### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

##### Moderate Concern

The first US stock assessment for white seabass was conducted in 2016 and shows that  $B$  is just below  $B_{MSY}$  ( $B = 0.73B_0$  and  $B_{MSY} = 0.76B_0$ ) (Valero and Waterhouse 2016). White seabass is not considered overfished (CDFG 2002). The biomass of white seabass in Mexico is unknown (Baja California Gobierno Del Estado 2015). Since the stock is moderately vulnerable to fishing (PSA table) and the stock status is unknown, abundance is ranked as "moderate" concern.

##### Justification:

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

The PSA score of white seabass, *Atractoscion nobilis*, is 2.89, medium vulnerability based on the criteria below.

Productivity Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
Average age at maturity	4 years of age (Vojkovich and Crooke 2001)	1
Average maximum age	27 years (CDFW 2002)	3
Fecundity	760,000–1,500,000 eggs per batch (CDFW 2002)	1
Average maximum size (fish only)	171 cm (Vojkovich and Crooke 2001)	2
Average size at maturity (fish only)	61 cm for females, 51 cm for males (Vojkovich and Crooke 2001)	2
Reproductive strategy	Broadcast spawner	1
Trophic level	3.2 (Froese and Pauly 2017)	2

Density dependence (invertebrates only)		
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Susceptibility Attribute	Relevant Information	Score (1 = low risk, 2 = medium risk, 3 = high risk)
<b>Areal overlap</b> (Considers all fisheries)	Unknown what % of the fishery is fished	3
<b>Vertical overlap</b> (Considers all fisheries)	The fishery targets the fish in the majority of its range	3
<b>Selectivity of fishery</b> (Specific to fishery under assessment)	Species is targeted and conditions under high risk do not apply	2
<b>Post-capture mortality</b> (Specific to fishery under assessment)	Unknown	3

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### Moderate Concern

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

#### Justification:

The annual harvest quota or OY calculated as 75% of the MSY was established at 544.3 (1.2 million lb) in 2002 and did not change in subsequent years (CDFG 2002) (CDFG 2011). Total fishing mortality in 2011 and

2012 was therefore below the set OY of 544.2 MT (CDFG 2002) (CalCOFI 2013). Prior to 2016 the white seabass fishery lacked a quantitative stock assessment and target reference points, but landings in a season did not exceed the set OY. A 2007 fisheries independent survey of juvenile white seabass indicated that white seabass was in the process of recovery (Allen et al. 2007).

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

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### ≥ 100%

There are only three years of observer data for the California flounder gillnet fishery: 2007, 2010, and 2011. The most recent observer data available for the California flounder gillnet fishery are from 2011, where dead discards are 56% of landings during a total of 171 set gillnet sets (NMFS 2011). A report by Oceana used the same observer data to estimate discards in the California flounder fishery, but they used total discards (alive and dead), including seabirds and marine mammals. Combining the three years, they estimated that dead discards were 65% of total catch and therefore 186% of landings (Keledjian et al. 2014).

## HUMPBACK WHALE | SOUTHERN CALIFORNIA

## Factor 2.1 - Abundance

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### High Concern

The humpback whale has been listed as endangered under the ESA since 1970; however, in 2016, NMFS revised the humpback whale population designation by splitting it into 14 distinct population segments (DPS). The Mexican and Central American DPSs are found in California waters and have interacted with the California flounder fishery. Under the revised listing, the Mexican DPS is listed as threatened and the Central American DPS is listed as endangered (NOAA 2016). The most recent stock assessment estimated there are approximately 6,000 to 7,000 humpback whales in the Mexico DPS (Bettridge et al. 2015). Although there are no population trends for this particular DPS over time, the population is believed to be increasing at a rate of 4.9% per year (Bettridge et al. 2015). The Central American stock assessment found that the population is estimated at only 500 to 600 individuals and, due to its endangered status, humpback whale is of "high" conservation concern.

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### Low Concern

California flounder gillnet gear is listed as a Category II fishery in the NOAA List of Fisheries (NMFS 2016a). Fishing gear that interacts with humpback whale includes gillnet, pot, and trap gear. Total cumulative annual mortality and serious injury of humpback whale is greater than 1%, but less than 50% of the stock's potential biological removal (PBR) (59 FR 20550 2016). PBR is 11 for gillnet gear, and one humpback whale was seriously injured in 2007 (not likely attributed to the halibut fishery), which led to its Category II classification, as opposed to Category III. But gillnets are prohibited within 3 nautical miles of the mainland and 1 nautical mile of the Channel Islands, as well as within 60 fathoms of water along the central California coast. Thus, humpback whale interactions with the California flounder gillnet fishery are likely to be low. Because cumulative fisheries mortality is less than 50% of the stock's PBR, it is not believed to be threatening the population, and fishing mortality is of "low" concern.

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### ≥ 100%

There are only three years of observer data for the California flounder gillnet fishery: 2007, 2010, and 2011. The most recent observer data available for the California flounder gillnet fishery are from 2011, where dead discards are 56% of landings during a total of 171 set gillnet sets (NMFS 2011). A report by Oceana used the same observer data to estimate discards in the California flounder fishery, but they used total discards (alive and dead), including seabirds and marine mammals. Combining the three years, they estimated that dead discards were 65% of total catch and therefore 186% of landings (Keledjian et al. 2014).

## PACIFIC CHUB MACKEREL | SOUTHERN CALIFORNIA

## Factor 2.1 - Abundance

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### Moderate Concern

The most recent Pacific mackerel assessment was conducted in 2018; it found that the stock generally declined from 2008 to 2018; however, high recruitment estimates in 2016 and 2018 resulted in higher estimated biomass in 2017 (and forecasted into 2019-20) (Crone et al. 2019). There were significant sources of uncertainty in the stock assessment, including a lack of data on life history characteristics, a strong retrospective inconsistency that tends to overestimate biomass levels, and an incomplete model that does not incorporate ecological variables (Crone et al. Lynn 2011)(Crone et al. 2019). The estimated biomass (B, age 1+ fish) and spawning stock biomass (SSB, female and male) for the last three years was below ten year averages, but recruitment in 2016 and 2018 was well above average recruitment levels for the same time period (Crone et al. 2019). Since the stock is of medium vulnerability, due to the high uncertainty of the stock status, stock abundance is ranked as "moderate" concern.

#### Justification:

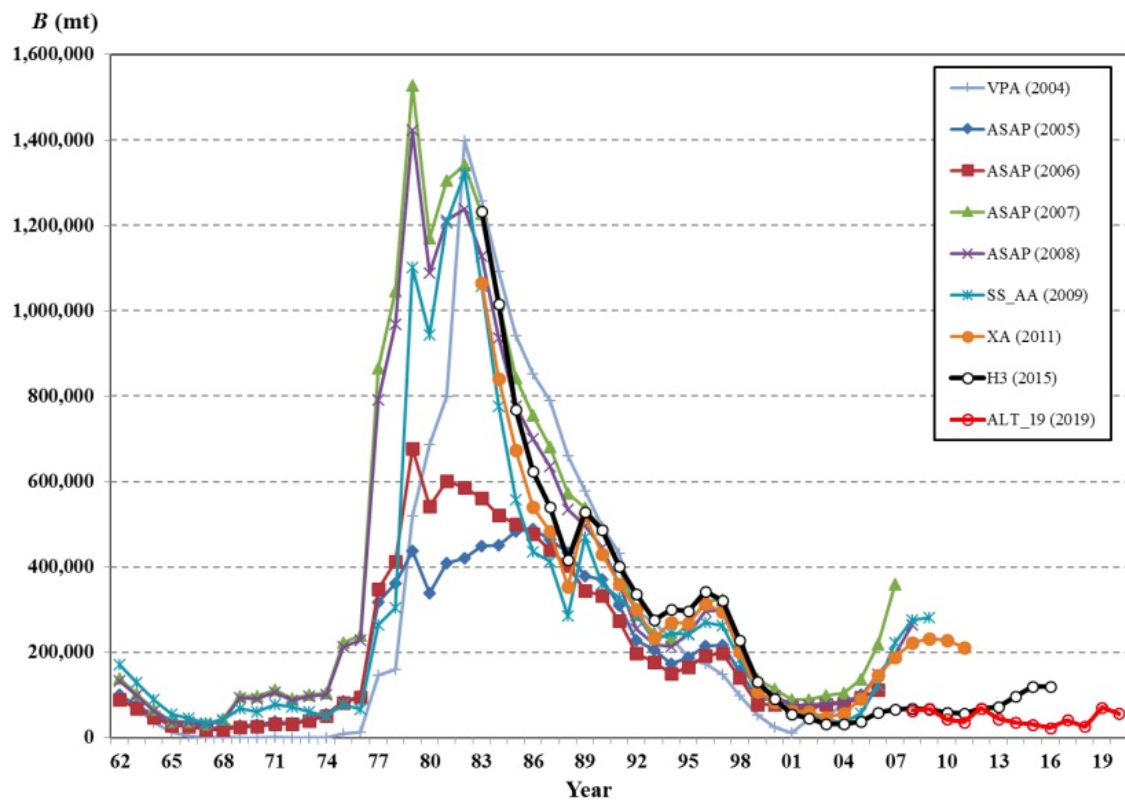


Figure 9 Estimated (historical) stock biomass ( $B$ , age 1+ fish, mt) time series used for Pacific mackerel management since 2004 (Crone et al. 2019).

The PSA score of Pacific mackerel is 2.66, medium vulnerability based on the criteria below.

PRODUCTIVITY ATTRIBUTE	RELEVANT INFORMATION	SCORE (1 = LOW RISK, 2 = MEDIUM RISK, 3 = HIGH RISK)
AVERAGE AGE AT MATURITY	1 year old (Gluyas-Millán and Quiñonez-Velázquez 1997)	1
AVERAGE MAXIMUM AGE	9 years old (Gluyas-Millán and Quiñonez-Velázquez 1997)	1
FECUNDITY	550,000 (Crone et al. 2011)	1
AVERAGE MAXIMUM SIZE	45 (Crone et al. 2011)	1
AVERAGE SIZE AT MATURITY	26 (Froese and Pauly 2017)	1
REPRODUCTIVE STRATEGY	Broadcast spawner	1
TROPHIC LEVEL	3.4 (Froese and Pauly 2017)	3

SUSCEPTIBILITY ATTRIBUTE	RELEVANT INFORMATION	SCORE (1 = LOW RISK, 2 = MEDIUM RISK, 3 = HIGH RISK)
AREAL OVERLAP (CONSIDERS ALL FISHERIES)	Unknown what % of the fishery is fished	3
VERTICAL OVERLAP (CONSIDERS ALL FISHERIES)	The fishery targets the fish in the majority of its range	3
SELECTIVITY OF FISHERY (SPECIFIC TO FISHERY UNDER ASSESSMENT)	Species is targeted and conditions under high risk do not apply	2
POST-CAPTURE MORTALITY (SPECIFIC TO THE FISHERY UNDER ASSESSMENT)	Unknown	3

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

#### Low Concern

Total landings of Pacific mackerel have declined throughout the 1990s, from 18,000 MT to only 11,487 MT in 2018 (Crone et al. 2019). The 2018 landings were more than double the landings in 2017, but still well below the acceptable biological catch level; landings in the U.S. have been below the annual catch limit every years since 2008 (see table below) (Crone et al. 2019). Harvest levels are set by the following formula: harvest = biomass at age1+ – cutoff biomass level (the lowest level of estimated biomass at which harvest is allowed)\* 30% (the proportion of biomass that can be harvested)\* 70% (the average fraction of total biomass at age 1+ in U.S. waters) (Crone et al. 2011). Harvest rates have been low due to the harvest control rule put in place by fisheries managers, and so fishing is not likely to be contributing to the decline of the pacific mackerel population. Therefore, fishing mortality is ranked as “low” concern.

#### Justification:

Fishing year	HG/ACL (mt)	Landings (mt)
2008	40,000	4,398
2009	10,000	3,015
2010	11,000	2,103
2011	30,386	2,038
2012	30,386	5,478
2013	39,268	11,874
2014	29,170	6,127
2015	21,469	4,404
2016	21,161	2,515
2017	26,293	1,359
2018	23,840	5,256

Figure 10 U.S. harvest guidelines/acceptable biological catches (HG/ACL, mt) and landings (mt) for Pacific mackerel since 2008. HG/ACL reflects final stipulated quotas (Crone et al. 2019).

#### Landings (mt)

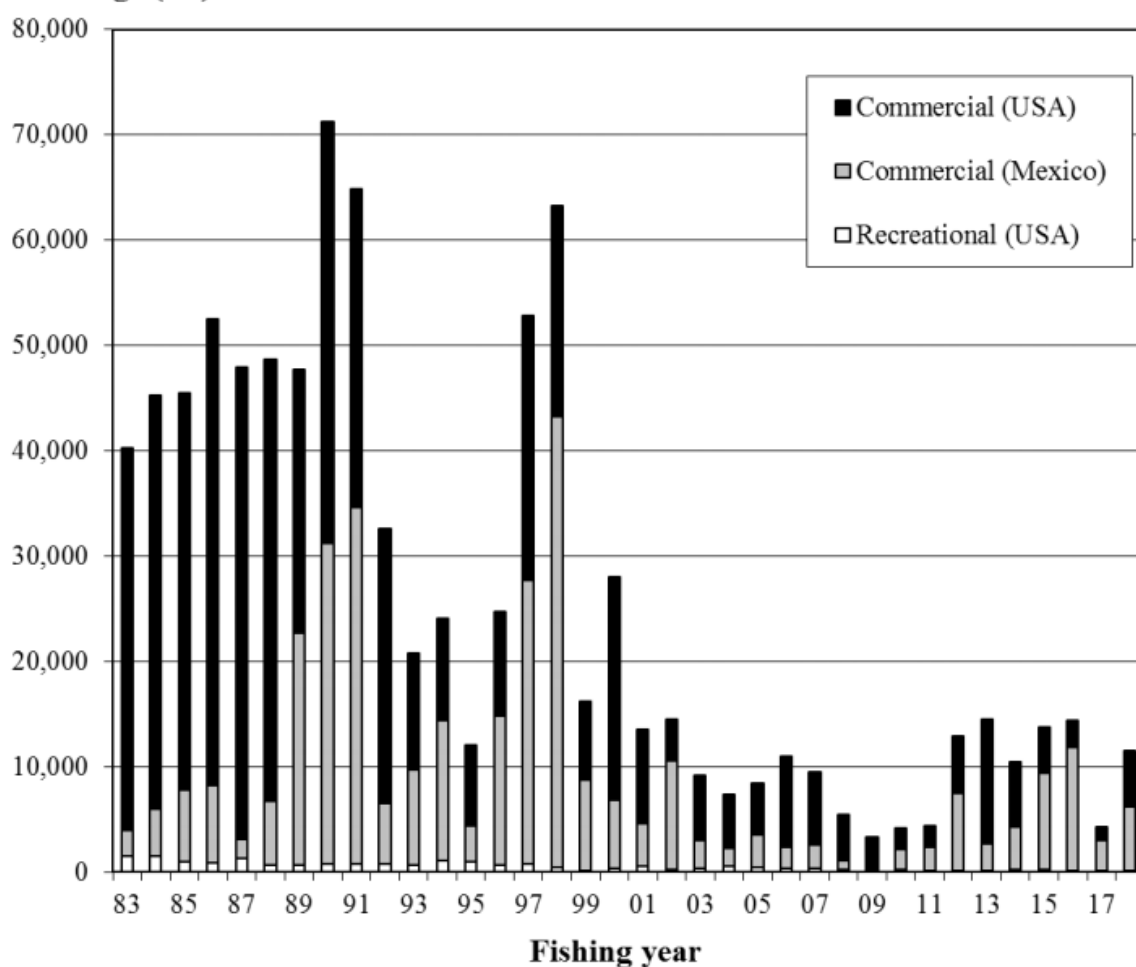


Figure 11 Landings of Pacific mackerel by fishery (1983-18). Landings in fishing year 2018 represent average values from 2013-17. Model ALT\_19 is based a single, combined (commercial and recreational) fishery (Crone et al. 2019).

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Set Gillnets | United States Of America | Southern California | Southern California

≥ 100%

There are only three years of observer data for the California flounder gillnet fishery: 2007, 2010, and 2011. The most recent observer data available for the California flounder gillnet fishery are from 2011, where dead discards are 56% of landings during a total of 171 set gillnet sets (NMFS 2011). A report by Oceana used the same observer data to estimate discards in the California flounder fishery, but they used total discards (alive and dead), including seabirds and marine mammals. Combining the three years, they estimated that dead discards were 65% of total catch and therefore 186% of landings (Keledjian et al. 2014).

## BIG SKATE | SOUTHERN CALIFORNIA

## Factor 2.1 - Abundance

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

Big skate was recently designated as a target species and became managed as a separate stock starting in 2017 under the West Coast Groundfish Fishery Management Plan (PFMC 2016). The Pacific coast big skate stock is currently listed as not overfished by NMFS (NMFS 2019b). Big skate was first assessed in 2019 under the Stock Synthesis model, but the results of the assessment have not gone through peer review (Taylor et al. 2019). The 2019 estimated spawning biomass is 1,999.3 mt, which is above the target reference point ( $B_{40\%} = 1,010$  mt) and well above the limit reference point ( $B_{25\%}$ ) (ibid), but there is some uncertainty in the results (see below). The assessment uses two bottom trawl survey indices of abundance. One, the Triennial Survey covering 1980-2004 shows an increasing trend over the period covered; the other, the West Coast Groundfish Bottom Trawl Survey (2003-2018) also shows an increasing trend (ibid).

Because the stock assessment demonstrates that there is "little evidence that the population is overfished..." and survey data suggests increases in abundance, but there is some uncertainty in the data used, big skate is ranked as "low" concern.

#### Justification:

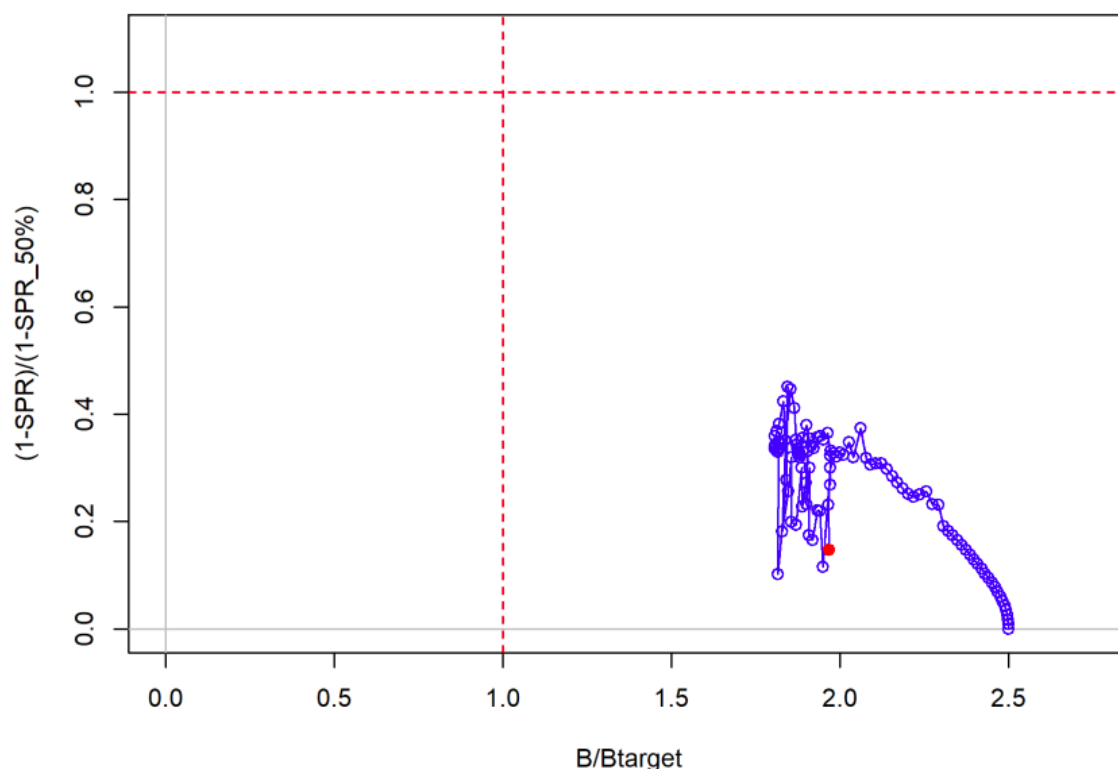


Figure 12 Phase plot of biomass vs fishing intensity (Taylor et al. 2019).

Uncertainties in the stock assessment stem from the following: length composition data is limited to only the past 10 years, the model has a limited ability to estimate changes in composition of the population during most of the history of the fishery and the behavioral processes affecting differences between female and male selectivity are not understood. Lastly, according to the authors of the assessment, "the data provide little information about the scale of the population, necessitating the use of a prior on catchability to maintain stable model results. During the review panel the prior was updated from the one developed in the 2007 Longnose Skate stock assessment to better account for Big Skate occurrences in shallower water than the surveyed region, but further refinement of this prior could be considered in the future" (Taylor et al. 2019).

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

Big skate is not an important fishery product; recent information has indicated that 98% of targeted big skate is in Oregon, and less than 2% of big skate catch occurs in California and overlaps with the California flounder fishery (PFMC 2016). Big skate landings were reported, along with other skate species, under the market category "Unspecified Skates," and only recently has the actual catch of big skate been isolated. Because of the stock's new designation as a target fishery, a new conservative harvest rate has been set. According to the 2019 stock assessment, current fishing mortality ( $F_{2016-2018} = 0.013$ ) is well below the  $F_{MSY}$  proxy (harvest rate yield corresponding to  $SPR = 50\%$ ) of 0.071 (Taylor et al. 2019). Further, landings have been well below

catch targets and catch limits in recent years (see table i. in Taylor et al. 2019). Because current levels of fishing appear sustainable and only a small percentage of big skate catch overlaps with the California flounder fishery, fishing mortality is scored as "low" concern.

#### Justification:

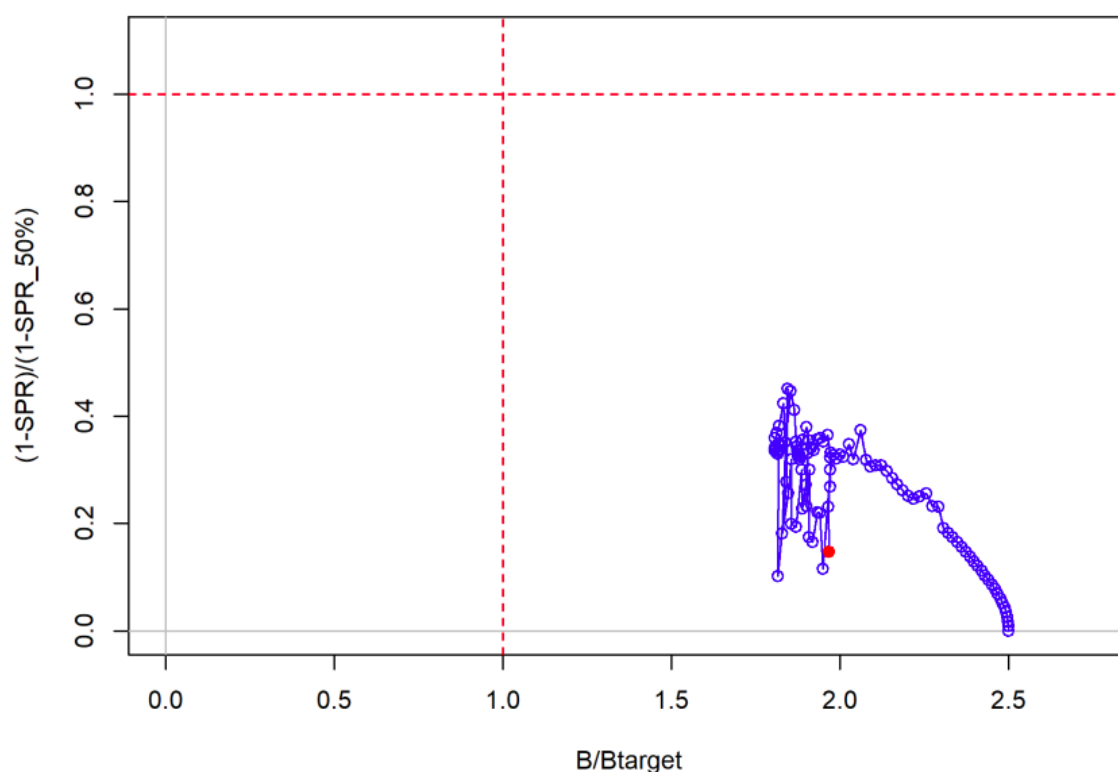


Figure 13 Phase plot of biomass vs fishing intensity (Taylor et al. 2019).

### Factor 2.3 - Discard Rate

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the

entire bottom trawl fishery.

## PACIFIC SANDDAB | SOUTHERN CALIFORNIA

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Very Low Concern**

The Pacific sanddab stock declined throughout the 2000s, but has slowly started to increase. Spawning stock biomass was 3,710 MT in 2004, but in 2013 was estimated at 8,554 MT (He et al. 2013). The stock is estimated to be at 95.5% of its virgin biomass, and well above the biomass target for flatfish; therefore, the stock is not overfished and abundance is of “very low” concern.

#### **Justification:**

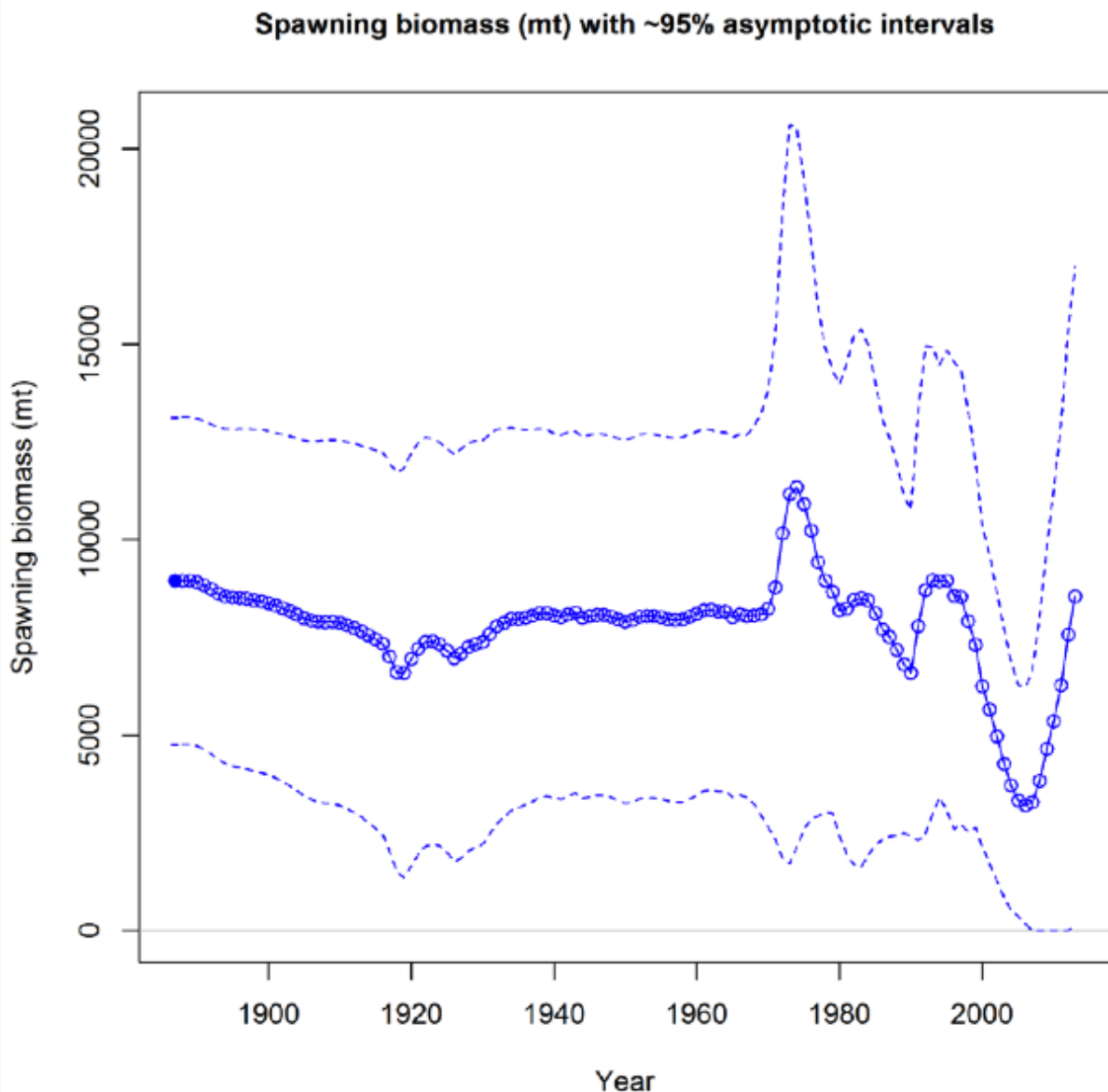


Figure 14 Estimated time series of annual spawning biomass of Pacific sanddab (He et al. 2013).

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

Landings of Pacific sanddab were at a high of 650 MT in 2003, but in 2012 were only 221.8 MT (He et al. 2013). The average catch from all sources from 2005 to 2012 was 23% of the total Pacific sanddab annual catch limit, and the only threat to the stock is from incidental catch in other fisheries. Discards of Pacific sanddab are high across all West Coast bottom trawl fisheries, including the halibut fishery, but the actual levels of bycatch from each fishery are uncertain. It is probable that fishing mortality from all sources is at or

below a sustainable level, since incidental catch does not appear to be affecting the stock; thus, fishing mortality is ranked as “low” concern.

#### Justification:

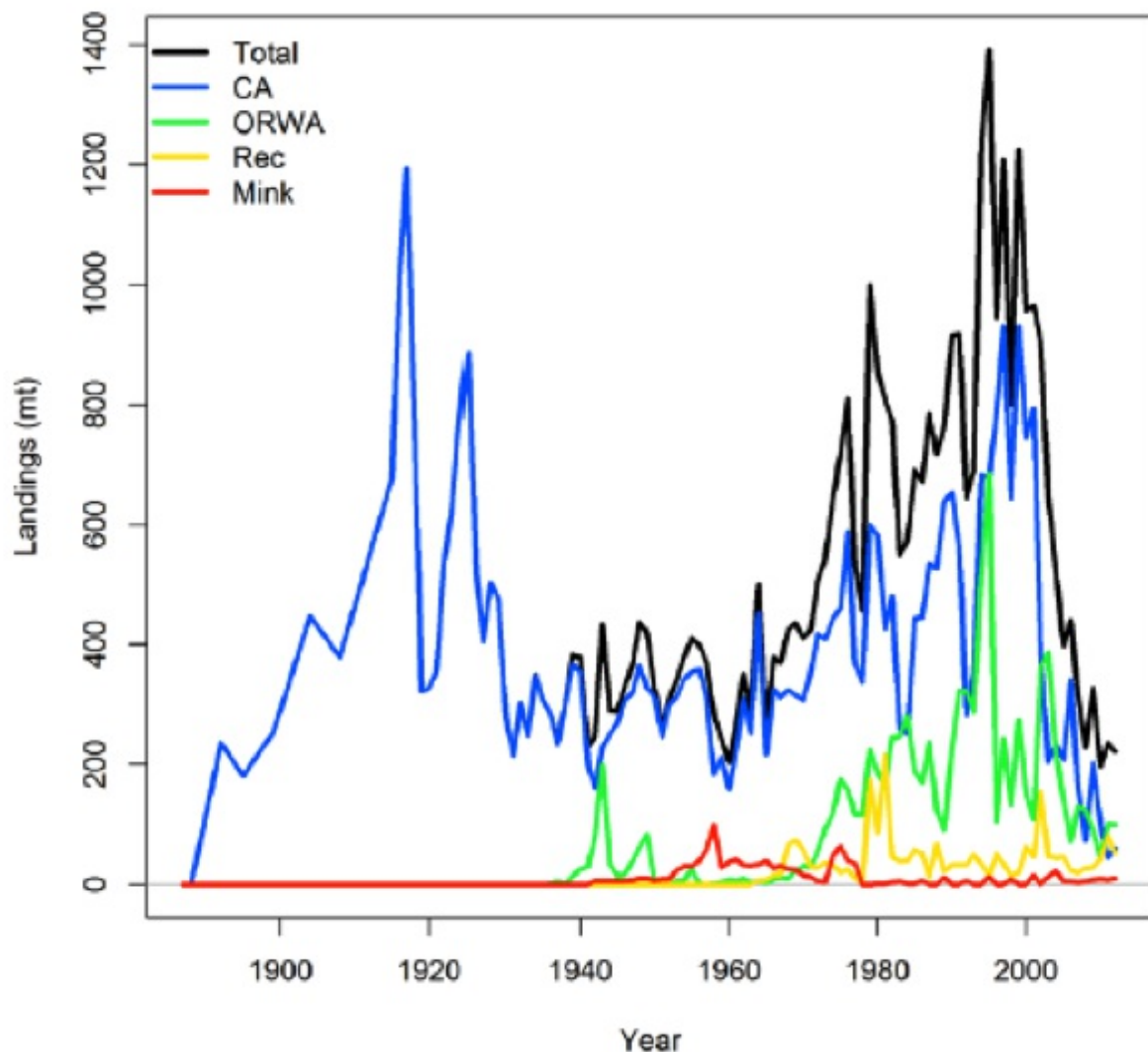


Figure 15 Time series of total landings and landings by four fleets catching Pacific sanddab from 1888 to 2012 (He et al. 2013).

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a

part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## SPINY DOGFISH | SOUTHERN CALIFORNIA

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Low Concern**

The most recent spiny dogfish assessment found that the stock is at 63% of virgin biomass, which is 79% of SPR, and above the spawning stock biomass target in which  $B/B_{TARGET} = 1.5$  ( $B_{TARGET} = SB_{40\%}$  or 45% of SPR (Gertseva and Taylor 2011). Therefore, the stock is not overfished (Gertseva and Taylor 2011). The estimated SPR for spiny dogfish in 2010 (79%) exceeds the target ( $SPR_{45\%}$ ), and also exceeds a suggested alternate management target for spiny dogfish of  $SPR_{77\%}$  (this suggestion reflects the very low fecundity of the species). Estimates of SPR for the period since 2001 have similarly exceeded  $SPR_{45\%}$ . Over the past 35 years, spawning females have been slowly declining, but not enough to provoke concern about the stock (Gertseva and Taylor 2011). Therefore, because abundance is above target reference points, but the data are more than 5 years old and managers employ a proxy for MSY (SPR), abundance of the stock is of "low" concern.

#### **Justification:**

Most recently, estimated SPR for the period 2001 to 2010 has been well above  $SPR_{45\%}$ , with the estimated SPR for 2010 at 79%. See Table ES-4 in (Gertseva and Taylor 2011). But a concern raised by the authors of the stock assessment is worth noting:  $SPR_{45\%}$  may not be an appropriate target for spiny dogfish because it is "expected to severely reduce the spawning output of spiny dogfish over the long term" (Gertseva and Taylor 2011). This is because spiny dogfish has very low productivity. The authors suggest that the Council consider an alternative SPR of approximately 77%, which would achieve the standard target spawning output of 40% (Gertseva and Taylor 2011). Their suggestion does not affect the recommendation in this assessment, because the estimated 2010 SPR (79%) exceeds this suggested management target as well.

### **Factor 2.2 - Fishing Mortality**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Low Concern**

Harvest levels (444 MT in 2010) do not exceed the current overfishing proxy; therefore, overfishing is not occurring in the spiny dogfish fishery. The 2010 overfishing limit (OFL)/annual catch limit (ACL) was set at 5,600 MT, and the 2010 catch is far below that threshold (1,163 MT) (Gertseva and Taylor 2011). Estimated spiny dogfish mortality in non-hake commercial groundfish fisheries was 524 t in 2011, 70% of which was

taken in the IFQ trawl fishery; this is a substantial reduction from catch levels in recent years (see Table ES-1 in Gertseva and Taylor 2011). Therefore, fishing mortality is ranked as “low” concern.

#### Justification:

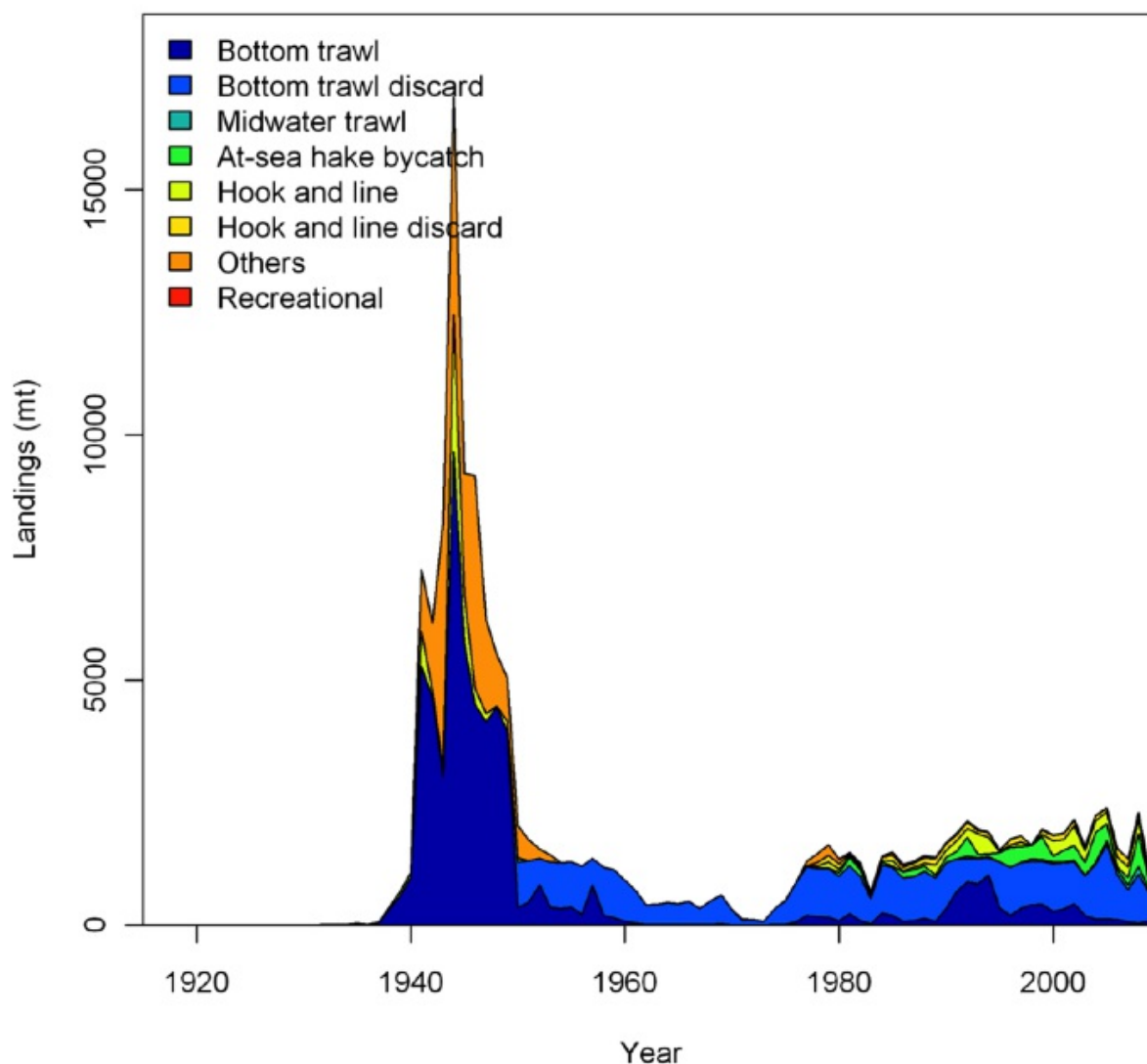


Figure 16 Reconstructed time series of spiny dogfish removals by fleet (MT) (Gertseva and Taylor 2011).

### Factor 2.3 - Discard Rate

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over

100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## **BIG SKATE | CENTRAL CALIFORNIA**

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Low Concern**

Big skate was recently designated as a target species and became managed as a separate stock starting in 2017 under the West Coast Groundfish Fishery Management Plan (PFMC 2016). The Pacific coast big skate stock is currently listed as not overfished by NMFS (NMFS 2019b). Big skate was first assessed in 2019 under the Stock Synthesis model, but the results of the assessment have not gone through peer review (Taylor et al. 2019). The 2019 estimated spawning biomass is 1,999.3 mt, which is above the target reference point ( $B_{40\%} = 1,010$  mt) and well above the limit reference point ( $B_{25\%}$ ) (ibid), but there is some uncertainty in the results (see below). The assessment uses two bottom trawl survey indices of abundance. One, the Triennial Survey covering 1980-2004 shows an increasing trend over the period covered; the other, the West Coast Groundfish Bottom Trawl Survey (2003-2018) also shows an increasing trend (ibid).

Because the stock assessment demonstrates that there is "little evidence that the population is overfished..." and survey data suggests increases in abundance, but there is some uncertainty in the data used, big skate is ranked as "low" concern.

#### **Justification:**

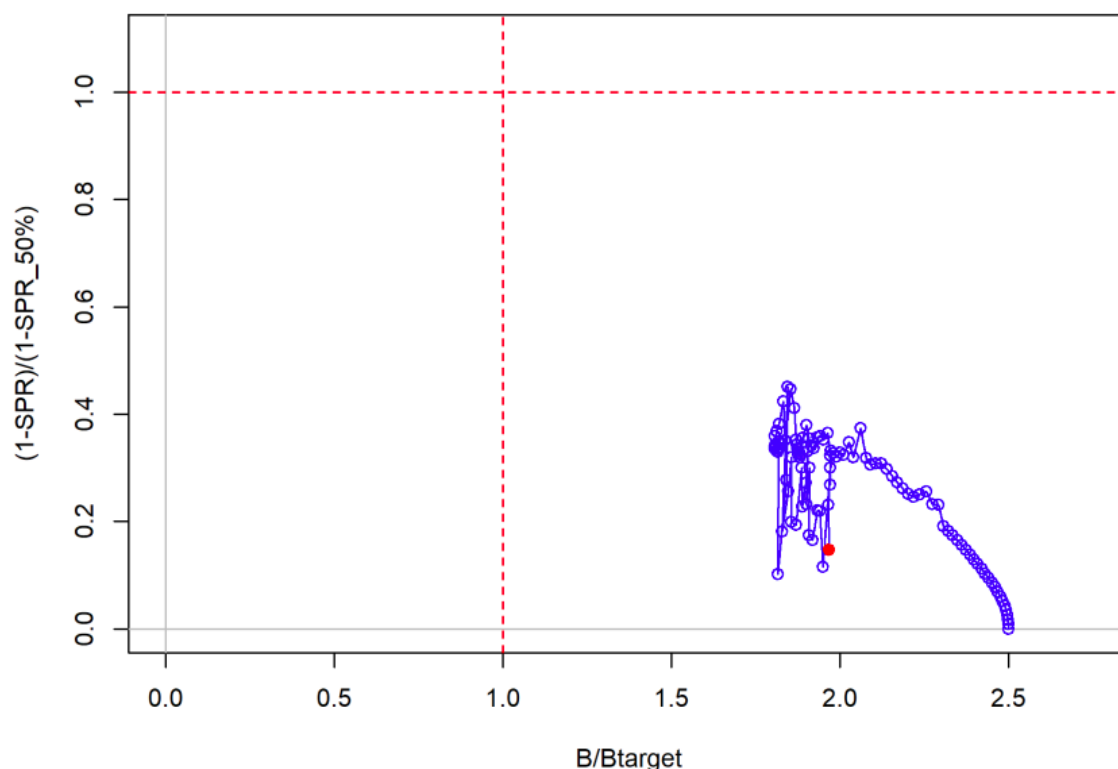


Figure 17 Phase plot of biomass vs fishing intensity (Taylor et al. 2019).

Uncertainties in the stock assessment stem from the following: length composition data is limited to only the past 10 years, the model has a limited ability to estimate changes in composition of the population during most of the history of the fishery and the behavioral processes affecting differences between female and male selectivity are not understood. Lastly, according to the authors of the assessment, "the data provide little information about the scale of the population, necessitating the use of a prior on catchability to maintain stable model results. During the review panel the prior was updated from the one developed in the 2007 Longnose Skate stock assessment to better account for Big Skate occurrences in shallower water than the surveyed region, but further refinement of this prior could be considered in the future" (Taylor et al. 2019).

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

Big skate is not an important fishery product; recent information has indicated that 98% of targeted big skate is in Oregon, and less than 2% of big skate catch occurs in California and overlaps with the California flounder fishery (PFMC 2016). Big skate landings were reported, along with other skate species, under the market category "Unspecified Skates," and only recently has the actual catch of big skate been isolated. Because of the stock's new designation as a target fishery, a new conservative harvest rate has been set. According to the 2019 stock assessment, current fishing mortality ( $F_{2016-2018} = 0.013$ ) is well below the  $F_{MSY}$  proxy (harvest rate yield corresponding to  $SPR = 50\%$ ) of 0.071 (Taylor et al. 2019). Further, landings have been well below

catch targets and catch limits in recent years (see table i. in Taylor et al. 2019). Because current levels of fishing appear sustainable and only a small percentage of big skate catch overlaps with the California flounder fishery, fishing mortality is scored as "low" concern.

#### Justification:

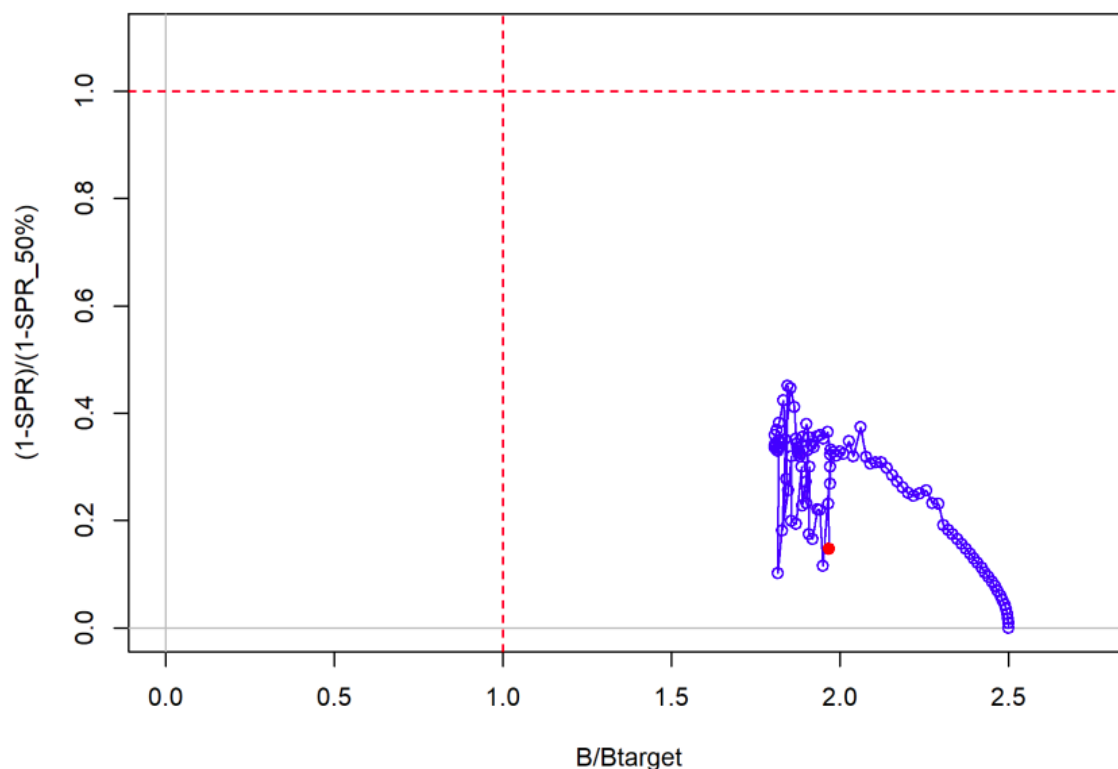


Figure 18 Phase plot of biomass vs fishing intensity (Taylor et al. 2019).

### Factor 2.3 - Discard Rate

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the

entire bottom trawl fishery.

## DUNGENESS CRAB | CENTRAL CALIFORNIA

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Moderate Concern**

There is no stock assessment available for Dungeness crabs. Population size depends on the recruitment success of larvae, which is driven by atmospheric forcing (Shanks and Roegner 2007). Since 1960, annual landings have provided a reasonable notion of abundance of legal-sized males because, over many years, fisheries have caught 80 to 90 percent of all available legal-sized males (Lee et al. 2001). Females must be discarded and are rarely caught since they generally do not exceed the minimum carapace width. But they may be experiencing reduced egg production (potentially 2% to 25%) because females mate with males larger than themselves and the fishery is removing a large portion of large males (Hankin et al. 1997)(Lee et al. 2001). According to the Seafood Watch standards, because there is no evidence that the stock is above or below reference points and the inherent vulnerability is medium, the stock status is of "moderate" concern.

#### **Justification:**

Dungeness crab has a medium inherent vulnerability (score of 2.77) due to its early age at sexual maturity, high fecundity, and short lifespan. Detailed scoring of each attribute is shown below.

<b>Productivity Attribute</b>	<b>Relevant Information</b>	<b>Score (1 = low risk, 2 = medium risk, 3 = high risk)</b>
Average age at maturity	3 years of age (ODFW 2016)	1
Average maximum age	Dungeness crab maximum age is 10 years (ODFW 2016)	2
Fecundity	2 million eggs per year (Higgins et al. 1997)	1
Average maximum size (fish only)		
Average size at maturity (fish only)		
Reproductive strategy	Egg brooder	2
Trophic level	Unknown	Unknown
Density dependence (invertebrates only)	Unknown	

<b>Susceptibility Attribute</b>	<b>Relevant Information</b>	<b>Score (1 = low risk, 2 = medium risk, 3 = high risk)</b>
---------------------------------	-----------------------------	---

<b>Areal overlap</b>	Unknown amount of crab habitat unfished	3
<b>Vertical overlap</b>	Crab fished only on the bottom, but there is no evidence that a greater than 33% of vertical habitat is unfished.	3
<b>Selectivity of fishery</b>	Species is targeted and conditions under high risk do not apply	2
<b>Post-capture mortality</b>	Unknown	3

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

There is no stock assessment with reference points for Dungeness crab in California, but the main fishery caught over 16 million pounds (7,500 MT) statewide in the 2014–2015 season (CA Department of Fish and Wildlife (CDFW 2016). Dungeness crab fisheries are considered sustainable because crabs reach maturity at a low age and the fishery removes only the large males from the population. Although catch varies from year to year, it is largely considered a direct result of changes in the environment, and not fishing pressure (CDFW 2011b). Catch in the California flounder bottom trawl fishery, where 100% is discarded, was 112 MT in 2014 and 146 MT in 2013 (NWFSC 2016). The Dungeness crab catch in the California flounder bottom trawl fishery represented 1.4% of the fishery in 2014; therefore, the fishery is not a substantial contributor to Dungeness crab fishing mortality and is of “low” concern.

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder

landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## SPINY DOGFISH | CENTRAL CALIFORNIA

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Low Concern**

The most recent spiny dogfish assessment found that the stock is at 63% of virgin biomass, which is 79% of SPR, and above the spawning stock biomass target in which  $B/B_{TARGET} = 1.5$  ( $B_{TARGET} = SB_{40\%}$  or 45% of SPR (Gertseva and Taylor 2011). Therefore, the stock is not overfished (Gertseva and Taylor 2011). The estimated SPR for spiny dogfish in 2010 (79%) exceeds the target ( $SPR_{45\%}$ ), and also exceeds a suggested alternate management target for spiny dogfish of  $SPR_{77\%}$  (this suggestion reflects the very low fecundity of the species). Estimates of SPR for the period since 2001 have similarly exceeded  $SPR_{45\%}$ . Over the past 35 years, spawning females have been slowly declining, but not enough to provoke concern about the stock (Gertseva and Taylor 2011). Therefore, because abundance is above target reference points, but the data are more than 5 years old and managers employ a proxy for MSY (SPR), abundance of the stock is of "low" concern.

#### **Justification:**

Most recently, estimated SPR for the period 2001 to 2010 has been well above  $SPR_{45\%}$ , with the estimated SPR for 2010 at 79%. See Table ES-4 in (Gertseva and Taylor 2011). But a concern raised by the authors of the stock assessment is worth noting:  $SPR_{45\%}$  may not be an appropriate target for spiny dogfish because it is "expected to severely reduce the spawning output of spiny dogfish over the long term" (Gertseva and Taylor 2011). This is because spiny dogfish has very low productivity. The authors suggest that the Council consider an alternative SPR of approximately 77%, which would achieve the standard target spawning output of 40% (Gertseva and Taylor 2011). Their suggestion does not affect the recommendation in this assessment, because the estimated 2010 SPR (79%) exceeds this suggested management target as well.

### **Factor 2.2 - Fishing Mortality**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Low Concern**

Harvest levels (444 MT in 2010) do not exceed the current overfishing proxy; therefore, overfishing is not occurring in the spiny dogfish fishery. The 2010 overfishing limit (OFL)/annual catch limit (ACL) was set at 5,600 MT, and the 2010 catch is far below that threshold (1,163 MT) (Gertseva and Taylor 2011). Estimated spiny dogfish mortality in non-hake commercial groundfish fisheries was 524 t in 2011, 70% of which was taken in the IFQ trawl fishery; this is a substantial reduction from catch levels in recent years (see Table ES-1

in Gertseva and Taylor 2011). Therefore, fishing mortality is ranked as “low” concern.

#### Justification:

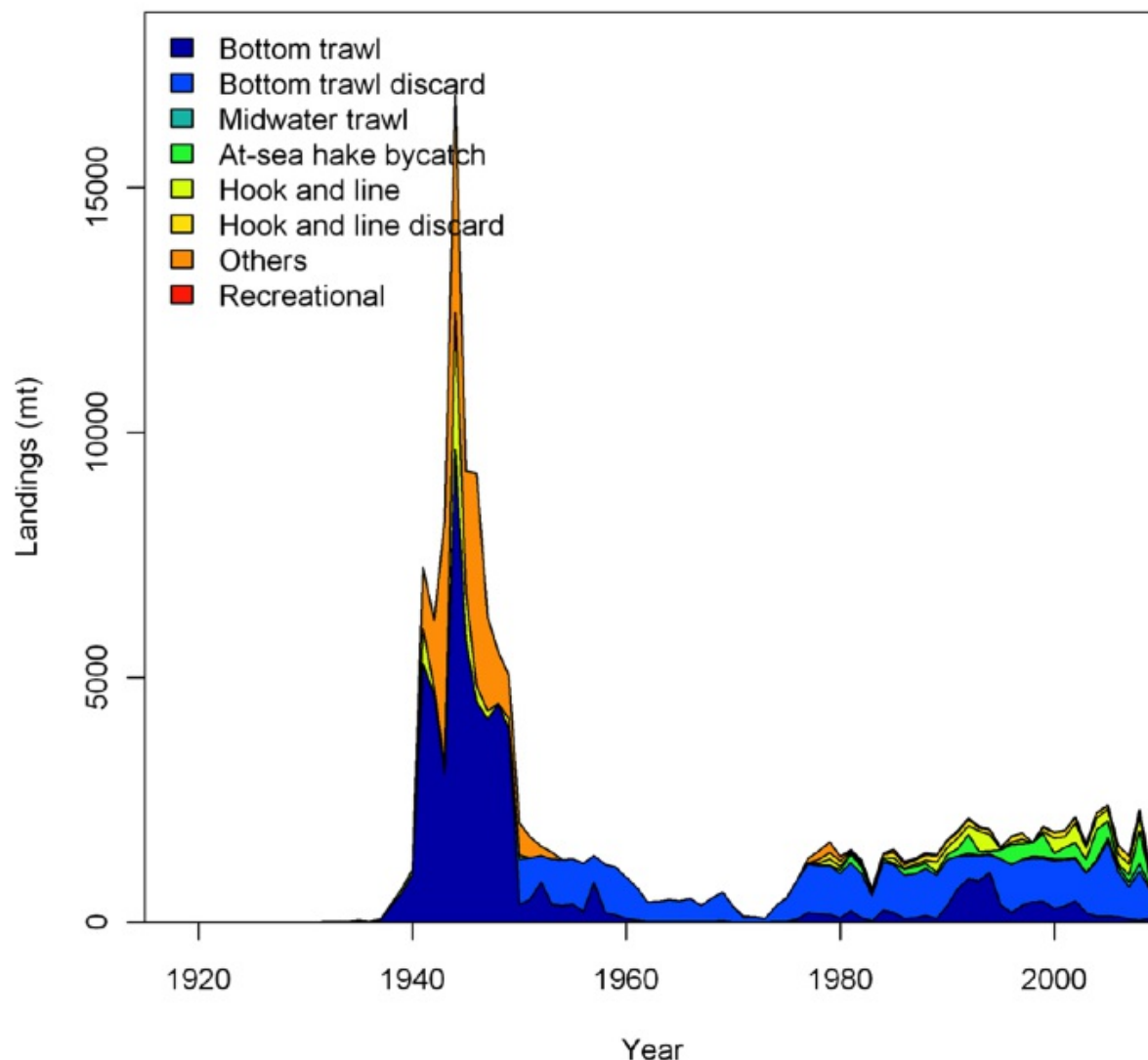


Figure 19 Reconstructed time series of spiny dogfish removals by fleet (MT) (Gertseva and Taylor 2011).

### Factor 2.3 - Discard Rate

#### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab,

skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## PACIFIC SANDDAB | CENTRAL CALIFORNIA

### **Factor 2.1 - Abundance**

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Southern California | Southern California

#### **UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC**

Bottom Trawls | United States Of America | Central California | Central California

#### **Very Low Concern**

The Pacific sanddab stock declined throughout the 2000s, but has slowly started to increase. Spawning stock biomass was 3,710 MT in 2004, but in 2013 was estimated at 8,554 MT (He et al. 2013). The stock is estimated to be at 95.5% of its virgin biomass, and well above the biomass target for flatfish; therefore, the stock is not overfished and abundance is of “very low” concern.

#### **Justification:**

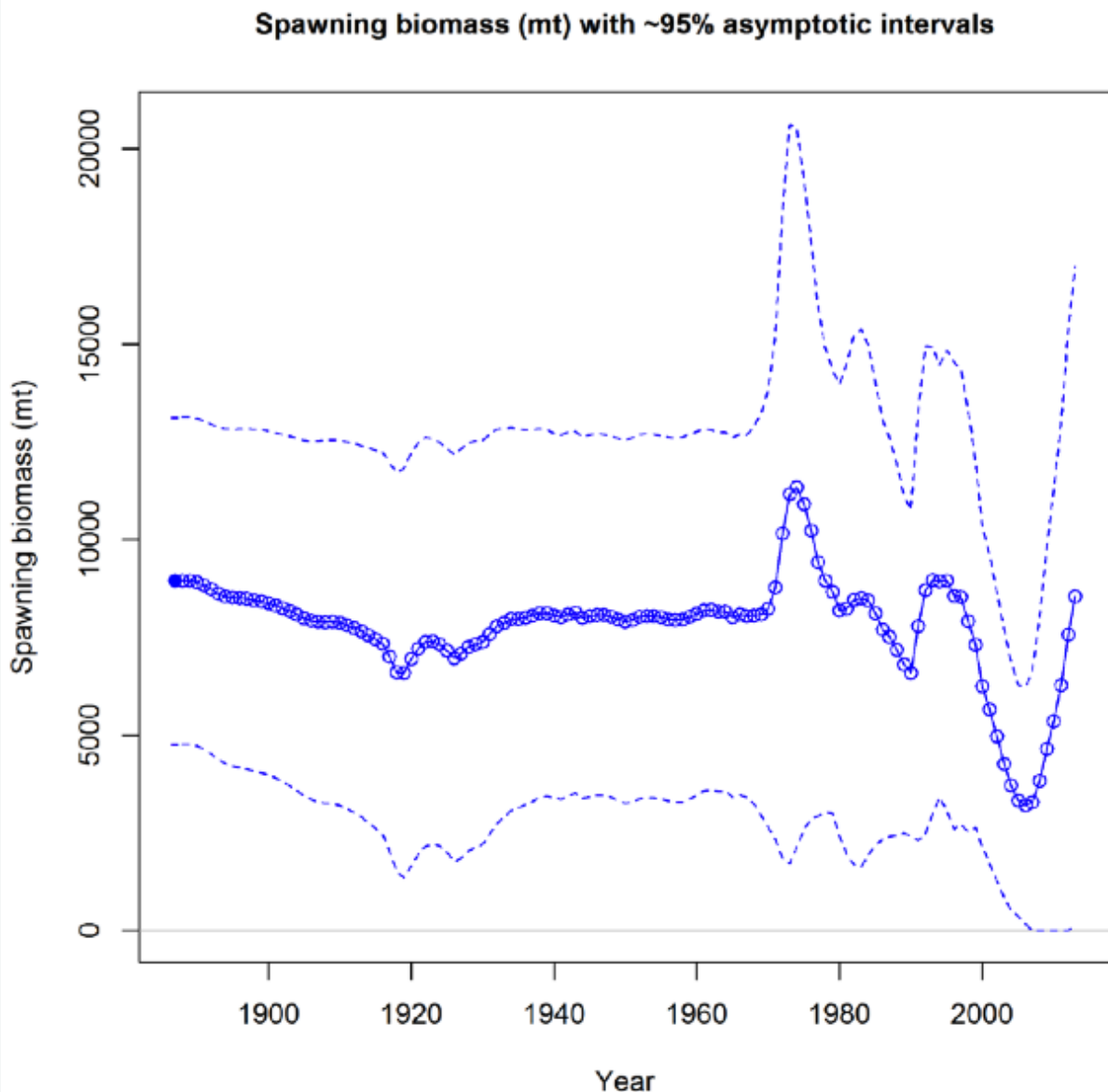


Figure 20 Estimated time series of annual spawning biomass of Pacific sanddab (He et al. 2013).

## Factor 2.2 - Fishing Mortality

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Southern California | Southern California

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### Low Concern

Landings of Pacific sanddab were at a high of 650 MT in 2003, but in 2012 were only 221.8 MT (He et al. 2013). The average catch from all sources from 2005 to 2012 was 23% of the total Pacific sanddab annual catch limit, and the only threat to the stock is from incidental catch in other fisheries. Discards of Pacific sanddab are high across all West Coast bottom trawl fisheries, including the halibut fishery, but the actual levels of bycatch from each fishery are uncertain. It is probable that fishing mortality from all sources is at or

below a sustainable level, since incidental catch does not appear to be affecting the stock; thus, fishing mortality is ranked as “low” concern.

#### Justification:

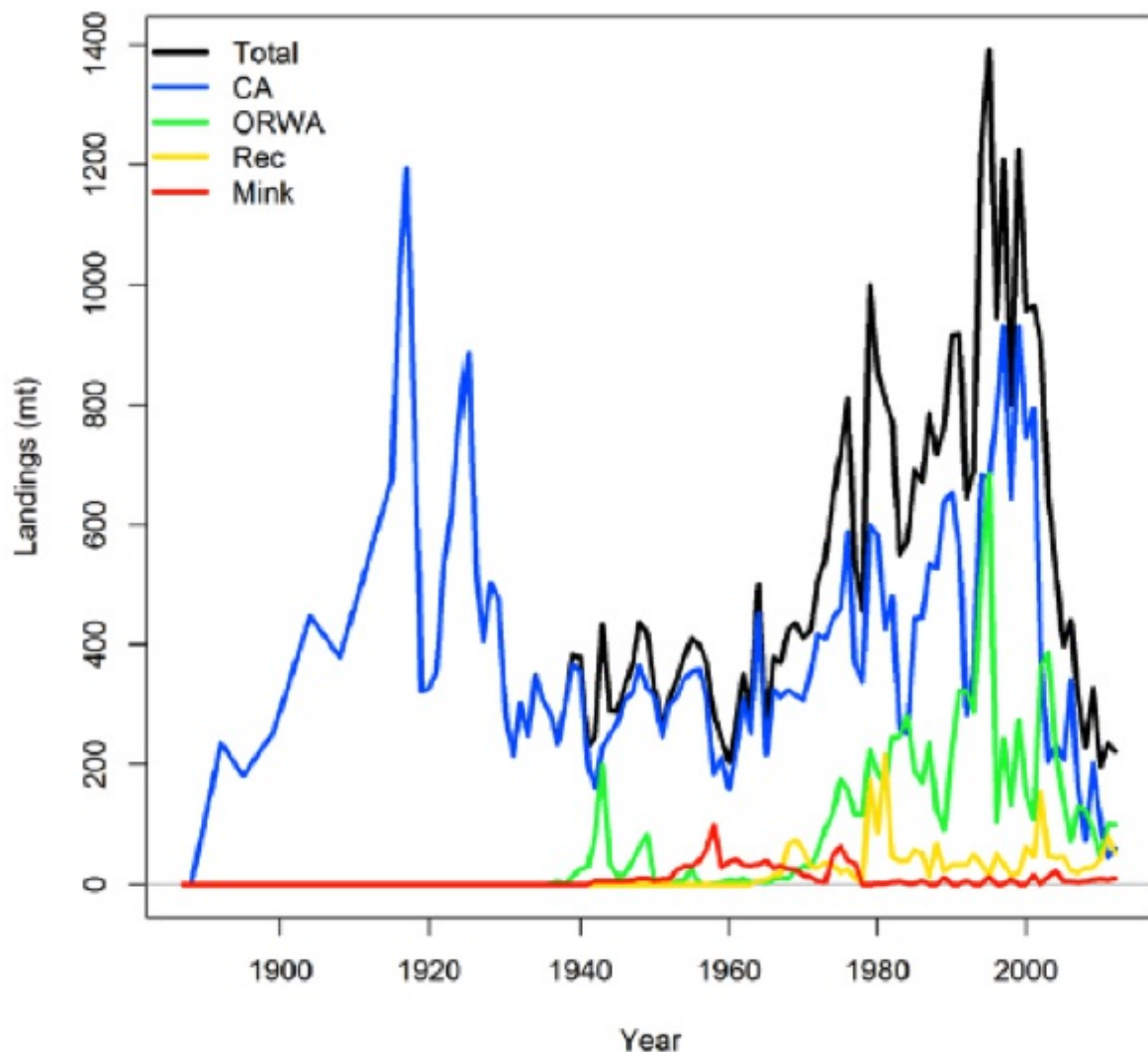


Figure 21 Time series of total landings and landings by four fleets catching Pacific sanddab from 1888 to 2012 (He et al. 2013).

## Factor 2.3 - Discard Rate

### UNITED STATES OF AMERICA / EASTERN CENTRAL PACIFIC

Bottom Trawls | United States Of America | Central California | Central California

#### ≥ 100%

The National Bycatch Report estimated that dead discards were 80% of the total catch for the open-access (state) California flounder bottom trawl (Karp et al. 2011). More recently, observer data from 2014 estimates that the ratio of total discards (all discards are assumed dead) to total landings is 290%, and therefore, over 100% (NWFSC 2016). Discards in the open-access bottom trawl fishery consist primarily of Dungeness crab, skates, and spiny dogfish (NWFSC 2016). Discards of halibut caught on groundfish trips are monitored as a

part of the West Coast Groundfish Management Plan. In 2013, there were only 19 MT of California flounder landings in the limited entry fishery, and in 2014, there were not any landings. California flounder in the limited entry fishery is often caught along with other ground fish, and discards are estimated for the entire trip (Travis Tanaka and Kayleigh Somers, pers. comm., 2017}. Therefore, the discard rates appear greater than 100% because California flounder landings are small compared to other groundfish catch on the same trip. It is therefore more appropriate to use the open-access state fishery discard rate as the discard rate for the entire bottom trawl fishery.

## **Appendix B: Updates to California Flounder Report**

**Updates to the September 5, 2017 California Flounder report were made on April 22, 2020**

**Overall Recommendations for California flounder** caught by bottom trawls, gillnets, and trolling line remained unchanged, but there were updates to individual criteria.

### **Updates included:**

- C1.1 California flounder (Central stock) downgraded from "Very Low" Concern to "Low" Concern because although the stock appears healthy, the stock assessment is more than five years old.
- C2 for the Southern California bottom trawl fishery upgraded from Red to Yellow based on updated status of big skate as described below:
- C2 Big skate upgraded from "Moderate" Concern to "Low" Concern because the 2019 stock assessment suggests that abundance is above target and reference levels.
- C2 Big skate upgraded from "Moderate" Concern to "Low" Concern because current levels of fishing mortality are well below target levels.