Lingcod and Spiny dogfish

Ophiodon elongates, Squalus acanthias

California, Oregon and Washington

Bottom trawls, Handlines and hand-operated pole-and-lines, Set longlines

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Seafood Watch Standard used in this assessment: Fisheries Standard v2

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About Seafood Watch

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

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

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

Guiding Principles

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

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

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

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

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

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

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

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

Avoid/Red: Take a pass on these for now; they're overfished, lack strong management or are caught or farmed in ways that harm other marine life or the environment.

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

Summary

This analysis encompasses the lingcod and spiny dogfish that are caught in the U.S. west coast commercial non-hake groundfish fisheries off of the coast of California, Oregon, and Washington. Lingcod are caught in most of the groundfish fisheries operating on the west coast, though landings are dominated by trawl (79%). Spiny dogfish are primarily landed in the hake fishery (approx. 80%), which is outside of the scope of this report. A recommendation is provided here for the 20% of spiny dogfish landed in the non-hake trawl fishery. Lingcod are primarily consumed domestically, while spiny dogfish are typically exported to Europe.

Lingcod are managed as two separate populations off the West Coast. Both were considered overfished in the 1990s, but had rebuilt by 2007 to levels above the management target. Spiny dogfish biomass is also considered to be above the management target. Recent fishing mortality for both lingcod and spiny dogfish is below management thresholds.

Due to the multi-species nature of the U.S. west coast non-hake commercial groundfish fisheries, the distinction between 'targeted' and 'bycatch' species is not often a clear one. The fish species included under Criterion 2 are either not groundfish (e.g., California sheephead), or are groundfish that are primarily discarded in all fisheries in which they are caught in significant amounts (for example, longnose skate are not included as a Criterion 2 species because, while they are primarily discarded in several fisheries, they are landed in significant amounts in the trawl fishery). In general, there are actually very few true 'bycatch' species that are caught in substantial amounts across all groundfish fisheries. As it does for Criterion 1, information availability informs the scores for Criterion 2 species, and several of the species have conservative scores due to a lack of information.

The Seafood Watch criteria define effective management via a number of guidelines. Due to the multi-species nature of some of the west coast groundfish fisheries, achieving all of the requirements is challenging. However, the management of the groundfish stocks caught in the west coast groundfish fisheries is strong, as it is characterized by up-to-date stock assessments and management measures such as biomass reference points, harvest control rules, and incorporation of uncertainty when determining catch limits.

By their nature, 'groundfish' tend to be demersal species, and therefore the fisheries that target them use bottom-tending gears. While the U.S. west coast non-hake commercial groundfish fisheries use a variety of gears, including bottom trawl, longline, pot, and hook and line gears, the common denominator between the gears is that they are expected to contact the bottom during their normal use. As such, the potential for habitat disturbance and destruction is present for all of the gears. A wealth of scientific information suggests that mobile bottom trawl gear should be expected to have the most significant impacts of all of the gears used in these fisheries; bottom longline and trap gears may also cause damage but, being fixed gears, they do not sweep over the seafloor as does trawl gear. In recognition of the potential for bottom-tending gears to damage habitat, a number of spatial restrictions on gear use are in place. These restrictions particularly limit the use of bottom trawl gear, and as such offer a degree of mitigation of bottom trawl habitat impacts.

This assessment covers approximately 20% and 95% of spiny dogfish and lingcod landings on the US West Coast, respectively. Lingcod caught by bottom trawl (79% of landings) and by longline in the northern open access fishery (3%) are considered Best Choices. Lingcod caught in the nearshore fisheries (14% of landings) are Good Alternatives. Spiny dogfish caught by bottom trawl is a Best Choice.

Lingcod caught in the US West Coast groundfish fishery by bottom trawl are certified sustainable to the standard of the Marine Stewardship Council.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Lingcod | Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	5.000	2.709	3.464	2.449	**Best Choice (3.274)**
Lingcod | Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	5.000	1.343	3.000	3.606	**Good Alternative (2.919)**
Lingcod | Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	5.000	2.000	3.000	3.606	**Good Alternative (3.225)**
Lingcod | Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	5.000	2.644	3.464	3.606	**Best Choice (3.584)**
Spiny dogfish | Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	5.000	2.709	3.464	2.449	**Best Choice (3.274)**

Summary

This analysis covers lingcod and spiny dogfish caught in the U.S. west coast commercial non-hake groundfish fisheries off of the coast of California, Oregon, and Washington. This assessment covers approximately 20% and 95% of spiny dogfish and lingcod landings on the US West Coast, respectively. Lingcod caught by bottom trawl (79% of landings) and by longline in the northern open access fishery (3%) are considered Best Choices. Lingcod caught in the nearshore fisheries (14% of landings) are Good Alternatives. Spiny dogfish caught by bottom trawl is a Best Choice.

Eco-Certification Information

Lingcod caught in the US West Coast groundfish fishery by bottom trawl are certified sustainable to the standard of the Marine Stewardship Council.

Scoring Guide

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

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

Best Choice/Green = Final Score >3.2, and no Red Criteria, and no Critical scores

Good Alternative/Yellow = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores

Avoid/Red = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

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

Introduction

Scope of the analysis and ensuing recommendation

This analysis covers lingcod and spiny dogfish caught in the U.S. west coast commercial non-hake groundfish fisheries off of the coast of California, Oregon, and Washington.

Species Overview

There are over 90 species listed in the West Coast Groundfish Fishery Management Plan (FMP), including rockfish, flatfish and numerous other species caught off California, Oregon and Washington. The fishery for these species has gone through several identifiable stages since World War II (Hanna, S. 2000). The first post-war stage was one dominated by foreign fleets and characterized by increasing catches from the late 1940s through 1960 (Hanna, S. 2000). The fishery began to transition towards a domestic fleet following implementation of the Magnuson-Stevens Act and the establishment of the Exclusive Economic Zone (EEZ), but the rapid buildup of the domestic fleet during the 1970s and 1980s led to fleet overcapitalization {PFMC & NMFS 2010}. A combination of fishery pressure and natural factors drove sharp downturns in the abundance of many commercial groundfish species during the 1980s and 1990s, and in an effort to manage and reduce capacity, the fishery was differentiated into Limited Entry and Open Access programs in 1994 {Shaw, W. & Conway, F.D.L. 2007}. In 2002, nine species of groundfish were declared 'overfished', and the entire shelf was closed to trawling {Shaw, W. & Conway, F.D.L. 2007}. In the years since, catches of rockfish have been low relative to historic levels, and flatfish have supplanted rockfish (*Sebastes* spp.) as the primary component of landings (Figure 1; (PFMC 2014)).

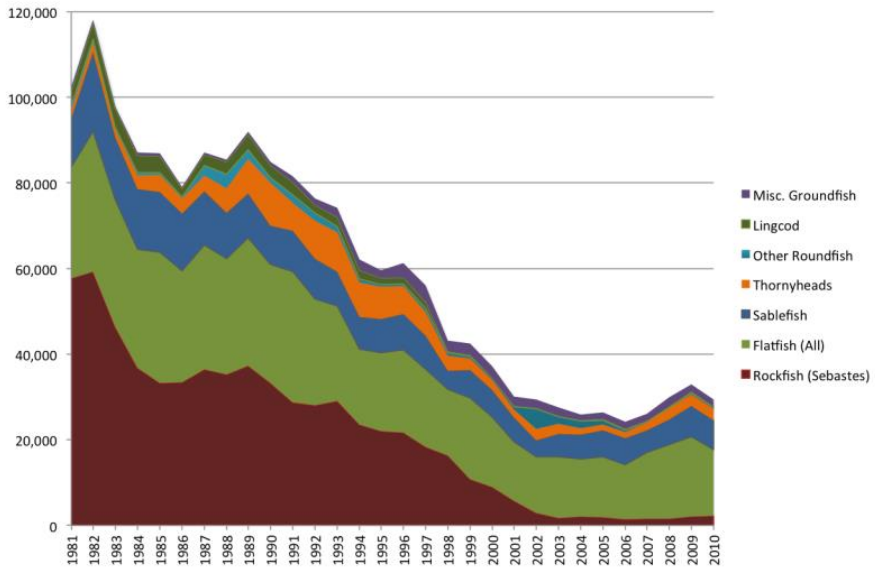


Figure 1. Composition of recent groundfish catches, 1981-2010 (Data from PFMC 2014).

Since 2002, management measures have allowed the overfished stocks to begin to rebuild, and fishing effort has been significantly reduced for many other stocks too. Six stocks are currently classified as rebuilding.

The commercial groundfish fishery on the U.S. west coast is composed of Limited Entry (LE), Open Access (OA), and Nearshore (NS) components. The LE component is divided into sectors identified by gear/species endorsements: trawl, fixed gear with sablefish endorsement, and fixed gear without sablefish endorsement. The limited entry and open access sectors are managed by the Pacific Fishery Management Council (PFMC). The PFMC recommends measures to the Secretary of Commerce via the National Marine Fisheries Service (NMFS), and the measures are implemented by NMFS regional offices. The Nearshore North and Nearshore South fixed gear fisheries are jointly managed by the PFMC and state authorities in Oregon and California, respectively; there is no nearshore groundfish fishery in state-managed waters off of the coast of Washington (NWFSC 2014).

As of 2011, limited entry trawl permit holders can participate in a new catch share program. One of the primary changes associated with the catch share program is an increase in at-sea and dockside monitoring; whereas the non-IFQ fisheries have varying levels of at-sea observer coverage, the catch share program requires 100% at-sea and dockside monitoring. Participants in this program receive a share of the catch for 29 commercial species/species-area complexes (NMFS Northwest Region 2012). Entry into the program is limited to holders of LE trawl permits, but these participants can use non-trawl gear to catch their quota shares (NMFS Northwest Region 2012). Some fishermen in the IFQ program do appear to be switching from trawls to other gears, for example, pots and hook and line gears to catch sablefish. Thus, as of 2012, the IFQ fisheries can be described as multi-species IFQ trawl, and two sablefish-focused IFQ fixed gear fisheries – one using hook and line gear, and the other using pot gear.

Production Statistics

Groundfish landings are dominated by flatfish (Figure 2), with Dover sole the primary flatfish species (Figure 3). In recent years, rebuilding plans have curtailed catches of the *Sebastes* species that had dominated rockfish landings in the past (e.g. Pacific ocean perch, widow rockfish, canary rockfish, yellowtail rockfish, etc.; J. Field, *pers. comm.,* Figure 1). Currently, rockfish and thornyhead landings are dominated by longspine and shortspine thornyhead (*Sebastolobus* spp.), with a number of *Sebastes* species also landed (Figure 2). Other species that are landed in significant amounts include longnose skate, spiny dogfish, lingcod, and Pacific cod (Figure 3).

GET CHARTS FROM FINAL REPORT

Lingcod are caught in most of the groundfish fisheries operating on the west coast, though landings are dominted y trawl (79%) (Figure 3 Top). Spiny dogfish are primarily landed in the hake fishery (approx. 80%) (Figure 3 bottom), which is outside of the scope of this report. A recommendation is provided here for the 20% of spiny dogfish landed in the non-hake trawl fishery.

Importance to the US/North American market.

Lingcod are primarily consumed on the US market, while spiny dogfish are primarily exported to Europe (REFERENCE).

Common and market names.

The only market name deemed acceptable for lingcod by the FDA is 'lingcod,' but various vernacular names are also used including cultus cod, blue cod, buffalo cod, and ling. Likewsie, spiny dogfish shoudl nony be found on the market under the names dogfish shark or cape shark, but may also be found under spring dogfish, spiked dogfish and spur dog (FDA 2012)

Primary product forms

Lingcod are processed as fresh and frozen H&G and fillets (Pacific Seafood 2014). Spiny dogfish are primarily sent to Europe for use in fish and chips.

Assessment

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

Criterion 1: Impacts on the species under assessment

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

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

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

Guiding principles

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

Criterion 1 Summary

LINGCOD				
REGION / METHOD	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

SPINY DOGFISH				
REGION / METHOD	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

Inherent Vulnerability

Seafood Watch fishery assessments typically rate the inherent vulnerability of each stock included in the assessment based on the FishBase (www.fishbase.org) vulnerability score, or alternaitvely based on a set of pre-defined productivity attributes where FishBase scores are not available. This allows resilience to be rated in a consistent fashion across all fisheries globally. For the present assessment, fishbase scores are supplemented with productivity data from the region-specific productivity-

susceptibility analyis conducted for many west coast groundfish species by Cope, J.M. et al (2011) (Table 1). Where there was a discrepancy between the productivity scores and the Fishbase vulnerability scores, the productivity scores were the final determinant of the inherent vulnerability score. The manner in which these productivity scores are interpreted is described below.

Cope and colleagues scored each species for 10 productivity attributes; for each attribute, the species was put into one of three "bins" based on its species-specific information for that attribute. Each bin had a score associated with it, and the three bins were: low productivity (score of 1), medium (2), and high (3) (Table 2 in Cope, J.M et al. 2011). The species' overall productivity score was then derived from its scores on these 10 specific attributes. Since a species' productivity score could range between 1.0 and 3.0 (i.e, no species could have an overall productivity score of less than 1 or more than 3), the "distance" over which a species' productivity score could range was 2. If this "distance" (i.e., 2) is divided equally between the three bins, we can say that the "low" productivity bin includes productivity scores of 1 to 1.67, the "medium" bin has scores of 1.68-2.33, and the "high" bin has scores of 2.34-3.0. To inform this report's assessment of inherent vulnerability (rather than resilience), these scores are reversed to reflect vulnerability, as follows:

- *high vulnerability is indicated by a productivity score of 1.0-1.67*
- *medium vulnerability is a score of 1.68-2.33*
- *low vulnerability is a score of 2.34-3.0.*

Management reference points

The amount of information available varies considerably from stock to stock, and as such fisheries management classifies west coast groundfish stocks into one of three Categories based on information availability. Category 1 stocks have data-rich, quantitative stock assessments that support stock-specific estimates of overfishing level (OFL) and biomass reference points. In contrast, Category 2 stocks are those for which relatively less data are available or more uncertainty is present. Category 2 stocks tend to lack biomass reference points and are managed with OFLs that are based on historical catches and at least one index of abundance, such as survey biomass trends (PFMC 2011a), but may incorporate more data. Category 3 stocks are those that are more data-poor than Category 2 stocks. As survey data are often lacking for them, Category 3 stocks are managed with OFLs derived from historical catch-based methods and life-history information (Cope, J.M. In press; PFMC 2011a).

Unless otherwise specified, the management target biomass reference point for non-flatfish species is 40% of unexploited equilibrium spawning biomass or spawning output, and the overfished/rebuilding threshold (aka the minimum stock size threshold, or MSST) is 25% of unexploited spawning biomass or output. For flatfish, the target and overfished reference points have recently been defined as 25% and 12.5% of unfished biomass, respectively (PFMC 2011a). Care was taken by the author to properly differentiate between assessments of spawning output (SO), and spawning biomass (SB), as the former is more appropriate for species in which fecundity increases disproportionately to body mass (Taylor and Wetzel 2011).

For the Criterion 1 and 2 assessments, biomass reference points are thus defined as follows:

- *target reference point is $SB_{40\%}$ or $SO_{40\%}$ for non-flatfish species, depending on the whether biomass or output is the unit, and $SB_{25\%}$ for flatfish species*
- *limit reference point (also called the overfished or rebuilding reference point) is $SB_{25\%}$ or $SO_{25\%}$ for non-flatfish, and $SB_{12.5}$% for flatfish*
- *unexploited equilibrium spawning biomass and spawning output are SB_0 and SO_0, respectively.*

As the calculation of MSY requires information that is often lacking for west coast groundfish species, proxy values for fishing mortality target/limit refernce points expressed as the mortality rate that will result in an specified spawning potential ratio ($SPR_{X\%}$), are used by fisheries managers. Overfishing is said to be occuring if fishing mortality is greater than these target

reference points.

- *Flatfish:* $F_{MSY} = F_{SPR30\%}$
- *Lingcod, spiny dogfish, sablefish:* $F_{MSY} = F_{SPR45\%}$
- *Rockfish and thornyheads:* $F_{MSY} = F_{SPR50\%}$

The Seafood Watch assessment criteria require a strong scientific rationale for target and limit reference points that are below $B_{30\%}$ and $B_{15\%}$, respectively. As such, a brief review of the flatfish reference points is necessary. The PFMC's recent adoption of the current flatfish reference points was driven by the 2009 petrale sole stock assessment, which showed that the stock had been below the old limit reference point ($SB_{25\%}$) since 1953, and had been experiencing 'chronic annual overfishing' (which was then defined as $F>F_{40\%}$) since 1943 (PFMC 2011a). However, this review also showed that the stock had maintained steady catches of greater than 2,000 t for several decades, and it was suggested that the proxy reference points of $F_{40\%}$ and $B_{25\%}$ were not appropriate for the productivity of the stock (PFMC 2011a). The assessment bodies therefore suggested the use of petrale sole stock-specific estimates of B_{MSY} ($SB_{19\%}$) and F_{MSY} ($F_{20\%}$) (PFMC 2011a). The discrepancy between these estimates and the established proxy values led to the development of new proxy values for all managed flatfish. A review of productivity information for several key west coast flatfish led to the following conclusions (PFMC 2011a):

a) Steepness for the reviewed species was ≥0.80,

b) The F_{MSY} associated with a steepness of 0.80 was approximately $F_{30\%}$, and

c) The B_{MSY} associated with $F_{30\%}$ was $B_{25\%}$

Following subsequent reviews and recommendations, the PFMC adopted the following proxy values for all managed flatfish species: a proxy B_{MSY} of $B_{25\%}$, a proxy limit reference point of ½ B_{MSY} ($B_{12.5\%}$), and a proxy F_{MSY} of $F_{30\%}$ (PFMC 2011a). For the purposes of this assessment, the scientific rationale for the revised flatfish reference points is considered to be strong.

Throughout this assessment, "total catch" refers to estimates of all removals (including those associated with recreational fisheries and research activities), whereas "commercial" refers to the catch in non-tribal, non-hake commercial groundfish-targeting fisheries on the U.S. west coast.

References

Cope, J.M. In press. "Implementing a Statistical Catch-at-Age Model (Stock Synthesis) as a Tool for Deriving Overfishing Limits in Data-Limited Situations." *Fisheries Research*

Cope, J.M, DeVore, J., Dick, E.J., Ames, K., Budrick, J., Erickson, D.L., Grebel, J., et al. 2011. "An Approach to Defining Stock Complexes for U.S. West Coast Groundfishes Using Vulnerabilities and Ecological

PFMC. 2011. "Proposed Harvest Specifications and Management Measures for the 2011-2012 Pacific Coast Groundfish Fishery and Amendment 16-5 to the Pacific Coast Groundfish Fishery Management Plan to Update Existing Rebuilding Plans and Adopt a Rebuilding Plan for Petrale Sole; Final Environmental Impact Statement." Pacific Fishery Management Council.

Taylor, I.G., and C. Wetzel. 2011. "Status of the U.S. Yellowyeye Resource in 2011 (update of 2009 Assessment Model)". National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA.

Table X

Criterion 1 Assessments

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.*

Lingcod

Factor 1.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery

Medium
The Fishbase vulnerability score for lingcod is 63, but the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.75. Lingcod inherent vulnerability is therefore scored "medium".

Factor 1.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery

Very Low Concern
The most recent assessment of west coast lingcod was conducted in 2009 (Hamel, O.S., et al., 2009); this assessment took into consideration both commercial and recreational catch and generated separate assessments of lingcod in a southern area (California) and northern area (Oregon and Washington). Biomass estimates suggest that both stocks were overfished in the 1990s but had rebuilt by 2007 to levels above the management target ($SB_{North}/SB_{40\%}$=1.675; $SB_{South}/SB_{40\%}$=1.85) For 2012, northern and southern lingcod are projected to have spawning biomasses that are 62% and 71% of SB_0, respectively (PFMC 2011a). Most recently, lingcod were classified as 'not overfished', with a $B:B_{MSY}$ ratio of 1.676, in 2012 (NMFS 2012).

Factor 1.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery

Very Low Concern
The lingcod catch did not approach the coastwide overfishing limit from 2000 to 2008 (Table 1) (Hamel, O.S., et al., 2009). For 2011, non-hake commercial groundfish fishing mortality of lingcod was well under the overfishing limits for both the 'north' and 'south' regions (24% and 10%, respectively (Table 16 in (Bellman, M.A., et al., 2012)). The stock is classified as not experiencing overfishing in 2012 (NMFS 2012)..
Justification:
Over 80% of the 'north' lingcod commercial groundfish fishing mortality was taken in the IFQ trawl fishery, which represented 43% of total 'north' lingcod mortality across all fisheries; the Nearshore North fishery contributed another 10% and 5% of the commercial and total fishing mortality, respectively, of 'north' lingcod (Bellman, M.A., et al., 2012). Non-hake commercial groundfish fishing mortality of 'south' lingcod was primarily taken in the California Nearshore (51% of commercial mortality, 7% of total mortality), IFQ trawl (19% and 3%), and Oregon Nearshore (10% and 2%) fisheries (Bellman, M.A., et al., 2012).

Year	Commercial Landings (t) (South)	Commercial Landings (t) (North)	Commercial Landings (t) (coastwide)	Overfishing limit (coastwide)
2000	56	90	146	700
2001	63	93	156	1,120
2002	81	124	205	745
2003	51	107	158	841
2004	63	115	178	1,385
2005	61	140	201	2,922
2006	62	197	259	2,716
2007	79	190	269	6,706
2008	69	216	285	5,853

Figure 10:
Comparison of commercial lingcod landings (not including discards) and associated overfishing limits, 2000-2008 (Hamel, O.S., et al., 2009).

Spiny dogfish

Factor 1.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

High
The Fishbase vulnerability score for spiny dogfish is 70 and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.11.

Factor 1.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Very Low Concern
Estimated spiny dogfish spawning output (a proxy for adult biomass) for 2011 was 63% of unfished spawning output; both this estimate and the associated lower confidence interval are above the target reference point ($SO_{40\%}$).

Justification:
Spiny dogfish spawning output dropped sharply from approximately 1940 to 1950 (Figure ES-2 in {Gertseva, V. & Taylor, I.G. 2012}), due to removals by the target fishery for dogfish liver. Following the cessation of the liver fishery, a gradual and moderate increase in spiny dogfish spawning output persisted until the late 1970s, when a fishery began targeting dogfish for human consumption. For the past four decades, spiny dogfish spawning output has gradually but steadily declined due to fishing mortality and the stock's low productivity {Gertseva, V. & Taylor, I.G. 2012}. For 2011, the spawning output is estimated to be 44,660 thousand fish (95% C.I. = 8,937 – 80,383 thousand). This is 63% of SO_0 {Gertseva, V. & Taylor, I.G. 2012}, and both the estimated spawning output and the associated lower confidence interval are above the management target of $SO_{40\%}$ and the overfished threshold of $SB_{25\%}$ (Figure ES-4 in {Gertseva, V. & Taylor, I.G. 2012}).

Factor 1.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Very Low Concern

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 $SPR_{45\%}$.

Justification:

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 (Bellman, M.A., et al., 2012); this is a substantial reduction from catch levels in recent years (Table ES-1 in {Gertseva, V. & Taylor, I.G. 2012}).

Estimated spiny dogfish SPR was well below $SPR_{45\%}$ for several years during the 1940s liver fishery, but for all other years it has exceeded $SPR_{45\%}$ (Figure ES-5 in {Gertseva, V. & Taylor, I.G. 2012}). Most recently, estimated SPR for the period 2001-2010 has been well above $SPR_{45\%}$, with the estimated SPR for 2010 being 79% (Table ES-4 in {Gertseva, V. & Taylor, I.G. 2012}). However, it is worth noting a concern raised by the authors of the stock assessment: $SPR_{45\%}$ may not be an appropriate target for spiny dogfish, as it is "expected to severely reduce the spawning output of spiny dogfish over the long term" {Gertseva, V. & Taylor, I.G. 2012}. This is because spiny dogfish have 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, V. & Taylor, I.G. 2012}. The authors' suggestion does not impact the recommendation in this assessment, as the estimated 2010 SPR (79%) exceeds this suggested management target as well.

Criterion 2: Impacts on Other Species

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

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

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

Guiding principles

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

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

LINGCOD			
REGION / METHOD	**SUB SCORE**	**DISCARDS+BAIT / LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	2.709	1.000: < 20%	Yellow (2.709)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	1.414	0.950: 20-40%	Red (1.343)
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	2.000	1.000: < 20%	Red (2.000)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	2.644	1.000: < 20%	Yellow (2.644)

SPINY DOGFISH			
REGION / METHOD	**SUB SCORE**	**DISCARDS+BAIT / LANDINGS**	**SCORE**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	2.709	1.000: < 20%	Yellow (2.709)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

EASTERN CENTRAL PACIFIC | HANDLINES AND HAND-OPERATED POLE-AND-LINES | UNITED STATES | CALIFORNIA | SOUTH OF 40° 10' | NEARSHORE

SUB SCORE: 1.414 DISCARD RATE: 0.950 **SCORE: 1.343**

SPECIES	INHERENT VULNERABILITY	ABUNDANCE	FISHING MORTALITY	SCORE
California sheephead	2.000: Medium	2.000: High Concern	1.000: High Concern	Red (1.414)
Black and yellow rockfish	2.000: Medium	3.000: Moderate Concern	2.330: Moderate Concern	Yellow (2.644)
Canary rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Grass rockfish	1.000: High	3.000: Moderate Concern	3.670: Low Concern	Green (3.318)
Brown rockfish	1.000: High	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Cabezon	2.000: Medium	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
China rockfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Lingcod	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

EASTERN CENTRAL PACIFIC, NORTHEAST PACIFIC | BOTTOM TRAWLS | UNITED STATES | CALIFORNIA | OREGON | WASHINGTON | IFQ TRAWL FISHERY

SUB SCORE: 2.709 DISCARD RATE: 1.000 **SCORE: 2.709**

SPECIES	INHERENT VULNERABILITY	ABUNDANCE	FISHING MORTALITY	SCORE
Minor shelf and slope rockfish complexes	1.000: High	2.000: High Concern	3.670: Low Concern	Yellow (2.709)
Blackgill rockfish	1.000: High	4.000: Low Concern	2.330: Moderate Concern	Yellow (3.053)
Bocaccio rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Canary rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Finescale mora	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Yelloweye rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Pacific ocean perch	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Rougheye rockfish	1.000: High	5.000: Very Low Concern	2.330: Moderate Concern	Green (3.413)
Arrowtooth flounder	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Chilipepper rockfish	2.000: Medium	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Greenstriped rockfish	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Cowcod	1.000: High	3.000: Moderate Concern	5.000: Very Low Concern	Green (3.873)
Spotted ratfish	1.000: High	3.000: Moderate Concern	5.000: Very Low Concern	Green (3.873)
Darkblotched rockfish	1.000: High	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Shortbelly rockfish	2.000: Medium	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Widow rockfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Lingcod	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Spiny dogfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Aurora rockfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Splitnose rockfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)
Yellowtail rockfish	1.000: High	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

EASTERN CENTRAL PACIFIC, NORTHEAST PACIFIC | HANDLINES AND HAND-OPERATED POLE-AND-LINES | UNITED STATES | CALIFORNIA | OREGON | WASHINGTON | NORTH OF 40° 10' | NEARSHORE				
SUB SCORE: 2.000		DISCARD RATE: 1.000		**SCORE: 2.000**
SPECIES	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
China rockfish	1.000: High	4.000: Low Concern	1.000: High Concern	Red (2.000)
Kelp greenling	2.000: Medium	3.000: Moderate Concern	2.330: Moderate Concern	Yellow (2.644)
Vermilion rockfish	1.000: High	2.000: High Concern	3.670: Low Concern	Yellow (2.709)
Blue rockfish	1.000: High	4.000: Low Concern	2.330: Moderate Concern	Yellow (3.053)
Canary rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Yelloweye rockfish	1.000: High	2.000: High Concern	5.000: Very Low Concern	Yellow (3.162)
Black rockfish	1.000: High	4.000: Low Concern	3.670: Low Concern	Green (3.831)
Cabezon	2.000: Medium	4.000: Low Concern	5.000: Very Low Concern	Green (4.472)
Lingcod	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

EASTERN CENTRAL PACIFIC, NORTHEAST PACIFIC | SET LONGLINES | UNITED STATES | CALIFORNIA | OREGON | WASHINGTON | NORTH OF 36° N. | OPEN ACCESS LONGLINE FISHERY				
SUB SCORE: 2.644		DISCARD RATE: 1.000		**SCORE: 2.644**
SPECIES	**INHERENT VULNERABILITY**	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Sablefish	3.000: Low	3.000: Moderate Concern	2.330: Moderate Concern	Yellow (2.644)
Lingcod	2.000: Medium	5.000: Very Low Concern	5.000: Very Low Concern	Green (5.000)

Species included in the assessment

The U.S. west coast non-hake commercial groundfish fisheries catch a variety of species. A species was included in this assessment if the catch of the species in a given fishery composed >5% of that fishery's catch, *or* >1% of that fishery's catch *and* >5% of species' total mortality across all fisheries, *or* <1% of fishery's catch *and* >20% of species' total mortality across all fisheries. Species of concern, including overfished and rebuilding species and marine mammals and seabirds, were also included where appropriate. The intent was to include the 'main' species, and the species of concern, that are associated with the U.S. west coast non-hake commercial groundfish fisheries. Therefore, the analyst's discretion was used in some situations. The Criterion 2 score for each fishery is the score of the lowest scoring 'main' species caught in that fishery, multiplied by a modifier based on the discard rate in the fishery.

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)

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

Arrowtooth flounder

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Medium
The Fishbase vulnerability score for arrowtooth flounder is 64, but the species' productivity rating in Cope et al., 2011 is 1.95 (Table 1 in (Cope, J.M., et al., 2011)). Arrowtooth flounder inherent vulnerability is therefore scored "medium".

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
The available information suggests that arrowtooth flounder adult biomass is likely well above the target (SB2007/SB40%=1.98, projected SB2011/SB40%=1.65; {Kaplan, I.C. & Helser, T.E. 2007}; (PFMC 2011a)), and the population is classified as 'not overfished' (NMFS 2012). The population has not been assessed since 2007, however, and there is a relatively high degree of scientific uncertainty regarding the assessment, which contributed to the population's classification as Category 2 by fisheries management (Chapter 4 in (PFMC 2011a)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
In 2011, total fishing mortality of arrowtooth flounder was well beneath catch limits (approximately 15% of that year's overfishing limit; Table 16 in (Bellman, M.A., et al., 2012)), and the population was classified as not experiencing overfishing for 2012 (NMFS 2012). The age of the most recetn stock assessment (2007) and the uncertinty therein preclude a score of 'very low' concern, however.

Aurora rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for aurora rockfish is 56, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.33.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
Aurora rockfish was assessed in 2013. At that time, adult biomass was estimated to be above the management target (SBcurrent/SB40%=1.6; Table ES-2 in {Hamel, O.S., Cope, J.M., & Matson, S. 2013}). The reconstruction of biomass trends presented in the assessment indicates that the population’s biomass has never been lower than the management target (Figure ES-4 in {Hamel, O.S., Cope, J.M., & Matson, S. 2013}).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
Fishing mortality was estimated to be less than the management target in the latest year assessed (1-SPR2012/SPR50%=1.38) and for the last 18 years (Hamel et al. 2013).

Big skate

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High
The Fishbase vulnerability score for big skate is 85, and the species' productivity rating in Table 1 of (Cope, J.M., et al., 2011)) is 1.37.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High Concern
No stock assessment has been conducted for big skate, so the species' stock status is unknown (PFMC 2012b). The 'high concern' rating reflects the unknown status of the stock combined with the high vulnerability of the species to overfishing.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern
The overfishing limit for big skate was set for the first time for the 2013-2014 fishing season, at 458 mt (PFMC 2012b). The estimates were derived from survey biomass and MSY harvest rate estimates in a new methodology for assessing data-poor stocks. Total estimated mortality during the 2012 season across all fisheries was 77mt {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. Thus it is unlikely that overfishing is occurring, but uncertainty precludes a rating of 'very low concern.'

Black and yellow rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Medium
The Fishbase vulnerability score for black-and-yellow rockfish is 47, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.89.

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Moderate Concern
The black-and-yellow rockfish stock has never been assessed. It is part of the northern and southern 'minor nearshore' rockfish complexes, which had 'unknown' designations from NMFS for overfished status for 2012 (NMFS 2012). Black-and-yellow rockfish are of 'medium' resilience (see factor 1.1), and this fact, combined with the lack of information regarding stock status, warrants a score of 'moderate' for this factor.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Moderate Concern
There is no information on the effect of current fishing mortality on the stock, and a productivity-susceptibility analysis indicates that the susceptibility of the species to fishing pressure is relatively high (Table 4-4 in (PFMC 2011a)). The combination of unknown impacts of current fishing mortality and a susceptibility to fishing that is not low requires a rating of 'moderate' concern.
Justification:
There has been no assessment of the black-and-yellow rockfish stock. Total fishing mortality of black-and-yellow rockfish was 23.5 t in 2011; approximately 53% of this catch was taken in the Nearshore South fishery (Table 15 in (Bellman, M.A., et al., 2012)). A productivity and susceptibility analysis rated black-and-yellow rockfish as a relatively high-productivity rockfish with relatively high susceptibility to fishing, and overall, as a species that had moderate vulnerability to overfishing (Table 4-4 in (PFMC 2011a)). However, out of 50 data-poor species, black-and-yellow rockfish had the sixth-highest score for the probability (P=0.40) that recent catches would exceed a species-specific overfishing limit (note that this analysis used the average catch from 2008-2009, which was higher than that from 2010-2011) (Table 63 in {Dick, E.J. & MacCall, A.D. 2010}. This information suggests that the susceptibility of the stock to fishing pressure cannot be assumed to be low.

Black rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High
The Fishbase vulnerability score for black rockfish is 66.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
Southern black rockfish were last assessed in 2007, using spawning output as a proxy for adult biomass. Spawning output for southern black rockfish exceeded the management target ($SO_{40\%)}$ (Sampson, D.B. 2007). For 2012, the spawning output of the southern black rockfish stock was projected to exceed the managment target (SOcurrent/$SO_{40\%}$=1.4; Table 3-6, Chapter 3 in (PFMC 2011a)). Furthermore, the stock was classified as 'not overfished' by NMFS in 2012 (NMFS 2012). However, the stock has not had a recent assessment, increasing uncertainty in current stock status and precluding a rating of very low concern.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
The 2007 stock assessment found that overfishing was not occurring (F2007/FSPR50%=0.22), had not been occurring from 1996-2007, and had been delining over that period (Sampson, D.B. 2007). In 2011, total fishing mortality of southern black rockfish was still well beneath the catch limit (43% of the overfishing limit)(Table 16 in (Bellman, M.A., et al., 2012)), and the stock was classified as not experiencing overfishing for 2012 (NMFS 2012). The age of the stock assessment precludes a rating of very low concern.

Black-footed albatross

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

High
The Seafood Watch criteria assign an inherent vulnerabiity score of 'high' to all seabirds.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

High Concern
The population of black-footed albatross has increased three-fold since the 1920s, but the current status of the population relative to historical levels is not known. The species is listed as 'vulnerable' by the IUCN, but was recently rejected by the U.S. Fish and Wildlife Service for listing under the Endangered Species Act. As per Seafood Watch criteria, black-footed albatross stock status is scored 'high' concern.
Justification:
Historical levels of black-footed albatross abundance are not known, but it is known that the population was depleted by feather hunting during the early 20th century (Arata, J.A., et al., 2009). Since the 1920s, black-footed albatross abundance has increased three-fold, from just under 20,000 breeding pairs to over 60,000 pairs in 2005 (Figure 22 in (Arata, J.A., et al., 2009)). However, it is still a species of concern. Black-footed albatross are listed as 'vulnerable' by the IUCN (IUCN 2012b), and were considered but ultimately rejected for listing under the U.S. Endangered Species Act.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

Very Low Concern
Bycatch mortality of black-footed albatross in the west coast groundfish fisheries is a minor contributor to overall anthropogenic mortality of this species, and in recent years has contributed less than 2% of an estimated maximum allowable annual adult mortality. Fishing mortality of black-footed albatross in the west coast groundfish fisheries is scored as 'very low' concern.

Justification:
Commercial fisheries bycatch, and more specifically pelagic longline bycatch, is the single greatest source of anthropogenic mortality of black-footed albatross (Arata, J.A., et al., 2009). An assessment of the global population of black-footed albatross concluded that fishery bycatch may be reducing black-footed albatross populations (Arata, J.A., et al., 2009), but bycatch at the 2005 levels (approximately 5,000 individuals caught world-wide) may be sustainable (Arata, J.A., et al., 2009). The numbers caught by the west coast groundfish fisheries are low relative to overall fisheries mortality of this species: from 2000-2005, estimated annual mortality of black-footed albatross from commercial fisheries was near 5,000 animals/year (Figure 4 in (Arata, J.A., et al., 2009)). Estimated bycatch of this species in U.S. west coast groundfish fisheries ranged from 32 to 91 individuals from 2003-2008 (Table 8b in (Jannot, J., et al., 2011)).
Adult survival rates of 96% or greater are thought to be required to maintain the black-footed albatross population (Naughton, M.B., et al., 2007). The most recent estimate of nesting pairs is 61,710 pairs (Table 1 in (Naughton, M.B., et al., 2007)); 4% of 61,710 pairs is over 4,900 individuals. The highest recent catch of black-footed albatross in U.S. west coast groundfish fisheries (an estimated 91 individuals in 2008) is less than 2% of 4,900 individuals. U.S. west coast groundfish fisheries, therefore, are a minor contributor to overall fishing mortality of this species, and do not, by themselves, appear to constitute a threat to the maintenance or rebuilding of the species.

Blackgill rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

High
The Fishbase inherent vulnerability score for blackgill rockfish is 70, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.22.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Low Concern
For 2011, estimated blackgill rockfish spawning output (30.2% of SO_0) was greater than the overfished threshold ($SO_{25\%}$) but less than the management target ($SO_{40\%}$; Table B.2 in {Field, J.C. & Pearson, D. 2012}). The stock assessment suggests that blackgill rockfish spawning output diminished sharply from the early 1970s through the mid-1990s and then increased in the 2000s, and was less than the overfished threshold from 1990 through 2005 (Table 20 in {Field, J.C. & Pearson, D. 2012}).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Moderate Concern
While recent catches have been approximately 50% of a hypothetical overfishing limit, estimated SPR was below 50% in 8 of the 10 years from 2001-2010, including the two most recent years assessed (2009 and 2010; {Field, J.C. & Pearson, D. 2012}). While NMFS classifies blackgill rockfish as 'unknown' in regard to potential overfishing (NMFS 2012), recent SPR rates have been similar to the target $SPR_{50\%}$. The stock assessment projects that the stock will continue to recover through 2022 under current management measures that decrease the overfishing limit and annual catch limit when the stock falls below the target (the 40:10 ACL rule) {Field, J.C. & Pearson, D. 2012}. Early estimates of total 2013 fishing mortality suggest that reducing landing limits in 2013 have had the desired effect of reducing blackgill mortalities (essentially by reducing targeting of the stock) (PFMC 2014b). Given the likelihood that blackgill rockfish has been experienceing overfishing for most of the decade through 2010, the close proximity of recent fishing mortality to the overfishing limit, the likely reduction in fishing mortality in 2013 and the projection that the stock will continue to recover over the next decade, the stock is rated a 'moderate concern.'
Justification:
The total mortality of southern blackgill rockfish across all fisheries was 150 t in 2011 (Table 15 in (Bellman, M.A., et al., 2012)). Approximately 81% of the total southern blackgill rockfish fishery catch in 2011 was caught in the LE non-endorsed longline (48%) and the OA longline (33%) fisheries (Bellman, M.A., et al., 2012).
While there is no species-specific OFL against which to compare the 2011 catch, the authors of the recent stock assessment state that total catch of the southern slope complex blackgill rockfish in 2010 was approximately 50% of an estimated OFL for that year (Table B.5 in {Field, J.C. & Pearson, D. 2012}). Estimates of SPR for the two most recent years assessed (2009 and 2010) were 42.4% and 40.4% of SPR_0, respectively, and as such indicate overfishing relative to the proxy F_{MSY} ($F_{SPR50\%}$) {Field, J.C. & Pearson, D. 2012}. Similarly, estimated SPR for the years 2001-2006 were all under 50% (Table B.4 in {Field, J.C. & Pearson, D. 2012}).

Blue rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High
The Fishbase vulnerability score for blue rockfish is 56, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.39.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
Blue rockfish spawning biomass in the assessment area has steadily increased in the years since 1994, and it was estimated to be 29.9% of SB_0 in 2007 (Table 22 in (Key, M., et al., 2008)), which places this stock above the overfished threshold ($SB_{25\%}$) but below the management target of $SB_{40\%}$. Blue rockfish off of the coast of California is classified as 'not overfished' ($B:B_{MSY}$ proxy ratio of 0.749; (NMFS 2012)). The 'low' concern score reflects the current estimate of biomass being between the limit and target reference points as well as the significant uncertainty in the stock assessment (including its age and the fact that much of the population north of 40°10'N was not covered).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Moderate Concern
The most recent stock assessment of blue rockfish found that the average of the combined commercial and recreational exploitation rates for the period 2000-2008 (0.038) is slightly less than the current target exploitation rate (the estimated exploitation rate that corresponds to the F_{MSY} proxy of $F_{SPR50\%}$ (0.040) (Key, M., et al., 2008)). This suggests that overfishing is not likely to be occurring; however, given the uncertainty regarding this interpretation, and the relative age of the assessment from which it is taken, the effect of fishing mortality on the stock is unknown. This corresponds to the NMFS classification of the stock as "unknown" in regard to potential overfishing for 2012 (NMFS 2012).

Bocaccio rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

High
The Fishbase vulnerability score for bocaccio is 63, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.28.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

High Concern
For 2013, estimated spawning output (a proxy for adult biomass) for the southern population of bocaccio (31.4% of SO_0) exceeded the overfished threshold ($SO_{25\%}$) but was less than the target ($SO_{40\%}$); the 95% confidence interval ranged from under the overfished threshold to slightly less than the target. The stock was classified as "not overfished-rebuilding" by NMFS for 2012. While the species' IUCN status could qualify it for a Factor 1.2 score of "very high" concern, the IUCN status is noted as requiring an update, and the recent trend in the status of the southern stock of bocaccio suggests that its abundance is increasing. Therefore, the stock status of bocaccio off of the coast of California is scored "high" concern for this assessment due to the proximity of the stock's biomass to the overfished threshold, the fact that the lower 95% confidence interval is under the overfished threshold, and the fact that the stock is listed as a "species of concern" by NMFS.
Justification:
The spawning output of the California population of bocaccio declined sharply in the 1950s to the early 1960s, and then rose rapidly in the later 1960s due to strong year classes (Field, J.C., et al., 2009). By the early 1970s, spawning output had exceeded mean unfished levels and commercial fishery catches and exploitation rates peaked; subsequently, a sharp decline in spawning output occurred in the later 1970s and through the 1980s and 1990s, until spawning output reaching a nadir of 11.8% of SO_0 in 2001 (Table 12 in (Field, J.C. 2014)). Bocaccio were officially classified as overfished following the 1996 stock assessment (Field, J.C., et al., 2009), and starting in 2000, fishing mortality was constrained by several years of low OYs (Field, J.C., et al., 2009).

Spawning output has increased in the years since the stock was declared overfished. For 2013, the spawning output of southern bocaccio was estimated to be 31.4% (95% C.I.= 23.1-39.6%) of SO_0, which placed it above the overfished threshold for rockfish ($SO_{25\%}$) but below the target reference point ($SO_{40\%}$) (Field, J.C. 2014). The southern (California) unit of bocaccio was classified as "not overfished – rebuilding" by NMFS for 2012 (NMFS 2012). The southern unit is listed as a "species of concern" by NOAA Fisheries Office of Protected Resources (NOAA Fisheries 2013), and the species as a whole is listed as "critically endangered" by the IUCN, although the IUCN website notes that the status "needs updating" (IUCN 2012a).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

Very Low Concern
The 2011 catch of southern bocaccio, which was spread across several gear sectors, was approximately 1% of the overfishing limit (Bellman, M.A., et al., 2012). Furthermore, the estimated SPR for southern bocaccio in 2012 was substantially greater than the MSY proxy of $SPR_{50\%}$. An analysis of rebuilding options suggests that recent SPR levels have a very high probability of rebuilding the stock within the next two decades.

Justification:
After reaching a nadir of approximately 10% of SPR_0 in the 1980s, the SPR of southern bocaccio has steadily increased, passing the MSY proxy of $SPR_{50\%}$ in the late 1990s and approaching 100% of SPR_0 in recent years (Figure E5 in (Field, J.C. 2014)). There is evidence that the current SPR level will not impede recovery: the target SPR for rebuilding is 77.7% (PFMC 2011c), and in the 2009 analysis of bocaccio rebuilding efforts, an SPR of 95% (which corresponds to the SPR estimate for 2008) has a 77% chance of recovery by 2022 and a 99% chance by 2038 (Table 3 in {Field, J.C. & He, X. 2009}).

While the species as a whole remains classified as "critically endangered" by the IUCN (although this status is noted as requiring an update; (IUCN 2012a)), the southern stock appears to be rebuilding (see Factor 2.2) and its SPR values have been similar to or greater than 90% for several consecutive years. The total estimated non-hake commercial groundfish fishing mortality of southern bocaccio in 2011 was 7.7 t; this was approximately 1% of the OFL and less than 3% of the ACL, and was spread out in trace amounts among the IFQ trawl, LE non-endorsed longline, OA longline, and Nearshore South fixed gear fisheries (Bellman, M.A., et al., 2012).

Brown rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

High
The Fishbase vulnerability score for brown rockfish is 58, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.61. Brown rockfish inherent vulnerability is therefore scored "high".

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Low Concern
Coastwide brown rockfish spawning biomass steadily declined from the 1960s through the 1990s, going below the target reference point in the early 1980s and approaching the limit reference point in the 1990s (Figure 55 in (Cope, J., et al., 2013)). Since 2000, spawning biomass has increased, and the coastwide SB_{2012}:SB_0 is estimated to be 0.4 (95% C.I. = 0.22-0.78; Table ES1 in (Cope, J., et al., 2013)). This is essentially equal to the target reference point (Figure 55 in (Cope, J., et al., 2013)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Very Low Concern
In the recent stock assessment, F_{2012}:F_{MSY} was estimated to be 0.58 (95% C.I. = 0.2-1.1; Table ES1 in Cope, J. et al. 2013), indicating overfishing was not occurring. The continuation of recent catch levels is projected to allow spawning biomass to continue to rebuild (Table 66 in Cope, J. et al. 2013).

Cabezon

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Medium
The Fishbase vulnerability score for cabezon is 37, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.72.

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
The available information suggests that the cabezon stock status on the US west coast is above the overfished threshold ($SB_{25\%}$), but its status relative to the target reference point ($SB_{40\%}$) is not as clear-cut. Cabezon are classified as 'not overfished' for 2012.
Justification:
The most recent stock assessment for cabezon developed assessments for four stocks: northern California (NCS), southern California (SCS), coast-wide California (CAS), and Oregon (ORS) {Cope, J.M. & Key, M. 2009}. These separations are supported by localized population dynamics, genetic analysis, and spatial differences in the fishery {Cope, J.M. & Key, M. 2009}. The NCS, SCS, and CAS spawning biomass estimates all showed substantial decreases during the 1970s and 1980s, with the NCS and CAS spawning biomasses dropping below the $SB_{40\%}$ management target in 1999 and 1998, respectively, and the SCS dropping below the $SB_{25\%}$ overfished threshold for the years 1991-1998 (Figure E-12 in {Cope, J.M. & Key, M. 2009}). Estimated biomass for these three regions increased in subsequent years. For 2009, the estimated CAS spawning biomass (34% of SB_0 ,95% C.I. = 23-45%) was below the management target of $B_{40\%}$; however, both the NCS (45%) and SCS (60%) were above it. The estimated ORS spawning biomass has been steadily decreasing since the 1970s but has never been less than the $SB_{40\%}$ management target; ORS estimated spawning biomass in 2009 was 52.4% of SB_0 (95% C.I. = 33-72%) (Table E-2 in {Cope, J.M. & Key, M. 2009}). For 2012, projected spawning biomasses for northern and southern cabezon are 48% and 47% of SB_0, respectively. Most recently, for the 2nd quarter of 2012, cabezon (coastwide) are classified by NMFS as 'not overfished', with a $B:B_{40\%}$ ratio of 1.169 (NMFS 2012).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Very Low Concern
California cabezon experienced periods of overfishing in the 1980s and 1990s but since 2000 fishing mortality has been less than the overfishing limit (i.e. SPR estimates have been greater than $SPR_{45\%;}$ Figure E-13 in {Cope, J.M. & Key, M. 2009}). Fishing mortality for cabezon in Oregon has approached the overfishing limit ($FSPR_{45\%)}$ in recent years, but has never been greater than it. For the last year in the assessment (2008), the SPR values for the four areas were: 74% (NCS), 78% (SCS), 65% (CAS), and 56% (ORS); only the lower confidence interval for ORS (40%) was less than $SPR_{45\%}$. For 2012, NFMS categorized cabezon (coastwide) as not experiencing overfishing (NMFS 2012).

California sheephead

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Medium
The Fishbase vulnerability score for California sheephead is 55.

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

High Concern
California sheephead are an IUCN 'vulnerable' species (IUCN 2014). The most recent stock assessment was conducted in 2004, and as such there is no recent assessment of the stock (CDFW 2011). The 2004 assessment estimated that California sheephead spawning biomass was 20% of SB_0 (Alonzo, S.H., et al., 2004). Due to the IUCN listing, the low estimated spawning biomass in the 2004 assessment, and the lack of a more recent assessment, California sheephead stock status is considered 'high' concern.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

High Concern
The non-hake commercial groundfish fishing mortality of California sheephead in 2011 was 30.9 t, virtually all of which was taken in the Nearshore South fixed gear fishery; this was approximately 43% of total estimated mortality of this species across all fisheries for that year (Bellman, M.A., et al., 2012). The impact of this level of fishing mortality is not known (CDFW 2011). As the impact of commercial fisheries pressure is not known and the susceptibility of the species to the fishery is not low, California sheephead are scored "high" concern for fishing mortality in the Nearshore South fishery.

California skate

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High
The Fishbase vulnerability score for California skate is 51, but the species' productivity rating in Cope et al., 2011 is 1.21 (Table 1 in (Cope, J.M., et al., 2011)).

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High Concern
No stock assessment has been conducted for California skate, so the species' stock status is unknown (PFMC 2012b). The unkonwn stock status, in combination with the species' high inherent vulnerability, compels a stock status score of "high" concern.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern
The overfishing limit for California skate was set for the first time for the 2013-2014 fishing season, at 86 mt (PFMC 2012b). The estimate was derived from survey biomass and MSY harvest rate estimates in a new methodology for assessing data-poor stocks. Total estimated mortality during the 2012 season across all fisheries was 2.93 mt {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. Thus it is unlikely that overfishing is occurring, but uncertainty precludes a rating of 'very low concern.'

Canary rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High
The Fishbase vulnerability score for canary rockfish is 62, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.28.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High Concern
Estimated adult biomass for canary rockfish in 2011 is below the overfished threshold (Wallace and Cope 2011), and the stock is classified by NMFS as 'overfished' for 2012 ($B:B_{MSY}$ proxy ratio of 0.576) (NMFS 2012).

Justification:
Canary rockfish spawning biomass decreased steadily from the 1940s through the 1990s, dropping below $SB_{25\%}$ in 1990 and reaching its minimum in 1999 at 10.87% of SB_0 (Table 13 in {Wallace, J.R. & Cope, J.M. 2011}). Estimated biomass for canary rockfish in 2011 is 6,458 t (95% C.I. = 4,506 – 8,411 t), which is 23.2% (95% C.I. = 17-30%) of SB_0 (Table b in {Wallace, J.R. & Cope, J.M. 2011}). This estimate is under $SB_{25\%}$, which constitutes an overfished status (Figure 6) {Wallace, J.R. & Cope, J.M. 2011}. While the short-term trend over the past several years is a moderate increase, the trend is "very uncertain" in the words of the 2011 assessment's authors, and is likely to slow as recent below-average year classes come into the spawning biomass {Wallace, J.R. & Cope, J.M. 2011}.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Very Low Concern
Estimated non-hake commercial groundfish fishing mortality of canary rockfish was 3.0% of the overfishing limit in 2011. Catches in recent years have been consistent with the harvest rule identified in the canary rockfish rebuilding plan, and are at a level that is modeled to have a greater than 70% probability of allowing the canary rockfish stock to rebuild.

Justification:
The estimated canary rockfish SPR dropped below the management target ($SPR_{50\%}$) in 1977 and reached a minimum of 13.1% in 1992; SPR slightly increased over the next several years, but only began a substantial increase between 1999 (28.1%) and 2000 (71.2%) as a result of the implementation of the rebuilding plan (Table 13 in {Wallace, J.R. & Cope, J.M. 2011}). For 2010, estimated SPR was at 88% of SPR_0 (Table f in {Wallace, J.R. & Cope, J.M. 2011}). This is very close to the harvest rule in the rebuilding plan (88.7%; (PFMC 2011c)). Commercial landings have not exceeded the overfishing level during the last ten years, as catch was constrained by OYs that were set much lower than the corresponding overfishing levels (Table c in {Wallace, J.R. & Cope, J.M. 2011}). In 2011, estimated non-hake commercial groundfish fishing mortality of canary rockfish (18.4 t) was 3.0% of the OFL (614 t) and 18.1% of the ACL (102 t) (Bellman, M.A., et al., 2012). Finally, NMFS categorizes canary rockfish as not experiencing overfishing in the 2^{nd} half of 2012 (NMFS 2012). It is also worth noting that the estimated 2010 SPR (88%) is nearly identical to one of the rebuilding alternatives (SPR = 88.7%) modeled in the 2007 canary rockfish rebuilding analysis (Stewart, I.J. 2007a); when this SPR was modeled, it resulted in a 75.0% chance of recovery within the maximum allotted timeframe, which was the same as the most stringent harvest control option that was modeled (F = 0) (Table 4 in (Stewart, I.J. 2007a)). (The 2007 rebuilding analysis is used in lieu of the 2009 rebuilding analysis due to the divergence between the 2009 assessment's biomass estimates compared to those in the 2007 and 2011 assessments). That modeling exercise indicates that the estimated 2010 SPR, and those of recent years, are at levels that will allow, with >70% probability, the rebuilding of the stock. In 2011, the Nearshore North fishery accounted for 73% of canary rockfish mortality in non-hake commercial groundfish fisheries, and 26% of total canary rockfish mortality across all fisheries (Appendix B; (Bellman, M.A., et al., 2012).

Chilipepper rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Medium
The Fishbase vulnerability score for chilipepper rockfish is 52, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.83.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
At the time of the most recent stock assessment (2006), the spawning biomass of chilipepper rockfish off of the coasts of California and Oregon was 70% of SB_0 (95% C.I.= 0.5-0.89% of SB_0), which exceeded the target for rockfish ($SB_{40\%}$) {Field, J.C. 2007}. For 2011 and 2012, chilipepper rockfish spawning biomass is projected to be greater than $SB_{40\%}$ (63 and 64% of SB_0, respectively) (Table 3-6, Chapter 3 in (PFMC 2011a). The stock is classified as 'not overfished' by NMFS (B:B_{MSY} proxy ratio of 1.784) (NMFS 2012). However, the stock has not been assessed since 2006, precluding a rating of 'very low concern'.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
Recent exploitation rates for chilipepper rockfish have been at their lowest point since 1950 (Figure E4 in {Field, J.C. 2007}). Chilipepper rockfish catch did not exceed the overfishing limit between 1987 and 2006 (Table 1 in {Field, J.C. 2007}). In 2011, total fishing mortality was well below catch limits (approximately 16% of the OFL and 17% of the ABC and ACL; Table 16 in (Bellman, M.A., et al., 2012)), and the stock was classified as not experiencing overfishing in 2012 (NMFS 2012). Finally, in a productivity-susceptibility analysis of west coast groundfish, chilipepper rockfish have the 2nd-lowest vulnerability-to-overfishing score of any rockfish, and the 12th –lowest vulnerability score of all west coast groundfish (Table 4-4 in (PFMC 2011a)). It is therefore probable that fishing mortality is below a sustainable level but there is uncertainty due to the age of the stock assessment.

China rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High
The Fishbase vulnerability score for china rockfish is 56, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.33.

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Very Low Concern
In a recent stock assessment, the SB_{2013}:SB_0 ratios for china rockfish north and south of 40°10'N were 0.33 (95% C.I. = 0.14-0.75) and 0.72 (0.41-0.95), respectively (Table ES1 in (Cope, J., et al., 2013)). This indicates that 'north' china rockfish are below the target reference point, but are above the limit reference point (Cope, J., et al., 2013).
The trajectory of modeled 'north' china rockfish spawning biomass indicates a continuous decline from the 1980s through the present, with spawning biomass only recently going below the target reference point (Figure 61 in (Cope, J., et al., 2013)). Conversely, 'south' china rockfish spawning biomass is modeled to have approached, but not gone below, the target reference point in the late 1990s before beginning a gradual increase in the subsequent years (Figure 58 in (Cope, J., et al., 2013)).

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
In a recent stock assessment, the SB_{2013}:SB_0 ratios for china rockfish north and south of 40°10'N were 0.33 (95% C.I. = 0.14-0.75) and 0.72 (0.41-0.95), respectively (Table ES1 in (Cope, J., et al., 2013)). This indicates that 'north' china rockfish are below the target reference point, but are above the limit reference point (Cope, J., et al., 2013).
The trajectory of modeled 'north' china rockfish spawning biomass indicates a continuous decline from the 1980s through the present, with spawning biomass only recently going below the target reference point (Figure 61 in (Cope, J., et al., 2013)). Conversely, 'south' china rockfish spawning biomass is modeled to have approached, but not gone below, the target reference point in the late 1990s before beginning a gradual increase in the subsequent years (Figure 58 in (Cope, J., et al., 2013)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Very Low Concern

For 'north' and 'south' china rockfish, F_{2012}:F_{MSY} was 1.9 (95% C.I. = 0.4-8.43) and 0.28 (0.06-0.59), respectively (Table ES1 in Cope, J. et al. 2013). This indicates overfishing of 'north' china rockfish likely occurred in 2012. Indeed, the recent stock assessment projects that, if recent annual catches were continued in coming years, 'north' china rockfish spawning biomass would decline (Table 67 in Cope, J. et al. 2013). Conversely, the continuation of recent catches of 'south' china rockfish would allow spawning biomass to increase (Table 68 in Cope, J. et al. 2013).

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

High Concern

For 'north' and 'south' china rockfish, F_{2012}:F_{MSY} was 1.9 (95% C.I. = 0.4-8.43) and 0.28 (0.06-0.59), respectively (Table ES1 in (Cope, J., et al., 2013)). This indicates overfishing of 'north' china rockfish likely occurred in 2012. Indeed, the recent stock assessment projects that, if recent annual catches were continued in coming years, 'north' china rockfish spawning biomass would decline (Table 67 in (Cope, J., et al., 2013)). Conversely, the continuation of recent catches of 'south' china rockfish would allow spawning biomass to increase (Table 68 in (Cope, J., et al., 2013)).

Cowcod

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for cowcod is 70, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.06.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Moderate Concern
A recent assessment of the cowcod sub-stock in the Southern California Bight (SCB) indicates that this sub-stock is above $SB_{25\%}$ but below $SB_{40\%}$. The status of the stock between 40°10′N and the SCB is not known. The sub-stock in the SCB continues to rebuild, but the lack of information regarding the status of the stock north of the SCB moderates this score.
Justification:
In 2000, cowcod were declared 'overfished' based upon an assessment of the SCB sub-stock (Dick, E.J. 2011). The SCB is the area between 34°27′N and the border of Mexico. Cowcod spawning biomass in the SCB has undergone two periods of steep reductions; the first came from 1900 through the early 1930s, when spawning biomass fell from 100% of SB_0 to less than 60%, and the second occurred from the late 1960s through the late 1980s, when spawning biomass fell again from over 60% of SB_0 in 1965 to approximately 10% in the late 1980s (Figure c in {Dick, E.J. & MacCall, A.D. 2013}). Spawning biomass has gradually increased in the years since. The estimated spawning biomass for 2013 is 33.9% of SB_0 (95% C.I. = 15%-65.6%; Table b in {Dick, E.J. & MacCall, A.D. 2013}). This is above the minimum stock size threshold for rockfish ($SB_{25\%}$), but less than the target reference point ($SB_{40\%}$).
The status of cowcod north of Point Conception and south of Cape Mendocino (i.e., south of 40°10′N but north of the SBC) is not known ({Dick, E.J. & MacCall, A.D. 2013}.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern

For the sub-stock of cowcod found in the SCB, recent exploitation rates have been less than the exploitation rate limit determined for rebuilding purposes, and catches in line with the ACL are modeled to allow for continued rebuilding. Catches of cowcod in the total area south of 40°10'N are well under catch limits, as well: in 2011, cowcod mortality in non-hake commercial groundfish fisheries was less than 1% of the overfishing limit.

Justification:

SCB cowcod exploitation rates have been ≤0.1% in each year since 2003 (Table h in {Dick, E.J. & MacCall, A.D. 2013}); for comparison, the 2013 assessment's estimate of the exploitation rate that produces MSY is 5.5% (Table d in {Dick, E.J. & MacCall, A.D. 2013}). For rebuilding purposes, the exploitation rate limit for 2013/2014 is set at 0.7% (Table 4 in {Dick, E.J. & MacCall, A.D. 2013}. Catches in line with the current ACL are modeled to allow for spawning biomass to continue to increase (Table 6 in {Dick, E.J. & MacCall, A.D. 2013}.

Looking beyond the SCB, during the period 2003-2012, total fishing mortality (commercial and recreational) of cowcod south of 40°10'N was well under catch limits (Table e in {Dick, E.J. & MacCall, A.D. 2013}). In 2011, non-hake commercial groundfish fishing mortality of cowcod was 0.02 t (all of which was taken in the IFQ fishery); this was less than 1% of the OFL, ABC, and ACL and was approximately 2% of the total estimated cowcod fishing mortality across all fisheries (including recreational fisheries; (Bellman, M.A., et al., 2012)).

Darkblotched rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

High
The Fishbase vulnerability score for darkblotched rockfish is 69, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.39.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

Low Concern
Darkblotched rockfish spawning output (a proxy dfor adult biomass) declined sharply from the 1970s through approximately 2000, and was below the limit reference point ($SO_{25\%}$) from 1992 through 2007 (Table 13 in {Gertseva, V.V. & Thorson, J.T. 2013}). Spawning output has increased since 2000, and darkblotched rockfish SO_{2013} was recently estimated to 36% of SO_0 (95% C.I. = 16%-56%; Table ES-2 in {Gertseva, V.V. & Thorson, J.T. 2013}). This is above the limit reference point (SO25%), but below the target reference point (SO40%), hence the rating of 'low concern'.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

Very Low Concern
The most recent stock assessment found SPR (86%) to be well above the target reference point (the F_{MSY} proxy of $SPR_{50\%}$; SPR has been above 50% for at least the past ten years {Gertseva, V.V. & Thorson, J.T. 2013}). For 2011, total fishing mortality of darkblotched rockfish was 26% of the OFL, 27% of the ABC, and 45% of the ACL (Bellman, M.A., et al., 2012).

Dover sole

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for Dover sole is 42, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.80.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
Dover sole adult biomass was estimated to be well above the target for 2011 (95% C.I.=67-100% of SB_0; Tables b and e in {Hicks, A.C., & Wetzel, C. 2011}), and for 2012, Dover sole B/B_{MSY} was estimated to be 3.35 (NMFS 2012).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
For 2011, total fishing mortality of Dover sole was substantially less than the catch limits (18% of the overfishing threshold); Table 16 in (Bellman, M.A., et al., 2012)) and the stock was classified as not undergoing overfishing in 2012 (NMFS 2012).

Dungeness crab

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot

Low
Dungeness crab have low inherent vulnerability (score of 2.67) due to their early age at sexual maturity, high fecundity and short lifespan. In Alaska, sexual maturity is reached at 2 years for females and 3 years for males (Hoopes 1973) and maximum lifespan is 8-13 years (ADFG 1994).
Justification:
{IMG-2218: Dcrab }

Factor 2.2 - Abundance

Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot

Low Concern
There is no active Dungeness crab stock assessment program in California or Washington. Dungeness populations are fully exploited such that annual catch is considered to be a proxy for population size. Management considers the stock healthy, with annual landings that fluctuate around a fairly stable long-term mean {Hankin & Warner 2001}, (DFG 2012a), (NOAA 2013a). Landings have increased in recent years, reaching a record high in California in 2011 representing the largest catch by weight over the last 100 years (DFG 2012b). Little is known about female abundance and population size structure.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot

Very Low Concern
Legal-sized male Dungeness populations in California and Washington are fully exploited, with 80-90% estimated fishery capture, but are not considered overfished {Hankin & Warner 2001}. Intense harvest does not appear to impair mating success ((Hankin et al. 1997), {Oh & Hankin 2004}). Fishery mortality for directed fisheries is ranked as a moderate concern due to high exploitation rates resulting in dependance on annual recruitment for population persistence. Landings in Washington and California fluctuate but have had a stable long-term mean overall ((DFG 2012a), (NOAA 2013a)). In recent years fishery effort has increased as have landings with California reaching record highs in the past two seasons. Fishery mortality is regulated through management regulations limiting collection by size, sex and season, however, adequate data are not available to determine maximum sustainable yield. The catch in the Limited Entry groundfish pot fishery is typically landed, but comprises a fraction of total landings (1.14/20296mt in 2012), so fishing mortality in this fishery is considered negligible.

English sole

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for English sole is 43, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 2.25. The inherent vulnerability of English sole is therefore scored "medium".

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
English sole adult biomass sharply declined between 1900 and the 1930s and declined again during the 1950s and 1960s; adult biomass is estimated to have been below the target reference point ($SB_{25\%}$) through the 1960s, 1970s, and 1980s (Figure 103 in (Cope, J., et al., 2013)). Spawning biomass has increased in the years since, however, and in the latest assessment, is estimated to be well above the management target (SB_{2013}:SB_0 is 0.88 (95% C.I. = 0.77-0.96; Table ES1 in (Cope, J., et al., 2013)).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
The 2011 total fishing mortality of English sole was minimal relative to the catch limits (<1% of the overfishing threshold); Table 16 in (Bellman, M.A., et al., 2012)). Estimated F_{2012}:F_{MSY} was 0.02 (Table ES1 in (Cope, J., et al., 2013)), and the continuation of recent catch levels is projected to allow spawning biomass to increase (Table 73 in(Cope, J., et al., 2013)).

Finescale mora

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for finescale mora (AKA finescale codling/Pacific flatnose) is 68, and no assessment was conducted of the species in (Cope, J.M., et al., 2011).

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High Concern
There is no stock assessment for finescale codling. This information, combined with the species' 'high' inherent vulnerability, compels a score of 'high' concern.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
Finescale codling is not targeted by any west coast groundfish fishery (PFMC 2014b). Total catch in 2012 were estimated at about 2.65 mt {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}, and about 13mt average from 2007-2012 (PFMC 2014b). This latter is approximately 4% of the estimated overfishing limit (PFMC 2014b).

Giant rattail

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

High
Giant grenadier have a Fishbase vulnerability score of 72.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

High Concern
There is no stock assessment for giant grenadier. This information, combined with the species' 'high' inherent vulnerability, compels a score of 'high' concern for giant grenadier, and therefore for 'unknown grenadier', which are ilkely composed of Pacific and giant grenadier (Field, J.C. 2004).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

Low Concern
Along with Pacific grenadier, giant grenadier are likely a substantial component of the 'unspecified grenadier' catch noted in Bellman et al., 2012. In 2011, total catch of 'unspecified grenadier' was well below recent overfishing estimates for Pacific and giant grenadier. Giant grenadier fishing mortality is therefore scored 'low' concern.
Justification:
In 2011, a total of 125 t of ‘unspecified grenadier’ were caught in commercial non-hake groundfish fisheries (Bellman et al. 2012); giant and Pacific grenadier are expected to have made up the majority of the ‘unspecific’ catch (Field 2004).
To date, grenadiers have been managed as part of the 'other groundfish’ complex, without species-specific catch limits. However, OFLs were recently estimated for Pacific grenadier (1,386.0 t), giant grenadier (638.6 t), and other grenadiers (40.1 t) (Taylor, I. et al. 2013).

In 2011, the IFQ trawl, LE non-endorsed longline, and OA longline fisheries were responsible for 72%, 17%, and 6%, respectively, of all “grenadier, unidentified” catch in 2011 (Bellman et al. 2012).

Grass rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

High
The Fishbase vulnerability score for grass rockfish is 53, but the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.61.

Factor 2.2 - Abundance

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Moderate Concern
There is no assessment for grass rockfish, and the status of the population is not defined by the National Marine Fisheries Service (NMFS 2012). When combined with the 'medium' inherent vulnerability score (see Factor 1.1), the lack of information on stock status relative to reference points justifies a score of 'moderate' concern for grass rockfish south of 40°10'N.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

Low Concern
There is no stock assessment for grass rockfish. However, an estimate of the overfishing limit has been calculated for fifty data-poor stocks, including grass rockfish {Dick, E.J. & MacCall, A.D. 2010}. The authors found that recent catch (24.1t average in 2008-2009) had a relatively low probability (P=0.15) of exceeding the median overfishing limit estimate (52.3t in 2010; Table 63 in {Dick, E.J. & MacCall, A.D. 2010}). The catch in 2011 was 22.2t (Bellman, M.A., et al., 2012). Thus it is unlikely that overfishing is occurring, but the lack of a full assessment precludes a rating of 'very low concern.'

Greenstriped rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for greenstriped rockfish is 63, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.28.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
Greenstriped rockfish were last assessed in 2009 (Hicks et al. 2009). The assessment found adult biomass to be 81.4% of SB_0, above the management target of $SB_{40\%}$. Uncertainty in the assessment preculdes a rating of "very low concern."

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
Spawning output was above the management target of 40% in 2008, and it is unlikely the stock has ever fallen below this threshold (Hicks et al. 2009). Fishing mortality generally increased and occasionally exceeded the current overfishing limit during the 1970s, 1980s and 1990s but decreased to very low levels in the late 1990s and 2000s to rebuild other species. Uncertainty precludes a score of "very low concern," however.

Kelp greenling

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Medium
The Fishbase vulnerability score for kelp greenling is 48, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.83.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Moderate Concern
There has been one assessment of kelp greenling off of Oregon, in 2005. Estimated adult biomass (48.9% of SB_0) was higher than the management target ($SB_{40\%}$) (Table E-4 in {Cope, J.M. & MacCall, A.D. 2005}). For 2011 and 2012, the coastwide projected adult biomasses were 33% and 35% of SB_0, respectively, which are less than the target ($SB_{40\%}$) but greater than the overfished threshold ($SB_{25\%}$; (PFMC 2011a)). Kelp greenling off of Oregon were classified as 'not overfished' for the second quarter of 2012, with a $B:B_{MSY}$ ratio of 1.23 (NMFS 2012). Kelp greenling stock status is scored 'moderate' concern due to the projected sub-target status for 2012 and the age of the last stock assessment.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Moderate Concern
For the last year assessed (2004), kelp greenling fishing mortality was less than the target (SPR was 60% of SPR_0; Table E-4 in {Cope, J.M. & MacCall, A.D. 2005}). The catch of kelp greenling is not managed with species-specific limits, and NMFS scored kelp greenling as 'unknown' in regards to potential overfishing for 2012 (NMFS 2012). A productivity-susceptibility analysis of west coast groundfish found that kelp greenling did not have a high vulnerability to overfishing, but that they have relatively high susceptibility to fisheries (PFMC 2011a). The combination of moderate-high susceptibility and unknown impacts of recent levels of fishing mortality combine to require a score of 'moderate' for fishing mortality.

Longnose skate

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

High
The Fishbase vulnerability score for longnose skate is 55, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.53.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Low Concern
Estimated longnose skate adult biomass has been gradually declining since the early 20th century, but it still above the management target (SB40%). For the last year assessed (2007), the estimated spawning biomass for longnose skate was 66% of estimated SB_0 (Table ES-2 in {Gertseva, V.V. & Schirripa, M.J. 2008}). Longnose skate spawning biomass is projected to be 66% of SB_0 for 2011 as well (PFMC 2011a). For 2012, longnose skate is classified as 'not overfished', with a $B:B_{MSY}$ ratio of 1.647, by NMFS (NMFS 2012). The lack of a recent stock assessment precludes a score of 'very low' concern.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Low Concern
For 2011, total fishing mortality of longnose skate was 36% of the OFL, 38% of the ABC, and 84% of the ACL; this mortality was at a level that is not expected to reduce spawning biomass to less than $SB_{45\%}$ within at least the next 6 years. Approximately 75% of all non-hake commercial groundfish fishing mortality of longnose skate in 2011 was taken and mostly retained in the IFQ trawl fishery; smaller amounts were also taken and mostly discarded by the LE endorsed longline and OA longline fisheries. The stock is classified as not experiencing overfishing for 2012, but there is no recent stock assessment.
Justification:
The fishing mortality rate associated with the target $SPR_{45\%}$ was calculated at 4.3% for longnose skate in the 2008 assessment {Gertseva, V.V. & Schirripa, M.J. 2008}. Mortality rates from 2001 to the last year assessed (2007) ranged from 0.68% to 1.87% (Table ES-4 in {Gertseva, V.V. & Schirripa, M.J. 2008}). More recently, total fishing mortality of longnose skate in 2011 (1,133 t) was 36% of the OFL, 38% of the ABC, and 84% of the ACL (Bellman, M.A., et al., 2012). The stock was classified as not undergoing overfishing in 2012 (NMFS 2012).
The authors of the most recent stock assessment suggest that the proxy harvest rate of $F_{SPR45\%}$ may not be appropriate for longnose skate, as it would be expected to result in a long-term spawning biomass of 12% of SB_0 {Gertseva, V.V. & Schirripa, M.J. 2008}. Therefore, it is useful to review the potential for current harvest rates to reduce spawning biomass to less than $SB_{45\%}$.

The OFL, ABC, and ACL for 2012 are 3,006 t, 2,873 t, and 1,349 t, respectively (Table 2a to Part 660, Subpart C, (NMFS Northwest Region 2012)); this corresponds to the lower, uncertainty-adjusted alternative harvest specifications presented in (PFMC 2011a) and the 'medium' harvest scenario presented in the 2008 assessment's decision table {Gertseva, V.V. & Schirripa, M.J. 2008}. In that table, annual catches of 1,349 between 2009 and 2018 are not expected to reduce the spawning biomass to below $SB_{40\%}$ (Table 19 in {Gertseva, V.V. & Schirripa, M.J. 2008}). The 2011 total fishing mortality (1,133 t; (Bellman, M.A., et al., 2012)) was essentially the same as the 'medium' catch levels assessed in the 2008 stock assessment's decision table, and as such would not be expected to reduce longnose skate spawning biomass to less than $SB_{45\%}$ within the next 6 years.

Fishing mortality of longnose skate in non-hake commercial groundfish fisheries was 36% of the OFL in 2011 (Bellman, M.A., et al., 2012). The IFQ trawl fishery was responsible for 76% of this catch, and 75% of total longnose skate catch across all fisheries for that year (Bellman, M.A., et al., 2012). In addition, the LE endorsed longline and OA longline fisheries also caught longnose skate in amounts that were not insubstantial (6% and 13% of total non-hake commercial groundfish fishing mortality of this species, respectively); these two fisheries discarded most of their catch of longnose skate (Bellman, M.A., et al., 2012).

Longspine thornyhead

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

High
The Fishbase vulnerability score for longspine thornyhead is 60, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.47.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Very Low Concern
After declining from the 1970s through the end of the 1990s, longspine thornyhead adult biomass has steadily increased since the late 1990s (Figure d in {Stephens, A. & Taylor, I.G. 2013}). Longspine thornyhead SB_{2013} is estimated to be 75.2% of SB_0 (95% C.I. = 53.5%-96.9%), which is well above the target reference point of $SB_{40\%}$ {Stephens, A. & Taylor, I.G. 2013}.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Very Low Concern
Total fishing mortality of longspine thornyhead in 2011 was below the catch limits (28% of the OFL and 33% of the ABC; (Bellman, M.A., et al., 2012)). The stock was also classified as not experiencing overfishing for 2012 by NMFS (NMFS 2012). Estimated SPR for 2012 was above $SPR_{50\%}$ (Table d in {Stephens, A. & Taylor, I.G. 2013}), which indicates that mortality was less than OFL levels.

Minor shelf and slope rockfish complexes

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High

Other rockfish caught in the ITQ trawl fishery in relatively small quantities include those listed below (for an exhaustive list see Appendix H). All are considered to be have "high" inherent vulnerability.

Justification:

Species	FishBase score	Productivity score (Table 1 in (Cope, J.M., et al., 2011)
rosethorn rockfish (S. helvomaculatus)	66	1.19
silvergray rockfish (S. brevispinis)	68	1.22
stripetail rockfish (S. saxicola)	65	1.39
sharpchin rockfish (S. zacentrus)	64	1.36
shortraker rockfish (S. borealis)	71	1.22
yellowmouth rockfish (S. reedi)	63	

Figure 11: Table 2.1

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High Concern

The rockfish listed here are managed in the minor shelf and slope rockfish complexes. None have been assessed (PFMC 2012b). An unknown stock status combined with a high vulnerability to overfishing score requires a rating of "high concern" for stock status.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern

Each of the minor rockfish complexes have an overarching overfishing limit associated with them, calculated from the sum of the component species' overfishing limits (PFMC 2012b). Estimated fishing mortality in 2012 was well below (<33%) the overfishing limit for each complex {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}, so the complexes are classified as not undergoing overfishing. Overfishing limits are also set for each component species where possible, though the PFMC's Science and Statistical Committee recommends against using these 'limits' to evaluate whether overfishing is occurring for component stocks (PFMC 2013b). Instead, in cases where overfishing limits are consistently exceeded for component stocks, the level of concern for those stocks is raised by managers, allowing for discussion of additional management measures (e.g. reduced harvest guidelines), removing from the complex, prioritizing those stocks for assessment and so on. The overfishing limit for most component species in the north and south minor shelf and slope rockfish complexes was not exceeded in 2012, but there were some exceptions: aurora, blackgill, rougheye, shortraker rockfish, and vermilion rockfish (Table 2-2 in (PFMC 2012d)). Stock assessments have been conducted on the former three species, so these are addressed individually in the present assessment.

Several factors are considered here when rating shortraker fishing mortality. Mortality of shortraker rockfish has been higher than that species' overfishing limit for most years since 2004 (PFMC 2013f). However, the overfishing limit has also been exceeded in most years since 2004 for blackgill and rougheye rockfish (PFMC 2013), and at least in 2012 for aurora (Table 2-2 in (PFMC 2012d)), but subsequent stock assessments indicate overfishing is probably not occurring for those species (see species accounts in this assessment). Thus, the overfishing limits calculated for data poor stocks may be more conservative than necessary. Furthermore, the vast majority of the shortraker rockfish biomass and catch occurs north of the west coast EEZ in waters off British Columbia and Alaska. According to managers, it is likely the small proportion of removals in west coast fisheries will have little effect on overall stock status (PFMC 2014b).

Vermilion rockfish are mostly caught in the southern management area (South of 40°10' N.) (Table 2-2 in (PFMC 2012d)). While the component species overfishing limit was exceeded in the northern management region in 2012 (fishing mortality was 19mt; overfishing limit was 11mt), it was not in the south (fishing mortality was 233mt; overfishing limit was 308mt). The PFMC's Science and Statistical Committee notes that "combining northern and southern individual stock contributions to the OFL is more informative when determining management performace of these stocks coastwide." (PFMC 2013g). The coastwide overfishing limit was not exceeded in 2012.

A rating of 'low concern' has been applied for the minor shelf and slope rockfish complexes (other than species otherwise assessed individually in this assessment) due to the complexes' overfishing limits not being exceeded, there being few concerns over stocks that have exceeded their component overfishing limits, but there still being high uncertainty due to the lack of ful stock assessments for the majority of them.

Non-FMP flatfish complex

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
Deepsea sole and slender sole comprise the vast majority of the catch of 'non-FMP flatish' {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. The FishBase vulnerability score for these species are 52 and 47, respectively.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Moderate Concern
No stock assessments have been conducted on deepsea or slender sole, so stock status is unknown.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Moderate Concern
No information is available on fishing mortality of deepsea sole. Slender sole are considered a 'Least Concern' by the IUCN based on their wide distribution and abundance and minimal take by commercial fisheries (Monroe 2010).

Non-FMP skate complex

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High

The 'Non-FMP skate' complex comprises multiple species, several of which are caught in the IFQ bottom trawl fishery {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. The species that acounted for the majority of the catch of this complex in 2012 are listed below. All are considered to have a high vulnerability to overfishing.

Justification:

Species	FishBase Vulnerability score
Aleutian skate	86
Black skate	67
Pacific electric ray	78
Sandpaper skate	59

Figure 12: Table 2.1

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

High Concern

No stock assessments have been conducted on these species, so stock status is unknown (PFMC 2012b). The Seafood Watch criteria require a rating of high conservation concern for stocks of unknown status but that are highly vulnerable to overfishing.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern

Although no stock assessments have been completed for these species, all are listed as 'Least Concern' by the IUCN due to the majority of their biomass being in deeper waters outside of current fishing pressure eg (Davis et al. 2009).

Other flatfish complex

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium

The other flatfish complex comprises several flatfish species, some of which are caught in the IFQ bottom trawl fishery {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. The species that account for the majority of the catch of this complex in the fishery are listed below. Their FishBase vulnerability scores and productivity scores from Table 1in (Cope, J.M., et al., 2011) suggest they are typically of low to moderate vulnerability. An exception to this is rock sole, which is a high vulnerability species when using the FishBase score alone. However, (Cope, J.M., et al., 2011) suggest rock sole vulnerability is more moderate, with a prodcutivity score of 1.95 (Table 1 in (Cope, J.M., et al., 2011)).

Justification:

Species	FishBase Vulnerability score	Productivity scores (Table 1 in {Cope, J.M., et al., 2011})
Butter sole	35	2.45
Flathead sole	36	2.30
Rock sole	57	1.95
Sand sole	37	2.35

Figure 13: Table 2.1

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Moderate Concern

No stock assessments have been conducted for these stocks, so their status is unknown (PFMC 2012b).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern

Although no stock assessments have been conducted for the species in this complex (except Pacific sanddab and rex sole, assessed separately), managers have set an allowable biological catch and overfishing limit for each species which are then summed for the complex as a whole (PFMC 2012b). Catches in 2012 were below the 2012 overfishing limit for each species and for the complex as a whole (PFMC 2012b){Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. In addition, a recent assessment to identify the likelihood that a number of data poor stocks are experiencing overfishing found a 0.00% chance that that rock sole, Pacific sanddab and sand sole were (the other species in the 'Other flatfish' complex were not included inthe assessment {Dick, E.J. & MacCall, A.D. 2010}. The relatively high level of uncertainty precludes a score of 'very low concern.'

Pacific cod

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for Pacific cod is 50, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 2.11.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Moderate Concern
There is no stock assessment for west coast Pacific cod (PFMC 2011a), the population is classified by NMFS as 'unknown' in regards to potential overfished status for 2012, and the inherent resilience of Pacific cod is not 'high.'. Stock status is therefore a 'moderate' concern.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern
Total fishing mortality of Pacific cod is well below catch limits, as 2011 total mortality across all fisheries was 19% of the overfishing limit (Table 16 in (Bellman, M.A., et al., 2012)). It should be noted that Pacific cod are a Category 3 species and as such the OFL is determined by maximum historical landings (NMFS Northwest Region 2012). In a productivity-susceptibility assessment of over 80 west coast groundfish species, Pacific cod received the sixth-lowest vulnerability-to-overfishing score (Table 4-4 in (PFMC 2011a)).

Pacific grenadier

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

High
Pacific grenadier have a Fishbase vulnerability score of 79, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.44.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

High Concern
There is no stock assessment for Pacific grenadier, and the status of the Pacific grenadier stock is classified as 'unknown' by NMFS for 2012. This information, combined with the 'high' inherent vulnerability of Pacific grenadier (Factor 1.1), requires a score of 'high' concern for Pacific grenadier stock status.
Justification:
Throughout the 1990s, grenadier biomass estimates from trawl surveys were between 29,000-36,000 t; giant grenadier and Pacific grenadier were estimated to comprise 92% of grenadier biomass (Field, J.C. 2004). There are no recent assessments of the grenadier stock, and NMFS classifies Pacific grenadier as 'unknown' in regard to the potential for being overfished for 2012 (NMFS 2012).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)

Very Low Concern
To date, grenadiers have been managed as part of the 'other groundfish' complex, without species-specific catch limits. However, overfishing limits were recently estimated for Pacific grenadier (1,386.0 t), giant grenadier (638.6 t), and other grenadiers (40.1 t) (Taylor, I., et al., 2013). These overfishing limits were derived from estimated natural mortality (M), F_{MSY}/M, and survey biomass estimates (Taylor, I., et al., 2013). In 2011, mortality of Pacific grenadier was approximately 8% of the overfishing limit (and 17% if all of the 'unspecified grenadier' were Pacific grenadier) (Bellman, M.A., et al., 2012).
Justification:
In 2011, a total of 111 t of Pacific grenadier and 125 t of 'unspecified grenadier' were caught in commercial non-hake groundfish fisheries (Bellman, M.A., et al., 2012); giant and Pacific grenadier are expected to have made up the majority of the 'unspecific' catch (Field, J.C. 2004). The IFQ trawl fishery was responsible for 44% of all fisheries mortality of Pacific grenadier in 2011, the LE non-endorsed longline fishery was responsible for another 39%, and the IFQ hook and line fishery was responsible for 7% (Bellman, M.A., et al., 2012).

Pacific ocean perch

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for Pacific Ocean perch is 60, and the species' score in Table 1 of (Cope, J.M., et al., 2011) is 1.44.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High Concern
Pacific Ocean perch spawning output (a proxy for adult biomass) dropped below the overfished threshold ($SO_{25\%}$) in 1980 and has been there ever since; for 2011, Pacific Ocean perch spawning output was 19.1% of SO_0 (Table b in {Hamel, O.S., & Ono, K. 2011}). The stock is classified as 'overfished' by NMFS for 2012 ($B:B_{MSY}$ proxy ratio of 0.478, for 2012)(NMFS 2012).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
Total fishing mortality of Pacific Ocean perch in 2011 was well below (6%) the overfishing limit (Table 16 in (Bellman, M.A., et al., 2012)). The stock is on a rebuilding plan that specifies a harvest control rule of 86.4% of SPR (i.e. fishing mortality be low enough that SPR remains at 86.4 or above). Since 2002, SPR has been above 80% and as high as 91.2%; in 2010 the SPR was 87.0% (Table 8 in {Hamel, O.S., & Ono, K. 2011}). According to modeled rebuilding scenarios, an SPR of 83.9% or greater has a >70% probability of rebuilding in the maximum timeframe; an SPR of 86.4% has a 73.2% probability (Table 4 in (Hamel, O.S. 2011)).

Pacific sanddab

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low
The Fishbase vulnerability score for Pacific sanddab is 35, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 2.40.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
An assessment of the Pacific sanddab stock was recently completed. While the results of that assessment were not considered to be sufficiently reliable to serve as a basis for harvest specifications, the weight of the evidence presented in that assessment was sufficient for the PFMC's Scientific and Statistical Committee to conclude that the stock's status was "well above" the flatfish target reference point ($SB_{25\%}$; (SSC 2013)). Furthermore, that assessment indicated that Pacific sanddab spawning biomass has never been lower than $SB_{25\%}$, and has been increasing in recent years (Figure d in (He, X., et al., 2013)).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
Catches of Pacific sanddab reached their highest point in 1995, and have generally declined from 2000-2012 (Table 1 in (He, X., et al., 2013)). While the recent stock assessment was not considered to be suitable for supporting harvest specifications (SSC 2013), it does indicate that Pacific sanddab SPR_{2012} was well above $SPR_{30\%}$ (i.e., mortality was less than the proxy used for F_{MSY}) (Table d in (He, X., et al., 2013)). Furthermore, a productivity-susceptibility analysis suggests that Pacific sanddab have one of the lowest vulnerability-to-overfishing scores of all west coast groundfish (PFMC 2011a).

Petrale sole

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for Petrale sole is 55, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.70.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern
Petrale sole adult biomass declined sharply from the late 1930s to the early 1960s, declined again in the 1970s and 1980s, and remained under the limit reference point during the 1980s, 1990s, and into the 2000s (Figure d in (Haltuch, M.A., et al., 2013)). After a brief period of rebuilding, adult biomass is estimated to have declined from 2005-2010, reaching a minimum of 10.4% of SB_0 in 2010 before increasing from 2010 to 2013 (Table b in (Haltuch, M.A., et al., 2013)). In the latest assessment, SB_{2013} is estimated to be 22.3% of SB_0 (95% C.I. = 15.1%-29.5%) (Table b in (Haltuch, M.A., et al., 2013)). This is above the limit reference point (SB12.5%), but less than the target reference point (SB25%) (Figure d in (Haltuch, M.A., et al., 2013)).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Moderate Concern
Fishing mortality of petrale sole exceeded the current proxy for F_{MSY} for the last half of the 20th century and into the 2000s, and exceeded the overfishing proxy as recently as 2010. Estimates of SPR for recent years are very close to $SPR_{30\%}$, and total fishing mortality of petrale sole in 2011 was >90% of the OFL.

Justification:
Petrale sole fishing mortality exceeded the current F_{MSY} proxy (i.e., SPR values were lower than $SPR_{30\%}$) from the 1950s through 2010 (Haltuch, M.A., et al., 2013). Estimates of recent SPR are very close to $SPR_{30\%}$ (Figure e in (Haltuch, M.A., et al., 2013)). Petrale sole fishing mortality in 2011 (953 t) was 93% of the OFL and 98% of the ABC and ACL (Table 16 in (Bellman, M.A., et al., 2012)). Mortality in the non-hake commercial groundfish fisheries was 79% of the OFL, and the IFQ trawl fishery accounted for 85% of total estimated petrale sole mortality across all fisheries in 2011 (Bellman, M.A., et al., 2012).

Rex sole

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for rex sole is 65, but the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 2.05. Rex sole inherent vulnerability is therefore scored "medium".

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
Rex sole adult biomass sharply declined from the 1950s through the 1980s, approaching and perhaps going beneath the current flatfish target reference point ($SB_{25\%}$) in the late 1970s and through the 1980s (Figure 117 in (Cope, J., et al., 2013)). Biomass then sharply increased during the 1990s and 2000s, and in the latest assessment, estimated SB_{2013}:SB_0 is 0.80 (95% C.I. = 0.64-0.93; Table ES1 in (Cope, J., et al., 2013)).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
Total catches of rex sole exceeded 1,000 t (and often exceeded 2,000 t) in each year from 1952 through 1992; however, catches have been <1,000 t/year since 1997 and <500 t/year in 2011 and 2012 (Table 17 in (Cope, J., et al., 2013)). Estimated fishing mortality in 2012 was a fraction of the overfishing limit (F_{2012}:$F_{MSY=}$0.07 (Table ES1 in (Cope, J., et al., 2013)), and continued catches similar to those in the past several years are projected to allow adult biomass to increase (Table 74 in (Cope, J., et al., 2013)).

Rougheye rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

High
The Fishbase vulnerability score for rougheye rockfish is 69, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.17.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Very Low Concern
In the first assessment of the rougheye/blackspotted rockfish complex, adult biomass is estimated to have sharply declined during the 1980s and 1990s before leveling out above the target reference point (Figure d in (Hicks, A.C., et al., 2013)). Rougheye/blackspotted rockfish SB_{2013} is estimated to be 47.3% of SB_0 (95% C.I. = 30.5%-64.2%; Table b in (Hicks, A.C., et al., 2013)). This is above the target reference point of $SB_{40\%}$(Figure d in (Hicks, A.C., et al., 2013)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Moderate Concern
Overfishing was occurring on rougheye rockfish from 2008 to 2011 (SPR was less than $SPR_{50\%}$) during the 2008-2011 period (Table d in (Hicks, A.C., et al., 2013)). For 2012, the estimated SPR was 51.0% (95% C.I. = 32.2%-69.8%; Table d in (Hicks, A.C., et al., 2013)), bringing rougheye rockfish out of overfishing status. However, the several years of overfishing before 2012 and the lower 95% CI bound in 2012 being higher than the overfishing limit preclude a rating of 'very low' or 'low' concern.

Sablefish

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

Low
The Fishbase vulnerability score for sablefish is 49, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.61.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

Moderate Concern

Estimated sablefish adult biomass dropped under the management target ($SB_{40\%}$) in 2009, and has diminished further during the subsequent two years (Stewart, I.J., et al., 2011). This is a continuation of a sharp downward trend that is entering its fourth consecutive decade (Figure 7). While the estimated spawning biomass for 2011 is above the $SB_{25\%}$ overfished threshold (Figure 7), the clear and persistent downward trend in abundance, the current sub-target status of spawning biomass, and the uncertainty in the biomass estimates, compels a score of "moderate" concern for U.S. West Coast sablefish.

Justification:

Estimated sablefish spawning biomass has been trending downwards since the beginning of the 1980s; this trend is attributed to large catches during the late 1970s and early 1980s (Stewart, I.J., et al., 2011). In recent years, estimated sablefish biomass has declined from 47% of SB_0 in 2002 to 35% of SB_0 in 2010, and the 2011 assessment estimates that 2011 sablefish has declined further, to 33% of SB_0 (95% C.I. = 18-49%;(Stewart, I.J., et al., 2011). This is below the management target ($SB_{40\%}$) but above the overfished threshold ($SB_{25\%}$) (Figure 7). There is a high degree of uncertainty in the current assessment's estimation of spawning biomass: the estimate is 60,957 t, and the 95% confidence intervals are substantial (16,418 – 104,495 t)(Stewart, I.J., et al., 2011).

Due to their stock status, sablefish are one of three species classified as being in the 'precautionary zone', along with Pacific whiting and blue rockfish (PFMC 2011a). Most recently, NMFS has classified sablefish as "not overfished", with a ratio of $B:B_{MSY}$ proxy of 0.837 (NMFS 2012).

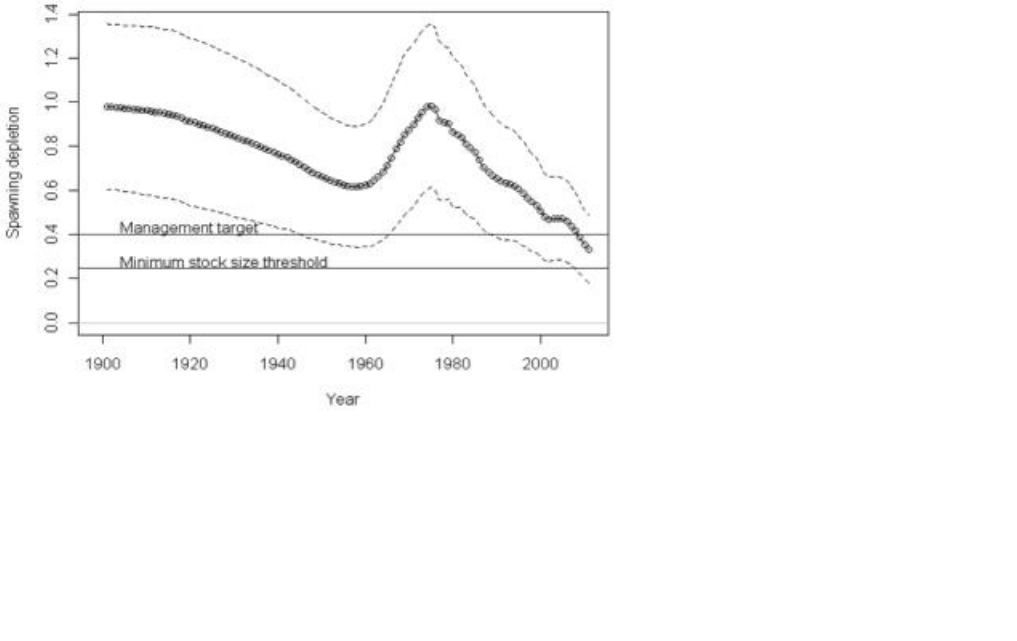


Figure 7. Estimated sablefish spawning biomass relative to SB0, with 95% confidence intervals (figure fromStewart, I.J., Thorson, J.T., and Wetzel, C. 2011).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish

pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

Moderate Concern

There are many pieces of information to consider when assigning a score to sablefish mortality. In 2009 and 2010, sablefish SPR was slightly less than the target ($SPR_{45\%}$); by definition, this constitutes overfishing for those years.

However, the 2011 total fishing mortality of sablefish was less than catch limits, and the stock was classified as not experiencing overfishing in 2012. Given the high degree of uncertainty regarding the current stock assessment, the fact that fishing mortality seems to have been increasing over the four years preceding the recent stock assessment, and the fact that estimated SPR for sablefish in 2010 was less than $SPR_{45\%}$ and was the lowest estimate since the late 1970s, fishing mortality for sablefish is scored "moderate" concern. For reasons explained in greater detail below, this score is applied to any commercial groundfish fishery for which 'north' or 'south' sablefish accounted for >20% of fishery catch in 2011, or which accounted for >20% of total fishing mortality of 'north' or 'south' sablefish in the same year. Thus, the IFQ trawl, IFQ hook and line, IFQ pot, LE endorsed longline, LE endorsed pot, LE non-endorsed longline, LE non-endorsed pot, OA longline, and OA pot fisheries receive scores of "moderate" concern for their catch of sablefish in 2011.

Justification:

The most recent stock assessment attributes the continuing decline in sablefish abundance "primarily to relatively poor recruitments", because fisheries exploitation was below target rates from 1998 through 2008 (Stewart, I.J., et al., 2011). Despite this, the study also notes that relative SPR (1-SPR/1-$SPR_{45\%}$) and relative exploitation rate increased sharply over the 4 years immediately prior to the assessment (Stewart, I.J., et al., 2011). The relative SPR for 2009 and 2010 both exceeded 100% (with 95% C.I.s of approximately 60-146%; Table c in (Stewart, I.J., et al., 2011)). This means that, for these two years, overfishing was occurring (Stewart, I.J., et al., 2011). The 2009 and 2010 relative SPRs are the highest estimated since the large catches of the late 1970s and early 1980s (Figure 8) when the stock was more abundant (Figure 9).

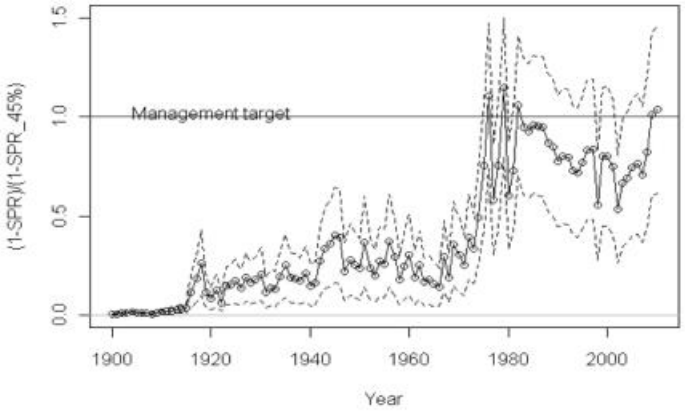


Figure 8. Relative Spawning Potential Ratio (1-SPR/1-SPR45%), with 95% confidence intervals. A relative SPR value of >1.0 indicates overfishing for that year. (Figure from Stewart, I.J., Thorson, J.T., and Wetzel, C. 2011).

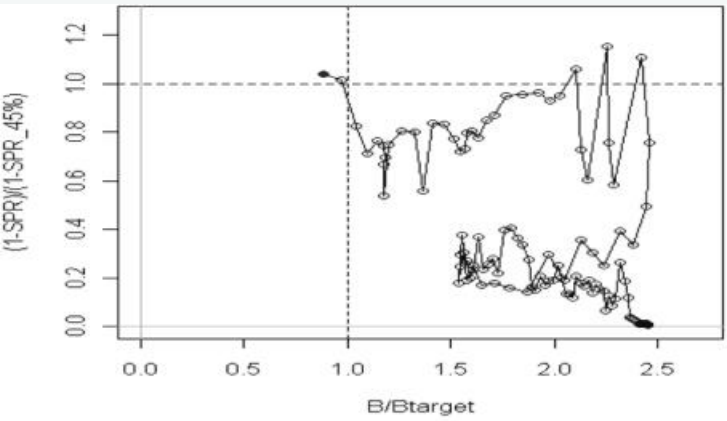


Figure 9. Fishery exploitation, expressed as Relative SPR (1-SPR/1-SPR45%), compared to stock status (SB/SB40%) (Figure from Stewart, I.J., Thorson, J.T., and Wetzel, C. 2011).

In apparent contradiction to the SPR-based estimates of potential overfishing in 2009 and 2010, the assessment also notes that from 2001-2010, estimated 'dead' catch (landings + modeled estimates of discarding) exceeded the overfishing limit in only one year (2008) (Table d in (Stewart, I.J., et al., 2011)). Furthermore, from 2010 through 2012, NMFS classified U.S. west coast sablefish as not experiencing overfishing (NOAA Fisheries 2012).

Total fishing mortality of sablefish (coastwide) in 2011 was 75% of the OFL, 78% of the ABC, and 97% and 94% of the north and south ACLs, respectively (Table 16 in (Bellman, M.A., et al., 2012)). For that year, non-hake commercial

groundfish fishing mortality of sablefish north of 36°N was 87% of uncertainty-adjusted ACL, and 94% of the ACL south of 36°N (Bellman, M.A., et al., 2012). The distribution of 'north' sablefish catch among fisheries reflected allocations: the IFQ, LE sablefish-endorsed, LE sablefish non-endorsed, and Open Access fixed gear fisheries all caught more than 90% of their allocations of 'north' sablefish in 2011 (with the LE non-endorsed fishery exceeding its allocation due to catch in the LE non-endorsed longline sector) (Bellman, M.A., et al., 2012). The catch of 'south' sablefish was primarily distributed among IFQ hook and line (12% of commercial groundfish fishery catch of 'south' sablefish), IFQ pot (23%), non-endorsed longline (44%), and the OA longline (8%) and pot (5%) fisheries (Bellman, M.A., et al., 2012).

In most occasions, the determination of a score for this factor requires consideration of the fishery's catch of a species relative to the total catch of the species, and if it is found that the fishery's contribution to total mortality is relatively minor, the fishing mortality score is adjusted accordingly. The amounts of sablefish caught in the various commercial groundfish fisheries varies considerably from fishery to fishery, and at first glance, it would seem that sablefish would require several different mortality scores to reflect the various fisheries' contributions to sablefish mortality. However, the analyst believes that the distribution of sablefish catch among these fisheries is largely a reflection of allocation and other management decisions, and does not reflect more or less sustainable practices between the fisheries. The score for sablefish mortality is therefore based on total sablefish mortality across all non-hake groundfish fisheries, and this single score is applied to the sablefish catch of any fishery for which sablefish constituted >20% of the catch OR to any fishery that caught >20% of total 'north' or 'south' sablefish.

In 2011, the fisheries for which 'north' and/or 'south' sablefish constituted >20% of total catch were the IFQ hook and line, IFQ pot, LE endorsed longline, LE endorsed pot, LE non-endorsed longline, LE non-endorsed pot, OA longline, and OA pot. 'North' sablefish constituted only 9% of the IFQ trawl fishery's total catch, but due to the scale of this fishery, this still amounted to 31% of total fishing mortality of 'north' sablefish. These are the fisheries for which a common score for sablefish mortality will be assigned.

Shortbelly rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Medium
The Fishbase vulnerability score for shortbelly rockfish is 43, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.94.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Low Concern
Shortbelly rockfish was estimated to be 67% of SB_0 in 2005 (Field et al. 2008). This is above the target reference point of $SB_{40\%}$. The age of the stock assessment precludes a rating of "very low concern."

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
There are no commercial or recreational fisheries for shortbelly rockfish. While the 2007 stock assessment did not provide fishing mortality reference points (Field et al. 2008), total fishing mortality is very low compared to the species' allowable biological catch (7.45/5789mt in 2012) (Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013) {PFMC & NMFS 2010}.

Shortspine thornyhead

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

High
The Fishbase vulnerability score for shortspine thornyhead is 70, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.33.

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Very Low Concern
Shortspine thornyhead adult biomass has declined somewhat since the 1980s, but has stayed well above the target reference point (Figure d in {Taylor, I.G. & Stephens, A. 2013}). Shortspine thornyhead SB_{2013} is estimated to be 74.2% of SB_0 (95% C.I. = 56.1%-92.3%) (Table b in {Taylor, I.G. & Stephens, A. 2013}).

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)

Very Low Concern
Shortspine thornyhead fishing mortality was below catch limits in 2011 (42% of OFL, 44% of ABC, and 53% and 45% of north and south ACLs, respectively; Table 15 in (Bellman, M.A., et al., 2012)). In 2011, the ITQ trawl fishery and LE non-endorsed longline fishery together accounted for 40.7% of the coast-wide OFL, 42.6% of the ABC, and 61.7% of the ACL; combined, these fisheries accounted for some 94% of total fishing mortality (Bellman, M.A., et al., 2012). For 2012, shortspine thornyhead SPR exceeded $SPR_{50\%}$ (Table d in {Taylor, I.G. & Stephens, A. 2013}), which indicates that mortality was less than OFL levels. The stock was classified as not experiencing overfishing in 2012 (NMFS 2012).

Spiny dogfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

High
The Fishbase vulnerability score for spiny dogfish is 70 and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.11.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Very Low Concern
Estimated spiny dogfish spawning output (a proxy for adult biomass) for 2011 was 63% of unfished spawning output; both this estimate and the associated lower confidence interval are above the target reference point ($SO_{40\%}$).

Justification:
Spiny dogfish spawning output dropped sharply from approximately 1940 to 1950 (Figure ES-2 in {Gertseva, V. & Taylor, I.G. 2012}), due to removals by the target fishery for dogfish liver. Following the cessation of the liver fishery, a gradual and moderate increase in spiny dogfish spawning output persisted until the late 1970s, when a fishery began targeting dogfish for human consumption. For the past four decades, spiny dogfish spawning output has gradually but steadily declined due to fishing mortality and the stock's low productivity {Gertseva, V. & Taylor, I.G. 2012}. For 2011, the spawning output is estimated to be 44,660 thousand fish (95% C.I. = 8,937 – 80,383 thousand). This is 63% of SO_0 {Gertseva, V. & Taylor, I.G. 2012}, and both the estimated spawning output and the associated lower confidence interval are above the management target of $SO_{40\%}$ and the overfished threshold of $SB_{25\%}$ (Figure ES-4 in {Gertseva, V. & Taylor, I.G. 2012}).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Very Low Concern

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 $SPR_{45\%}$.

Justification:

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 (Bellman, M.A., et al., 2012); this is a substantial reduction from catch levels in recent years (Table ES-1 in {Gertseva, V. & Taylor, I.G. 2012}).

Estimated spiny dogfish SPR was well below $SPR_{45\%}$ for several years during the 1940s liver fishery, but for all other years it has exceeded $SPR_{45\%}$ (Figure ES-5 in {Gertseva, V. & Taylor, I.G. 2012}). Most recently, estimated SPR for the period 2001-2010 has been well above $SPR_{45\%}$, with the estimated SPR for 2010 being 79% (Table ES-4 in {Gertseva, V. & Taylor, I.G. 2012}). However, it is worth noting a concern raised by the authors of the stock assessment: $SPR_{45\%}$ may not be an appropriate target for spiny dogfish, as it is "expected to severely reduce the spawning output of spiny dogfish over the long term" {Gertseva, V. & Taylor, I.G. 2012}. This is because spiny dogfish have 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, V. & Taylor, I.G. 2012}. The authors' suggestion does not impact the recommendation in this assessment, as the estimated 2010 SPR (79%) exceeds this suggested management target as well.

Splitnose rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for splitnose rockfish is 66, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.28.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
The estimated spawning output (a proxy for adult biomass) of splitnose rockfish has exceeded $SO_{40\%}$ since 2003, and has been increasing relative to SO_0 since 1999. For the last year assessed (2009), estimated splitnose rockfish spawning output was above $SO_{40\%}$.

Justification:
Estimated splitnose rockfish spawning output declined from the 1960s through the 1990s (Gertseva, V.V., et al., 2009). Splitnose rockfish spawning output was below $SO_{40\%}$ from 1995-2003, but has been increasing since 1999 (35.8%) through the last year assessed (2009; 65.6%) (Table 19 in (Gertseva, V.V., et al., 2009)). The 2009 SO estimate is the highest since 1978 (Table 19 in (Gertseva, V.V., et al., 2009)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
For the most recent year assessed (2008), splitnose rockfish SPR was well above the target $SPR_{50\%}$, and the fishing mortality rate for splitnose rockfish was well below $F_{SPR50\%}$. Non-hake commercial groundfish fishing mortality of splitnose rockfish south of 40°10'N was less than 3% of the OFL in 2011, and the coast-wide stock of splitnose rockfish is classified as not experiencing overfishing for 2012.

Justification:
As of the last year assessed (2008), splitnose rockfish SPR was 93.45%, which exceeds the target $SPR_{50\%}$ (Table ES-4 in (Gertseva, V.V., et al., 2009)). The 2009 assessment estimated that the exploitation rate associated with $SPR_{50\%}$ was 0.033; exploitation rates were less than 0.003 for the last two years assessed (2007 and 2008) (Table ES-4 in (Gertseva, V.V., et al., 2009)). More recently, non-hake commercial groundfish fishing mortality of splitnose rockfish south of 40°10'N was 2.7% of the OFL in 2011 (Bellman, M.A., et al., 2012). For 2012, splitnose rockfish are classified by NMFS as not experiencing overfishing (NMFS 2012). The IFQ trawl fishery was the source for 95% of all fisheries catch of 'splitnose rockfish south of 40°10'N in 2011 (Bellman, M.A., et al., 2012).

Spotted ratfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High
The Fishbase vulnerability score for spotted ratfish is 50, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.63.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Moderate Concern
There is no information regarding the status of the spotted ratfish stock off of the west coast. The stock status of spotted ratfish is thus scored 'moderate' concern as its status is not known and the inherent vulnerability of the species is 'medium'.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

Very Low Concern
In 2011, non-hake commercial groundfish fishing mortality of spotted ratfish was approximately 73 t; the IFQ trawl fishery accounted for 95% of this mortality and 95% of total estimated mortality of spotted ratfish across all fisheries that year (Appendix B; (Bellman, M.A., et al., 2012)). The 2011 catch was well below the recently developed OFL estimate for ratfish (1,272.4 t; Table 1 in (Taylor, I., et al., 2013)). The IFQ trawl fishery discarded over 99% of its spotted ratfish catch (Bellman, M.A., et al., 2012). In addition, ratfish received a score of 'low concern' regarding vulnerability to overfishing in a productivity-susceptibility assessment of west coast groundfish (PFMC 2011a).

Starry flounder

Factor 2.1 - Inherent Vulnerability

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Medium
The Fishbase vulnerability score for starry flounder is 51, and the species is not assessed in (Cope, J.M., et al., 2011).

Factor 2.2 - Abundance

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Low Concern
Starry flounder was last assessed in 2005 (Ralston. 2005). That assessment considered starry flounder as two populations, and estimated that both the northern and southern populations were well above the 40% of SB0 precautionary threshold (44% of SB0 in Washington-Oregon and 62% in California). NMFS classifies the popualtion as not overfished, with a B/BMSY of 1.25 (NMFS 2012). The age of the assessment precludes a rating of 'very' low concern, however.

Factor 2.3 - Fishing Mortality

Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)

Very Low Concern
The 2005 assessment estimated that recent (at that time) exploitation rates were well below the FMSY proxy for flatfish (at that time F40%, now F30%) (Ralston. 2005). More recently, the catch has been a fraction of the species-specific overfishing limit 17/1813mt in 2012 {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}. Despite the age of the assessment, an exploitation rate this low is considered a 'very low' concern.

Vermilion rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

High
The Fishbase vulnerability score for vermilion rockfish is 63, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.22.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

High Concern
The status of the vermilion rockfish stock off of the coast of California was last assessed in 2005 (MacCall, A.D. 2005). However, the stock off of the coast of Oregon has not been assessed. The vermilion rockfish stock's status off of the coast of California was "unknown" in 2012 (NMFS 2012). When combined with the 'high' inherent vulnerability score, the lack of information on stock status relative to reference points justifies a score of 'high' concern for vermilion rockfish.

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)

Low Concern
There is no information regarding the appropriateness of current levels of fishing mortality for vermilion rockfish (e.g. (NMFS 2012)). In a productivity-susceptibility assessment, vermilion rockfish are identified as a 'species of high concern' in regards to vulnerability to overfishing (PFMC 2011a). However, in 2012, commercial catches of vermilion rockfish were less than 7% of the species' total fishing mortality south of 40°10'N, and were approximately 21% of the species' total mortality north of 40°10'N (Table 15 in {Bellman, M.A., Al-Humaidhi, J., Jannot, J. & Majewski, J. 2013}).

Widow rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

High
The Fishbase vulnerability score for widow rockfish is 65, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.31.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Very Low Concern
After being considered overfished in the 1990s and early 2000s, an up-to-date stock assessment estimates that the 2011 adult biomass of widow rockfish is above the target reference point of $SB_{40\%}$ (51.1% of SB_0 in 2011; (He, X., et al., 2011)). Widow rockfish were classified as 'not overfished' for 102 ($B:B_{MSY}$ proxy ratio of 1.277; (NMFS 2012)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Very Low Concern
Total fishing mortality of widow rockfish was 216 t in 2011; this was 4% of the overfishing limit (Table 16 in (Bellman, M.A., et al., 2012)). Widow rockfish SPR has been above 95% since 2003, and SPR for 2010 was 97.5%, well above the management target of SPR50% (Table ES5 in (He, X., et al., 2011)). Since 2002, exploitation rates have been less than 1%, whereas three calculations of sustainable exploitation rate are all above 6.7% (Table ES4 in (He, X., et al., 2011)). Finally, the stock is classified as 'not overfished' by NMFS for 2012 (NMFS 2012).

Yelloweye rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

High
The Fishbase vulnerability score for yelloweye rockfish is 73, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.22.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

High Concern
Yelloweye spawning output dropped rapidly from the 1970s through the 1990s, dropped below the current management target ($SO_{40\%}$) in 1988 and below the overfished limit ($SO_{25\%}$) in 1994, and reached a minimum of 15.7% of SO_0 in 2000 (Table 21 in {Taylor, I.G. & Wetzel, C. 2011}). Estimated spawning biomass has increased in every year after 2001 due to harvest restrictions put in place after declaration of the species as 'overfished' in 2002. The 2011 estimated spawning output is 21.3% of SO_0 (Table 21 in {Taylor, I.G. & Wetzel, C. 2011}). This is below the overfished limit ($SO_{25\%}$), and as a result yelloweye is classified as 'overfished' by NMFS (NMFS 2012).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline

Very Low Concern
Yelloweye SPR was estimated at 83.5% for 2010, which exceeds $SPR_{50\%}$, exceeds the selected rebuilding target, and is similar to two harvest scenarios that have >80% probability of allowing the stock to rebuild in the maximum time frame. Mortality in non-hake commercial groundfish fisheries has constituted approximately 35% of the total annual mortality of yelloweye over the past several years. Non-hake commercial groundfish fishing mortality in 2011 was approximately 3% of that year's OFL and was spread out among several commercial groundfish fisheries. As current levels of fishing mortality do not constitute overfishing and are not projected to hinder rebuilding, the score for yelloweye rockfish fishing mortality is a 'very low' concern for the IFQ trawl, IFQ hook and line, LE endorsed longline, and Nearshore North and South fisheries.
Justification:
Exploitation rates, which reached a high of 12.3% in 1997, have been below 1% for all but one year after 2002 (Table 21 in (Taylor, I.G. 2011)). Yelloweye rockfish SPR was above 90% of SPR_0 during the 1930s, declined to 72% by 1968, and then commenced a rapid decline that would persist until 1997 (Table 21 in {Taylor, I.G. & Wetzel, C. 2011}). Yelloweye SPR dropped below the overfishing limit ($SPR_{50\%}$) in 1976, and reached its lowest level (9.4% of SPR_0) in 1992. Yelloweye SPR has increased in the years since 1999, exceeding $SPR_{50\%}$ in 2000 and continuing to climb until the last year in the data (2010), when SPR was estimated at 83.5% of SPR_0 (Table 21 in {Taylor, I.G. & Wetzel, C. 2011}). The 2010 SPR exceeds the SPR rebuilding target (76%) that was selected in 2010 {Taylor, I.G. & Wetzel, C. 2011}. It is also worth noting that, in the most recent review of the yelloweye rebuilding plan, two modeled scenarios with SPRs (80.5% and 86.4%) that bracket the SPR_{2010} had probabilities of recovery of 82.8% and 93.7%, respectively, by the maximum year (Table 6 in (Taylor, I.G. 2011)).
Commercial catch has accounted for an average of 35% of total annual mortality since the implementation of the rebuilding plan; recreational catch makes up the balance (Table 2 in (Taylor, I.G. 2011)). Non-hake commercial groundfish fishing mortality of yelloweye rockfish was 1.4 t in 2011; this catch represented approximately 3% of the OFL and ABC, and 8.3% of the ACL, and was 16% of total yelloweye mortality across all fisheries (Bellman, M.A., et al., 2012). The catch of yelloweye in the non-hake commercial groundfish fisheries was spread out in small amounts among the IFQ trawl, IFQ hook and line, LE sablefish longline, and Nearshore North and South fisheries (Bellman, M.A., et al., 2012).

Yellowtail rockfish

Factor 2.1 - Inherent Vulnerability

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

High
The Fishbase vulnerability score for yellowtail rockfish is 56, and the species' productivity score in Table 1 of (Cope, J.M., et al., 2011) is 1.33.

Factor 2.2 - Abundance

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Very Low Concern
Yelllowtail rockfish are separated into two stocks: one that is north of 40°30'N, and one that is south {Wallace, J. & Lai, H.L. 2005}. In the information available for this assessment, catch of yellowtail rockfish is separated for catches north and south of 40°10'N. In 2011, catch of the 'south' stock in non-hake commercial groundfish fisheries was 2.2% of 'south' yellowtail rockfish total mortality across all fisheries (Bellman, M.A., et al., 2012). Therefore, the 'south' stock is not included in this assessment.

'North' yellowtail rockfish spawning biomass was essentially 100% of SB_0 prior to World War II, but declined thereafter, potentially approaching the target reference point (SB40%) during the 1980s and 1990s (Figure 89 in (Cope, J., et al., 2013)). Spawning biomass has increased in the 2000s, and estimated SB_{2012}:SB_0 was 0.69 (95% C.I. = 0.35-0.90; Table ES1 in (Cope, J., et al., 2013)).

Factor 2.3 - Fishing Mortality

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Very Low Concern
For 2011, total fishing mortality of yellowtail rockfish north of 40° 10' N was 1,352 t, which was approximately 30% of the overfishing limit; Table 16 in (Bellman, M.A., et al., 2012)). Estimated F_{2012}:F_{MSY} was 0.14 (Table ES1 in (Cope, J., et al., 2013)). Continued catches at levels similar to recent years is projected to allow spawning biomass to increase (Table 72 in (Cope, J., et al., 2013)).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore

20-40%
The discard:landings score for this fishery is 0.95 (20-40%). See Appendix C for rationale.

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery

< 20%
The discard rate:landings score for this fishery is 1.0 (<20%). See Appendix C for rationale.

Criterion 3: Management Effectiveness

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

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

The Criterion 3 rating is determined as follows:

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

Criterion 3 Summary

FISHERY	HARVEST STRATEGY	BYCATCH MANAGEMENT STRATEGY	SCORE
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	3.000	3.000	**Yellow (3.000)**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	4.000	3.000	**Green (3.464)**
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	3.000	0.000	**Yellow (3.000)**
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	4.000	3.000	**Green (3.464)**

Factor 3.1 Summary

FISHERY	STRATEGY	RECOVERY	RESEARCH	ADVICE	ENFORCE	TRACK	INCLUSION
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Moderately Effective	Highly effective
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	Highly effective	Highly effective	Highly effective	Highly effective	Highly effective	Moderately Effective	Highly effective
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	Moderately Effective	Highly effective	Moderately Effective	Highly effective	Highly effective	Moderately Effective	Highly effective
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	Highly effective	Highly effective	Highly effective	Highly effective	Highly effective	Moderately Effective	Highly effective

Factor 3.2 Summary

FISHERY	ALL SPECIES RETAINED?	CRITICAL?	STRATEGY	RESEARCH	ADVICE	ENFORCE
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	No	No	Moderately Effective	Moderately Effective	Highly effective	Highly effective
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	No	No	Moderately Effective	Highly effective	Highly effective	Highly effective
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	Yes	No				
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	No	No	Moderately Effective	Moderately Effective	Highly effective	Highly effective

The purpose of Criterion 3 is to assess the effectiveness of the overall management regime with respect to the main retained species (Criterion 3.1) which includes lingcod and spiny dogfish, and the main bycatch species (Criterion 3.2). The criteria define effective management via a number of guidelines. Due to the multi-species nature of some of the west coast groundfish fisheries, achieving all of the requirements is challenging. However, the management of the groundfish stocks caught in the west coast groundfish fisheries is strong, as it is characterized by up-to-date stock assessments and management measures such as biomass reference points, harvest control rules, and incorporation of uncertainty when determining catch limits.

Criterion 3 Assessment

SCORING GUIDELINES

Subfactor 3.1.1 – Management Strategy and Implementation
Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Subfactor 3.1.2 – Recovery of Species of Concern
Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.

Subfactor 3.1.3 – Scientific Research and Monitoring
Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Subfactor 3.1.4 – Management Record of Following Scientific Advice
Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Subfactor 3.1.5 – 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.

Subfactor 3.1.6 – Management Track Record

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

Subfactor 3.1.7 – Stakeholder Inclusion

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

Subfactor 3.2.2 – Management Strategy and Implementation

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

Subfactor 3.2.3 – Scientific Research and Monitoring

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

Subfactor 3.2.4 – Management Record of Following Scientific Advice

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

Subfactor 3.2.5 – Enforcement of Management Regulations

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

Factor 3.1.1 - Critical?

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

No

Factor 3.1.2 - Mgmt Strategy / Implement

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Moderately Effective
The management of the main retained species in the non-nearshore fisheries is scored "highly effective", as >50% of each of these fisheries' main species have biomass reference points, harvest control rules, and/or explicit buffering against risk and uncertainty built into catch limits. Less than 40% of the main retained species in the two nearshore fisheries achieve these standards, and therefore these two fisheries are scored "moderately effective".
Justification:
See Detailed Rationale for the other fisheries above for more detail.

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
The management of the main retained species in the non-nearshore fisheries is scored "highly effective", as >50% of each of these fisheries' main species have biomass reference points, harvest control rules, and/or explicit buffering against risk and uncertainty built into catch limits. Less than 50% of the main retained species in the two nearshore fisheries achieve these standards, and therefore these two fisheries are scored "moderately effective".
Justification:
Reference points
Appendix H shows which species have biomass reference points. Where they exist, these decision-making references meet the Seafood Watch standard for effective management.
Incorporating Uncertainty and Risk Aversion: Determination of ABC and ACL
A formal process is in place to buffer for uncertainty and risk aversion through the determination of the ABC and ACL. After the OFL has been determined (the process is described under the "Scientific Advice" section in subsequent pages), the ABC is derived from the OFL by applying a buffer against scientific uncertainty. For this step, the Scientific and Statistical Committee quantifies the stock assessment variability (σ) based on the species or stock's Category (1, 2, or 3), and the Council determines the probability (P*) that the estimated OFL is too high, given the stock assessment variability. The scientific uncertainty buffer (the difference between OFL and ABC) is determined by applying σ to the appropriate P*. The ABC, then, is essentially the OFL minus the scientific uncertainty buffer.

The Annual Catch Limit (ACL) is the harvest specification that is derived from ABC. It can be equal to or less than ABC, but not greater. The ACL is derived from ABC by taking into consideration conservation objectives, socioeconomic and ecological concerns, management uncertainty, and other sources of uncertainty (PFMC 2011b). Due to the relative lack of information for Category 2 and Category 3 stocks, a greater degree of scientific uncertainty exists regarding the OFL and the scientific uncertainty buffer between the OFL and the ABC therefore tends to be correspondingly larger. These measures are consistent with Seafood Watch guidelines for addressing uncertainty.

Harvest Control Rule
In order for management to receive a score of "highly effective", the Seafood Watch guidelines require a strategy for reducing mortality when biomass falls below a threshold, and for identifying a threshold at which mortality is reduced

to zero. The management of many retained groundfish species meets this benchmark through the "40-10" (or, for flatfish, the "25-5") harvest control rule. For Category 1 species, when estimated biomass falls below the precautionary threshold, the harvest rate begins decreasing. The precautionary threshold that triggers the harvest control rule is either B_{MSY} or the proxy ($B_{40\%}$ for non-flatfish, and $B_{25\%}$ for flatfish), or another level determined by the Council (between 25% and 50% of B_0) (PFMC 2011b). If biomass falls below $B_{10\%}$ for non-flatfish or $B_{5\%}$ for flatfish, the allowable catch is set at zero (PFMC 2011a). The actual reduction in allowable harvest takes place when the Council determines the ACL for the stock (PFMC 2011b).

There is no precautionary biomass threshold and no associated harvest control rule for Category 2 or Category 3 species.

Scoring for Management Strategy and Implementation

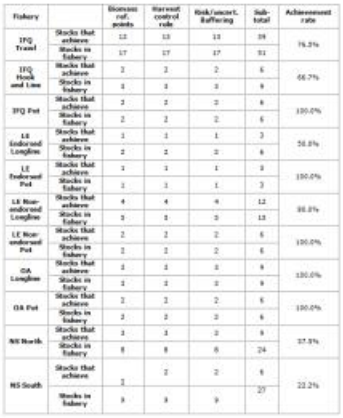
The West Coast groundfish fisheries vary in terms of the number of Criterion 1 stocks that they catch. Obviously, those that catch more stocks are more likely to catch a stock that does not currently have biomass reference points, an associated harvest control rule, etc. To avoid skewing the interpretation of "Management Strategy and Implementation" to favor fisheries with less-diverse catches, the following approach was used.

The three key components of Management Strategy and Implementation were first broken out (Table 2). Then, for each fishery, the number of Criterion 1 stocks that met each of these components was determined. The number of Criterion 1 stocks that achieved the components was then totaled, and divided by the total number of the fishery's Criterion 1 stocks multiplied by the number of management components (i.e., the total number of Criterion 1 stocks in the fishery multiplied by 3) to indicate the fishery's "achievement rate". The achievement rate is an indication of the frequency with which a fishery's stocks achieve the requirements of "Management Strategy and Implementation".

For example, three Criterion 1 stocks are caught in the IFQ Hook and Line fishery (Appendix H). Of these three stocks, two have biomass reference points, two have a harvest control rule, and two have catch limits that are explicitly buffered against uncertainty and risk (Appendix H). This fishery's Criterion 1 stocks therefore achieve six out of nine possible stock/management component combinations, for an achievement rate of 66.7% (Table 2).

As Table 2 demonstrates, all but two of the fisheries assessed in this report have achievement rates ≥50.0%. The two fisheries that have lower achievement rates are the two nearshore fisheries.

Table 2. Fisheries' achievement of the components of highly effective management strategy and implementation



Fishery		Biomass ref. points	Harvest control rule	Risk/uncert. Buffering	Sub-total	Achievement rate
IFQ Trawl	Stocks that achieve	13	13	13	39	76.5%
	Stocks in fishery	17	17	17	51	
IFQ Hook and Line	Stocks that achieve	2	2	2	6	66.7%
	Stocks in fishery	3	3	3	9	
IFQ Pot	Stocks that achieve	2	2	2	6	100.0%
	Stocks in fishery	2	2	2	6	
LE Endorsed Longline	Stocks that achieve	1	1	1	3	50.0%
	Stocks in fishery	2	2	2	6	
LE Endorsed Pot	Stocks that achieve	1	1	1	3	100.0%
	Stocks in fishery	1	1	1	3	
LE Non-endorsed Longline	Stocks that achieve	4	4	4	12	92.3%
	Stocks in fishery	5	5	5	13	
LE Non-endorsed Pot	Stocks that achieve	2	2	2	6	100.0%
	Stocks in fishery	2	2	2	6	
OA Longline	Stocks that achieve	2	2	2	6	100.0%
	Stocks in fishery	2	2	2	6	
OA Pot	Stocks that achieve	2	2	2	6	100.0%
	Stocks in fishery	2	2	2	6	
NS North	Stocks that achieve	2	2	2	6	37.5%
	Stocks in fishery	8	8	8	24	
NS South	Stocks that achieve	2	2	2	6	22.2%
	Stocks in fishery	9	9	9	27	

Figure 14: **Fishery specific information regarding the components of management strategy and implementation. Information summarized from Appendix H.**

Factor 3.1.3 - Recovery of Stock Concerns

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
Each of the seven stocks that were classified as "overfished" or "rebuilding" as of 2012 have a rebuilding strategy in place and receive regular status updates and rebuilding analyses. Harvest control rules are in place for each rebuilding species, and current mortality rates are in line with these rules. Current levels of fishing mortality have >70% probability of rebuilding the stock within the specific time frame.

Justification:
As of 2012, there were seven Pacific coast groundfish stocks that were classified as "overfished" or "rebuilding" from an overfished state: bocaccio (south of 40°10′N), canary rockfish, cowcod (south of 40°10′N), darkblotched rockfish, Pacific ocean perch, petrale sole, and yelloweye rockfish (NMFS 2012). These stocks each have a rebuilding strategy in place, and receive regular status updates and rebuilding analyses. The rebuilding analyses include estimated probabilities of recovery at different time points, based on different harvest decisions. Harvest control rules are in place for each rebuilding species, and current mortality rates are in line with these rules; current levels of fishing mortality have >70% probability of rebuilding within the specific time frame.
One species has been recently recovered: lingcod, which were declared overfished in 1999. A rebuilding plan was adopted in 2003 with a target rebuilding date of 2009 (PFMC 2011b); the stock was found to be rebuilt in the 2005 assessment {Jagielo, T.H. & Wallace, F.R. 2005}.

Factor 3.1.4 - Scientific Research / Monitoring

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot

Moderately Effective
The Seafood Watch criteria define stocks with up-to-date information as those that have stock assessments that are less than 3 years old, or regular monitoring every 1-3 years. There are up-to-date stock assessments for over 75% of the main stocks caught in each of the non-nearshore groundfish fisheries, and as such these fisheries receive a score of "highly effective". In contrast, less than 60% of the stocks in the two nearshore fisheries have up-to-date assessments. Scientific research and monitoring is scored "moderately effective" for the nearshore fisheries.
Justification:
The Seafood Watch criteria define stocks with up-to-date information as those that have stock assessments that are less than 3 years old, or regular monitoring every 1-3 years.

The composition of the groundfish fisheries' catch varies greatly from fishery to fishery, from 15 main retained species in the IFQ trawl fishery to one main retained species in the LE endorsed pot fishery (Appendix B). Those fisheries that catch a greater diversity of species are more likely to catch species for which there are no up-to-date stock assessments. To ensure consistency when assigning a score for "scientific research and monitoring" and to prevent this score from favoring fisheries with less-diverse catches, the following approach was used: for each fishery, the number of main retained species with up-to-date (i.e., 2009 or newer) assessments was divided by the total number of main retained species (both of these numbers were determined from the information presented in Appendix H). The result indicates the percentage of a fishery's main retained stocks that are covered by up-to-date stock assessments.

These calculations are shown in Table 3.

Table 3. Stocks with up-to-date stock assessments, by fishery (see Appendix H for information on stocks in each fishery).

Fishery	Stocks with new assessments	Stocks in fishery	% that are up-to-date
IFQ Trawl	13	17	76.5%
IFQ Hook and Line	3	3	100.0%
IFQ Pot	2	2	100.0%
LE Endorsed Longline	2	2	100.0%
LE Endorsed Pot	1	1	100.0%
LE Non-Endorsed Longline	5	5	100.0%
LE Non-Endorsed Pot	2	2	100.0%
OA Longline	3	3	100.0%
OA Pot	2	2	100.0%
Nearshore North	3	8	37.5%
Nearshore South	5	9	55.6%

Figure 15: **Stocks with up-to-date stock assessments, by fishery (see Appendix C for information on stocks in each fishery)**

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
The Seafood Watch criteria define stocks with up-to-date information as those that have stock assessments that are less than 3 years old, or regular monitoring every 1-3 years. As there are up-to-date stock assessments for over 66.0% of the main stocks caught in each of the non-nearshore groundfish fisheries, these fisheries receive a score of "highly effective".
Justification:
The Seafood Watch criteria define stocks with up-to-date information as those that have stock assessments that are less than 3 years old, or regular monitoring every 1-3 years.

The composition of the groundfish fisheries' catch varies greatly from fishery to fishery, from 15 main retained species in the IFQ trawl fishery to one main retained species in the LE endorsed pot fishery (Appendix B). Obviously, those fisheries that catch a greater diversity of species are more likely to catch species for which there are no up-to-date stock assessments. To ensure consistency when assigning a score for "scientific research and monitoring" and to prevent this score from favoring fisheries with less-diverse catches, the following approach was used: for each fishery, the number of main retained species with up-to-date (i.e., 2009 or newer) assessments was divided by the total number of main retained species (both of these numbers were determined from the information presented in Appendix H). Fisheries for which up-to-date assessments were available for 0-33.0% of main retained species received a sore of "ineffective", while a score of "moderately effective" was given to fisheries with 33.1-66.0% up-to-date assessments, and a score of "highly effective" was given to fisheries with >66.0% up-to-date assessments.

These calculations are shown in Table 3.

Table 3. Stocks with up-to-date stock assessments, by fishery (see Appendix H for information on stocks in each fishery).

Fishery	Stocks with new assessments	Stocks in fishery	% that are up-to-date
IFQ Trawl	13	17	76.5%
IFQ Hook and Line	3	3	100.0%
IFQ Pot	2	2	100.0%
LE Endorsed Longline	2	2	100.0%
LE Endorsed Pot	1	1	100.0%
LE Non-Endorsed Longline	5	5	100.0%
LE Non-Endorsed Pot	2	2	100.0%
OA Longline	3	3	100.0%
OA Pot	2	2	100.0%
Nearshore North	3	8	37.5%
Nearshore South	5	9	55.6%

Figure 16: **Stocks with up-to-date stock assessments, by fishery (see Appendix X for information on stocks in each fishery)**

Factor 3.1.5 - Scientific Advice

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
One of the primary avenues through which science informs management of west coast groundfish is through the determination of the OFL. The OFL sets a maximum limit on allowable catch, and ABCs and ACLs do not exceed OFLs. Therefore, compliance with science meets the standard for "highly effective" across all fisheries.
Justification:
The manner in which OFLs are determined ensures that the science is not overridden by other concerns:
Category 1 species: The OFL is determined by applying the F_{MSY} harvest rate (or proxy rate) to the current estimated exploitable biomass of the stock (PFMC 2011b).

Category 2 species: Category 2 species often lack up-to-date stock assessments or have assessments that are relatively data-poor, and often lack information for stock status, exploitation rate, and recruitment. OFLs are typically determined by historical catch-based approaches or trends in an index of abundance (PFMC 2011b).

Category 3 species and Ecosystem Component species: Category 3 and EC species are also data-poor; OFLs are set for Category 3 species based on historical catch or qualitative information, while EC species have no OFLs. The greater degree of uncertainty regarding Category 3 stocks is addressed through increasing the OFL to ABC uncertainty buffer over Category 2.

In essence, this process ensures that the maximum acceptable mortality is determined by scientists and cannot be overruled, exceeded, or otherwise ignored by managers.

Factor 3.1.6 - Enforce

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
Methods to ensure compliance with regulations include the use of fish tickets, logbooks, and Vessel Monitoring System (VMS) (PFMC 2011b). Sorted landings and associated information are recorded on state-issued fish tickets, and dockside monitoring is conducted by state employees (PFMC 2011b). Logbooks are administered by the states, and are required of all trawl vessels (PFMC 2011b).

In order to enforce area closures, both limited entry and open access vessels are required to have VMS installed and operating while fishing (NMFS Northwest Region 2012). Vessels that are required to use VMS during trips must ensure that their VMS is successfully transmitting information before participating in the fishery (NMFS Northwest Region 2012).

Factor 3.1.7 - Track Record

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South

of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Moderately Effective
The long-term track record of the management of the U.S. west coast groundfish fisheries is less than highly effective. In particular, the management track record for the period 1970-2000 was demonstrably unsuccessful, culminating in the delaration that nine species of groundfish were "overfished". Since then, however, significant changes to the management of the fisheries have combined to improve matters in recent years. Fishing capacity is managed by the Limited Entry program, which was introduced in 1994. Rebuilding plans for the overfished stocks, which were adopted in 2003 and 2004, have significantly reduced fishing mortality for these stocks. The estimated biomasses for these overfished species have been increasing in the years since overfishing plans were implemented (Figure 10). On the other hand, the management trend for sablefish, especially, is less certain. Estimated spawning biomass has been declining since the early 1980s, and it is now below the management target (SB40%), and estimated fishing mortality is now fluctuating around the target. While management has shown it is able to respond to other concerns in the fishery, this uncertainty in the management of the fishery's impacts on a major target species precludes a rating of 'highly effective.'

Justification:
Aggressive measures meant to build domestic fisheries capacity during the 1970s ultimately led to overcapitalization and overfishing, and these issues combined with environmental factors to result in steep declines in the abundance of many groundfish species during the 1970s, 1980s, and 1990s. Several species of rockfish were particularly diminished during this period (Figure 10). Subsequent management measures that significantly reduced allowable catch created economic and social turbulence, and the groundfish fishery was declared an economic disaster in January of 2000 {Shaw, W. & Conway, F.D.L. 2007}. In 2002, nine species of groundfish were declared "overfished" {Shaw, W. & Conway, F.D.L. 2007}.

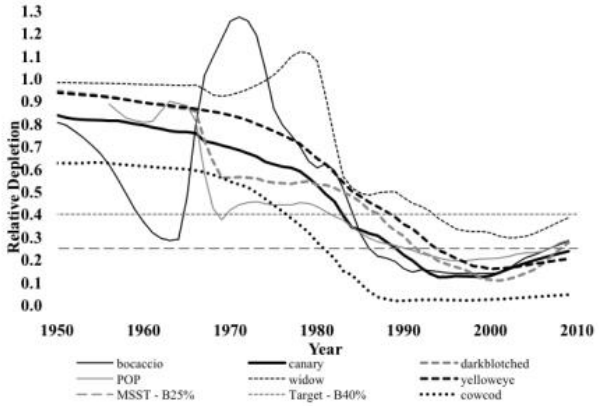


Figure 10. Estimated spawning biomass relative to SB0 for seven 'overfished' rockfish species (Figure fromPFMC 2011a).

Factor 3.1.8 - Stakeholder Inclusion

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Highly effective
The Pacific Fishery Management Council meets multiple times each year, in meetings that are open to the public (PFMC 2012). The Council receives advice from the Groundfish Advisory Subpanel, which represents the interests of commercial and recreational fisheries, tribes, conservationists, and the general public.

Factor 3.2.1 - All Species Retained?

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

No

The non-hake commercial groundfish fisheries of the U.S. west coast are multi-species fisheries, and there are few species that are always retained or always discarded. As such, there are few clear distinctions between "target" and "bycatch" species. For the purposes of this report, a "bycatch" species for a fishery is generally a main species that had a retention rate of less than 50% in that fishery; the analyst's discretion was used in situations in which the retention rate was close to 50%. By these criteria, the major species that are considered "bycatch" species are canary rockfish, Pacific grenadier, unidentified grenadier, spiny dogfish, and splitnose rockfish. Longnose skate was largely discarded in all fisheries except for the IFQ trawl fishery, and it is included here as a bycatch species for those other fisheries. Blue rockfish were primarily discarded in the Nearshore South fishery. Additionally, documented catch of humpback whales and black-footed albatross in recent years warrant their inclusion in this section.

By the standards outlined above, the IFQ pot, LE endorsed pot, LE non-endorsed pot, OA pot, and Nearshore North fisheries had no appreciable bycatch in 2011 (Bellman, M.A., et al., 2012). As such, these fisheries are exempted from this aspect of the assessment. The management of bycatch in the IFQ trawl, IFQ hook and line, LE endorsed longline, LE non-endorsed longline, OA longline, and Nearshore South fisheries is assessed as follows.

Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot

Yes

The non-hake commercial groundfish fisheries of the U.S. west coast are multi-species fisheries, and there are few species that are always retained or always discarded. As such, there are few clear distinctions between "target" and "bycatch" species. For the purposes of this report, a "bycatch" species for a fishery is generally a main species that had a retention rate of less than 50% in that fishery; the analyst's discretion was used in situations in which the retention rate was close to 50%. By these criteria, the major species that are considered "bycatch" species are canary rockfish, Pacific grenadier, unidentified grenadier, spiny dogfish, and splitnose rockfish. Longnose skate was largely discarded in all fisheries except for the IFQ trawl fishery, and it is included here as a bycatch species for those other fisheries. Blue rockfish were primarily discarded in the Nearshore South fishery. Additionally, documented catch of humpback whales and black-footed albatross in recent years warrant their inclusion in this section.

By the standards outlined above, the IFQ pot, LE endorsed pot, LE non-endorsed pot, OA pot, and Nearshore North fisheries had no appreciable bycatch in 2011 (Bellman, M.A., et al., 2012). As such, these fisheries are exempted from this aspect of the assessment.

Factor 3.2.2 - Critical?

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot

No

Factor 3.2.3 - Mgmt Strategy / Implement

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Moderately Effective
Reference points and associated harvest control rules are lacking for many of the primary "bycatch" species.
Justification:
Several commonly caught bycatch species lack biomass reference points and associated harvest control rules. This is true for Pacific grenadier, which in 2011 were primarily caught in the IFQ trawl, IFQ hook and line, and LE non-endorsed longline fisheries; unidentified grenadier, which in 2011 were primarily caught in the IFQ trawl, LE non-endorsed longline, and OA longline fisheries; spiny dogfish, which were primarily caught in the IFQ trawl fishery and were caught in several other groundfish fisheries in smaller amounts, spotted ratfish, which were caught in the IFQ trawl fishery, and blue rockfish (south of 40°10’N), which were caught and primarily discarded in the Nearshore South fishery (Bellman, M.A., et al., 2012).

Appropriate reference points are in place for longnose skate, which were mostly landed in the IFQ trawl fishery but were largely discarded in the LE endorsed longline and OA longline fisheries; canary rockfish, which were primarily caught in the Nearshore South fishery, and splitnose rockfish, which were caught almost entirely by the IFQ trawl fishery.

Factor 3.2.3 - Scientific Research / Monitoring

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery

Moderately Effective

At-sea observer coverage varies between the non-IFQ sectors (Figure 11). From 2002 to 2010, observers were present for an average of 26% LE endorsed fixed-gear landings landings, 8% LE non-endorsed fixed gear landings, 3% Open Access landings, and 5% Nearshore landings (Figure 11) (WCGOP 2012). These fisheries receive scores of "moderately effective".

Justification:

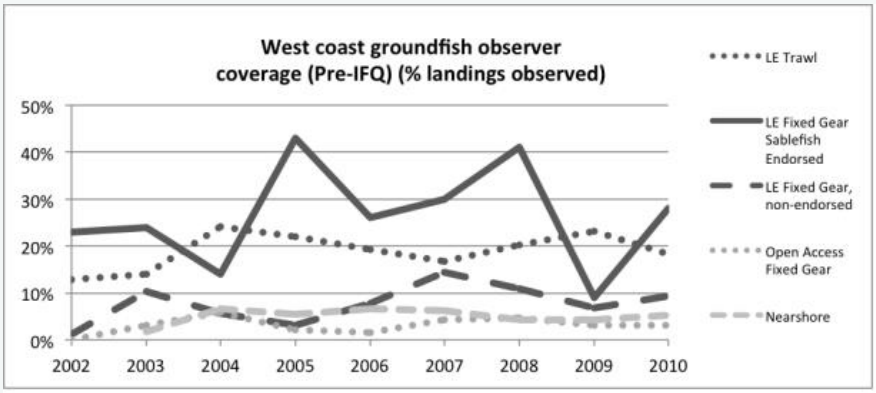


Figure 11. Observer coverage of west coast groundfish landings, 2002-2010 (Data source: WCGOP 2012).

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Highly effective
The IFQ trawl and IFQ non-trawl sectors have 100% at-sea and dockside monitoring, and as such these sectors meet the "highly effective' standard.

Factor 3.2.5 - Scientific Advice

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Highly effective
As with factor 3.1, the process for the determination of OFLs, ABCs, and ACLs is designed to ensure that managers adhere to scientific advice regarding maximum allowable catch levels.

Factor 3.2.6 - Enforce

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline

Highly effective
As with factor 3.1, a variety of mechanisms are in place to ensure "highly effective" enforcement.

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

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore	Low Concern	Minimal Mitigation	Low Concern	**Green (3.606)**
Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery	High Concern	Moderate Mitigation	Low Concern	**Yellow (2.449)**
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore	Low Concern	Minimal Mitigation	Low Concern	**Green (3.606)**
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery	Low Concern	Minimal Mitigation	Low Concern	**Green (3.606)**

By their nature, 'groundfish' tend to be demersal species, and the fisheries that target them correspondingly use bottom-tending gears. While the U.S. west coast non-hake commercial groundfish fisheries use a variety of gears, including bottom trawl, longline, pot, and hook and line gears, the common denominator between the gears is that they are expected to contact the bottom during their normal use. As such, the potential for habitat disturbance and destruction is present for all of the gears. A wealth of scientific information suggests that mobile bottom trawl gear should be expected to have the most significant impacts of all of the gears used in these fisheries; bottom longline and trap gears may also cause damage but, being fixed gears, they do not sweep over the seafloor as does trawl gear. In recognition of the potential for bottom-tending gears to damage habitat, a number of spatial restrictions on gear use are in place. These restrictions particularly limit the use of bottom trawl gear, and as such offer a degree of mitigation of bottom trawl habitat impacts.

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 - Impact of Fishing Gear on the Habitat/Substrate

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore

Low Concern
Hook and line (including troll and longline gear) and trap gears may be used in the Nearshore North and South groundfish fisheries. The 2010 observer data show no instances of bycatch of coral or sponge to indicate habitat impacts by the nearshore fisheries (see Appendix F). The score for factor 4.1 for nearshore fisheries is therefore 'low' concern.

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery

High Concern
The IFQ trawl fishery catches a variety of groundfish species, and these species in turn associate with a variety of habitats as adults (Appendix F, (PFMC 2005a)). Additional evidence of bottom trawl gear interactions with habitat include the observed bycatch of 3.09 tons of *Scleractinia* corals in the pre-IFQ LE bottom trawl fishery in 2010 (Appendx F; (WCGOP 2012)). The Seafood Watch criteria require a score of 'severe' for a fishery that uses trawls on cobble, boulder, or deep (>60 m) gravel.

Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot

Low Concern
In 2011, the Open Access fixed gear fishery primarily caught sablefish, which associate with soft substrates (see Appendix F). This fishery had no observed catch of coral or sponge in 2010 (see Appendix F). For these reasons, the impact of fishing gear on substrate is scored 'low' for the Open Access fixed gear sector.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot

Minimal Mitigation
Bottom longline and pot gears are prohibited from 15 EFH Conservation Areas that contain approximately 4.3% of the EFH in waters shallower than 700 fathoms. There are no habitats that have more than 20% representation in these closed areas. There are no other habitat impact mitigation measures in place for bottom longline and pot fisheries. Therefore, the score for impact mitigation of non-trawl gears is 'minimal' mitigation. See Appendix F for more information.

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Moderate Mitigation
There are several measures in place to mitigate the effect of bottom trawling on fish habitat on the U.S. west coast. Groundfish bottom trawling of any sort is prohibited in approximately 25% of the Essential Fish Habitat that is found in waters shallower than 700 fathoms, and expansion of groundfish bottom trawling into waters deeper than 700 fathoms is prohibited. Additionally, bottom trawling with footrope diameter that exceeds 19" is prohibited in the EEZ, and bottom trawling with footrope gear that exceeds 8" is prohibited in waters shallower than 100 fathoms.
The IFQ trawl fishery receive a score of 'moderate mitigation', for the following reasons:

- More than 20% of fishery-accessible EFH is protected from bottom trawling,

- The fishery cannot expand into deeper waters, and

- Nearly 4 out of every 5 habitats has more than 20% representation in the EFH Conservation Areas and/or the bottom trawl footprint closure.

See Appendix F for more information.

Factor 4.3 - Ecosystem-based Fisheries Management

Eastern Central Pacific, Northeast Pacific | Bottom trawls | United States | California | Oregon | Washington | IFQ Trawl Fishery
Pacific | Pacific, Eastern Central | Bottom trawls | United States | West Coast | IFQ trawl (soft substrate)
Eastern Central Pacific | Handlines and hand-operated pole-and-lines | United States | California | South of 40° 10' | Nearshore
Eastern Central Pacific, Northeast Pacific | Handlines and hand-operated pole-and-lines | United States | California | Oregon | Washington | North of 40° 10' | Nearshore
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Open access longline (south of Lucia)
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry endorsed sablefish longline
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | Limited entry non endorsed longline (south of Lucia)
Pacific | Pacific, Northeast | Set longlines | United States | West Coast | Limited entry non endorsed longline (north of Lucia)
Pacific | Pacific, Northeast | Pots | United States | West Coast | Limited entry non endorsed pot
Eastern Central Pacific, Northeast Pacific | Set longlines | United States | California | Oregon | Washington | North of 36° N. | Open Access Longline Fishery
Pacific | Pacific, Eastern Central | Set longlines | United States | West Coast | IFQ longline
Pacific | Pacific, Northeast | Pots | United States | West Coast | Open access pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | Limited entry endorsed sablefish pot
Pacific | Pacific, Eastern Central | Pots | United States | West Coast | IFQ pot
Pacific | Pacific, Northeast | Midwater trawls | United States | West Coast | IFQ midwater trawl

Low Concern
The fisheries addressed in this assessment do not target any species of exceptional ecological importance (see Appendix G for more information). While hake are indeed a groundfish species of exceptional ecological importance, they are not targeted by the fisheries addressed in this assessment and the bycatch of hake by these fisheries is minimal.
There is not a substantial portion of the groundfish fishery area that is protected in no-take zones, and there are no ecosystem-based harvest controls in place for any species. Currently, a Fishery Ecosystem Plan (FEP) is being developed. This plan will inform the existing single-species management approach with information regarding the influence of ecosystem considerations on the managed species, and vice versa.

As the fishery does not catch exceptional species, and a fishery ecosystem plan is being developed with a clear timeline, a process for incorporation into existing management processes, and suggestions for research to elucidate some broader ecosystem considerations for the groundfish fishery, the score for ‘impacts on the ecosystem and food web' is 'low' for all west coast groundfish fisheries addressed in this assessment. See Appendix G for more information.

Acknowledgements

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

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Appendix

Appendix A

Common, market, and vernacular names of groundfish species : NEED TO ADD TABLE/IMAGE

Appendix B

Main species in fisheries ： The following table is a complete list of species observed caught by the West Coast Observer Program in 2012 {Bellman et al. 2013}. The color coding defines the main species caught in each fishery - see the Seafood Watch criteria for more information.

Color codes
The catch of the species in the fishery under assessment composes >5% of that fishery's catch, or
The species is >1% of that fishery's catch and the fishery causes >5% of the species' total mortality across all fisheries, or
The species is <1% of that fishery's catch and the fishery causes >20% of species' total mortality across all fisheries, or
The species is overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species, and/or subject to overfishing and the fishery causes >1% of species' total mortality across all fisheries.

	IFQ				LE endorsed		LE non-endorsed			Open Access				Nearshore		
Fishery	Trawl	Mid wat. traw	Long line	Pot	Long line	Pot	Long line N	Long line S	Pot	Long line N	Long line S	Pot, N	Pot, S	N	S	Total mortal.
Total Catch -->	**18485**	**216**	**297**	**736**	**1511**	**333**	**269**	**597**	**10**	**215**	**148**	**112**	**23**	**248**	**212**	**210603**
Species																
Bocaccio rockfish (South of 40°10' N. lat.)	8.84			0.00	0.03		0.10	0.67		0.31	1.52				0.73	139.51
Canary rockfish	4.51	0.49		0.00	0.04	0.01				0.07				1.59	5.64	44.80
Cowcod rockfish (South of 40°10' N. lat.)	0.09															1.15
Darkblotched rockfish	81.04	0.07	0.22	0.03	6.75	0.04	1.34	0.10		0.79	0.02			0.07	0.02	104.95
Pacific Ocean Perch (North of 40°10' N. lat.)	36.13	0.03	0.08	0.01	0.30	0.04	0.03			0.04						55.79
Petrale sole	1030.50	1.69	0.32	0.08	0.53	0.00	0.06	0.13		0.07	0.02	0.01			0.00	1110.73
Yelloweye rockfish	0.03				0.23					0.06	0.04			1.71	0.08	11.56
Arrowtooth flounder	2357.15	1.90	4.38	1.22	35.05	0.15	0.97		0.09	3.01	1.93	1.10	0.24	0.01		2508.08
Black rockfish (North of 46°16' N. lat.)	0.72															249.40
Black rockfish (South of 46°16' N. lat.)	0.02													117.17	3.65	562.71
Cabezon (California)														1.70	28.88	73.93
Cabezon (Oregon)	0.08													28.97		46.83
California scorpionfish (South of 34°27' N. lat.)															3.19	120.18
Chilipepper rockfish (South of 40°10' N. lat.)	288.14			0.01	0.15		0.44	0.20		0.20	0.13		0.00		0.04	302.45
Dover sole	7015.24	4.17	0.41	3.28	4.55	1.11	0.94	2.33	0.03	0.55	0.20	0.17	0.04	0.00		7175.44
English sole	146.59	0.12			0.30											224.43
Lingcod (North of 42° N. lat.)	329.24	2.61	0.19	1.83	5.46	0.61	0.95		0.05	11.15		0.05		36.80		731.40
Lingcod (South of 42° N. lat.)	19.63			0.32	1.19	2.18	0.20	0.10		2.98	2.70	0.11	0.02	4.18	19.34	336.94
Longnose skate	890.79	1.56	14.98	0.00	44.39	0.69	9.07	3.20		5.39	2.41	0.05		0.03		990.99
Longspine thornyhead (North of 34°27' N. lat.)	891.84	0.12	0.20	0.03	0.77	0.02	0.67	4.23	0.00	0.13	0.05	0.00	0.09		0.00	912.04
Longspine thornyhead (South of 34°27' N. lat.)	0.40			0.00			0.00	15.00		0.00	0.66				0.05	17.53
Black and Yellow Rockfish (north)														0.01		0.02
Blue Rockfish (north)														12.28		43.64
Brown Rockfish (north)	0.01													0.30		0.92
China Rockfish (north)														9.41		17.11
Copper Rockfish (north)														2.24		14.07
Gopher Rockfish (north)														0.06		0.14
Grass Rockfish (north)														0.22		1.72
Nearshore Rockfish Unid (north)	0.01															0.09
Olive Rockfish (north)														0.07		0.15
Quillback Rockfish (north)	0.10													3.38		18.31
Black and Yellow Rockfish (south)															11.39	16.85
Blue Rockfish (south)															1.41	50.70
Brown Rockfish (south)															26.19	95.99
Calico Rockfish (south)															0.00	5.12

Figure 1: Main species page 1

Color codes
The catch of the species in the fishery under assessment composes >5% of that fishery's catch, or
The species is >1% of that fishery's catch and the fishery causes >5% of the species' total mortality across all fisheries, or
The species is <1% of that fishery's catch and the fishery causes >20% of species' total mortality across all fisheries, or
The species is overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species, and/or subject to overfishing and the fishery causes >1% of species' total mortality across all fisheries.

	IFQ				LE endorsed		LE non-endorsed			Open Access				Nearshore		
Fishery	Trawl	Mid wat. traw	Long line	Pot	Long line	Pot	Long line N	Long line S	Pot	Long line N	Long line S	Pot, N	Pot, S	N	S	Total mortal.
Total Catch -->	**18485**	**216**	**297**	**736**	**1511**	**333**	**269**	**597**	**10**	**215**	**148**	**112**	**23**	**248**	**212**	**210603**
Species																
China Rockfish (south)															3.14	15.56
Copper Rockfish (south)															4.72	85.38
Gopher Rockfish (south)																75.11
Grass Rockfish (south)															11.46	32.11
Kelp Rockfish (south)															0.59	19.70
Nearshore Rockfish Unid (south)															0.13	0.16
Olive Rockfish (south)															1.26	32.93
Quillback Rockfish (south)															0.21	2.93
Treefish Rockfish (south)															1.66	12.64
Bocaccio Rockfish (north)	1.66	0.01	0.00		0.04	0.00				0.08				0.01		4.73
Chilipepper Rockfish (north)	0.18	0.00	0.00		0.03					0.00						1.38
Cowcod Rockfish (north)	0.00															0.00
Greenblotched Rockfish (north)																0.00
Greenspotted Rockfish (north)	0.08	0.00			0.00											0.11
Greenstriped Rockfish (north)	28.20	0.57		0.00	0.20		0.03	0.00		0.14						31.89
Halfbanded Rockfish (north)	0.01															0.01
Harlequin Rockfish (north)	0.00															0.00
Pygmy Rockfish (north)	0.00															0.00
Redstripe Rockfish (north)	0.71	0.00	0.00													11.25
Rosethorn Rockfish (north)	3.09	0.00	0.08	0.01	0.79	0.01	0.02	0.00		0.04						4.66
Rosy Rockfish (north)	0.07				0.05	0.00								0.00		0.13
Shelf Rockfish Unid (north)	1.37		0.00	0.00	0.17	0.00	0.07	0.00		0.04		0.05		0.07		8.07
Silvergray Rockfish (north)	1.28	0.09	0.01		0.04	0.00	0.00	0.00		0.09						2.99
Squarespot Rockfish (north)	0.00															0.00
Starry Rockfish (north)	0.06													0.00		0.06
Stripetail Rockfish (north)	1.53				0.01		0.00			0.00						3.07
Swordspine Rockfsih (north)																0.00
Tiger Rockfish (north)														0.50		2.56
Vermilion Rockfish (north)										0.04				3.92		18.67
Yellowtail Rockfish (north)																0.75
Bronzespotted Rockfish (south)				0.02			0.00	0.10								0.12
Flag Rockfish (south)	0.00				0.05		0.00	0.01		0.00	0.18				0.11	14.53
Freckled Rockfish (south)															0.01	0.01
Greenblotched Rockfish (south)	0.03						0.00	0.08		0.00	0.07				0.05	0.98
Greenspotted Rockfish (south)	0.41						0.00	0.23		0.01	0.95				0.07	19.89
Greenstriped Rockfish (south)	1.17						0.00	0.00		0.00	0.04				0.01	2.55
Halfbanded Rockfish (south)	0.02															6.55
Honeycomb Rockfish (south)										0.00	0.0				0.00	6.23

Figure 2: Main species page 2

Color codes
The catch of the species in the fishery under assessment composes >5% of that fishery's catch, or
The species is >1% of that fishery's catch and the fishery causes >5% of the species' total mortality across all fisheries, or
The species is <1% of that fishery's catch and the fishery causes >20% of species' total mortality across all fisheries, or
The species is overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species, and/or subject to overfishing and the fishery causes >1% of species' total mortality across all fisheries.

	IFQ				LE endorsed		LE non-endorsed			Open Access				Nearshore		
Fishery	Trawl	Mid wat. traw	Long line	Pot	Long line	Pot	Long line N	Long line S	Pot	Long line N	Long line S	Pot, N	Pot, S	N	S	Total mortal.
Total Catch -->	**18485**	**216**	**297**	**736**	**1511**	**333**	**269**	**597**	**10**	**215**	**148**	**112**	**23**	**248**	**212**	**210603**
Species																
											0					
Mexican Rockfish (south)	0.00						0.00	0.00		0.00	0.03				0.00	0.04
Pink Rockfish (south)	0.01						0.00	0.76								0.79
Pinkrose Rockfish (south)							0.00	0.00								0.00
Pygmy Rockfish (south)																0.00
Redstripe Rockfish (south)	0.00															0.01
Rosethorn Rockfish (south)	0.04						0.00	0.39							0.03	0.48
Rosy Rockfish (south)	0.01				0.00		0.00	0.03		0.05	0.03				0.50	6.43
Shelf Rockfish Unid (south)	0.35			0.10	0.02		0.01	0.00		0.00	0.61		0.07		0.81	1.98
Speckled Rockfish (south)	0.00						0.00	0.09		0.00	0.01				0.02	9.76
Squarespot Rockfish (south)	0.00						0.00	0.16		0.00	0.03				0.00	4.64
Starry Rockfish (south)							0.00	0.10		0.05	0.17				0.27	24.01
Stripetail Rockfish (south)	11.32															13.38
Swordspine Rockfish (south)					0.04											0.05
Tiger Rockfish (south)	0.00															0.05
Vermilion Rockfish (south)	0.01						0.00	0.64		0.74	7.62				7.05	233.09
Yellowtail Rockfish (south)	0.01						0.00	0.04		0.27	0.28				0.35	56.44
Aurora Rockfish (north)	18.87	0.01	0.07	0.04	0.18	0.00	0.00	0.00		0.00						20.06
Bank Rockfish (north)	0.28			0.00	0.01		0.00	0.00		0.00						0.32
Blackgill Rockfish (north)	4.73	0.00	0.48	0.06	2.93	0.03	0.20	0.00		0.20		0.00				8.98
Blackspotted Rockfish (north)	0.19		0.04		0.15	0.00	0.01	0.00		0.01						0.41
Redbanded Rockfish (north)	5.90	0.00	0.71	0.06	17.55	0.09	2.41	0.00		1.80		0.00		0.00		35.86
Rougheye Rockfish (north)	47.35	0.07	19.36	0.09	46.55	0.06	3.13	0.00		2.79		0.00		0.00		236.70
Sharpchin Rockfish (north)	8.55		0.00		0.01	0.00	0.00	0.00		0.00						13.65
Shortraker Rockfish (north)	12.66	0.04	1.26	0.02	6.12		0.22	0.00		0.17				0.00		28.29
Shortraker/Rougheye Rockfish (north)			2.16		36.24	0.00	0.12	0.00		0.02						38.54
Slope Rockfish Unid (north)	1.39	1.16	0.00	0.02	3.35	2.16	0.80	0.00		0.18		0.08		0.01		10.38
Splitnose Rockfish (north)	12.69	0.00	0.02		0.13	0.00	0.03	0.00		0.04						50.96
Yellowmouth Rockfish (north)	6.64		0.18	0.00	1.19		0.07	0.00		0.00						8.90
Aurora Rockfish (south)	24.38		0.00	0.19	0.11		0.00	0.11		0.03	0.03	0.00	0.02			25.21
Bank Rockfish (south)	16.58						0.00	0.00		0.00	0.42		0.01		0.01	18.74
Blackgill Rockfish (south)	73.11		0.76	5.28	9.87	0.03	10.61	33.40	0.01	1.37	58.11	0.06	0.23		2.31	195.44
Blackspotted Rockfish (south)	0.05				7.13		1.67	0.00		0.01					0.02	8.89
Pacific Ocean Perch (south)	0.08															0.08
Redbanded Rockfish (south)	0.70				0.88		0.00	0.00	0.01	0.03	0.02	0.06	0.01		0.00	1.71
Rougheye Rockfish (south)	0.24				0.17					0.03	0.02					0.46

Figure 3: Main Species page 3

Color codes
The catch of the species in the fishery under assessment composes >5% of that fishery's catch, or
The species is >1% of that fishery's catch and the fishery causes >5% of the species' total mortality across all fisheries, or
The species is <1% of that fishery's catch and the fishery causes >20% of species' total mortality across all fisheries, or
The species is overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species, and/or subject to overfishing and the fishery causes >1% of species' total mortality across all fisheries.

	IFQ				LE endorsed		LE non-endorsed			Open Access				Nearshore		
Fishery	Trawl	Mid wat. traw	Long line	Pot	Long line	Pot	Long line N	Long line S	Pot	Long line N	Long line S	Pot, N	Pot, S	N	S	Total mortal.
Total Catch -->	**18485**	**216**	**297**	**736**	**1511**	**333**	**269**	**597**	**10**	**215**	**148**	**112**	**23**	**248**	**212**	**210603**
Species																
Sharpchin Rockfish (south)	0.25								0.00	0.00	0.00	0.04	0.01			0.33
Shortraker Rockfish (south)	0.00															0.00
Slope Rockfish Unid (south)	1.64			0.04	0.94	1.88	0.04	0.00		0.00	0.54	0.01	0.07		0.07	6.14
Yellowmouth Rockfish (south)	0.05															0.05
Shortspine/ Longspine Thornyhead	1.64						0.01	0.52					0.01		0.03	2.42
Butter Sole	2.22															2.33
Curlfin Turbot	0.94															1.71
Flatfish Unid	2.06					0.00		0.06		0.00	0.00				0.01	26.82
Flathead Sole	7.33	0.01					0.00									9.42
Pacific Sanddab	215.41	0.01						0.64		0.00	1.96				2.40	300.62
Rex Sole	374.40	1.15		0.01	0.32	0.00		0.02							0.00	443.84
Rock Sole	4.97	0.00								0.00	0.01				0.07	14.66
Roughscale Sole	0.00															0.00
Sanddab Unid	3.47									1.21	0.66		0.02		0.01	9.97
Sand Sole	70.70				0.22					0.01	0.00			0.00	0.13	87.81
Big Skate	47.69	0.00	0.03		2.38		0.02	3.52		0.38	0.24			0.01		76.53
Cabezon																7.97
California Scorpionfish															0.00	0.00
California Skate	2.11				0.00		0.00	0.01								2.93
Cod Unid	0.00															0.00
Grenadier Unid	70.21			0.01	6.87	0.00	14.71	23.48	0.00	5.78	0.02	0.02			0.62	126.23
Groundfish Unid	0.04															10.42
Kelp Greenling	0.15													19.85	4.54	65.07
Leopard Shark	0.26						0.00	0.10		0.07	0.72		0.08		0.24	38.43
Pacific Electric Ray																0.06
Pacific Flatnose	1.60		0.08	0.07	0.02	0.02	0.00	0.85		0.01	0.01					2.65
Pacific Grenadier	51.17		2.70	2.00	5.22	0.96	0.08	12.19	0.00	0.25	0.18	0.04	0.01			74.80
Ray Unid	0.01															0.01
Rockfish Unid					0.01		0.24	0.05		0.01	1.28		0.01	0.01	0.31	1.93
Roundfish Unid	0.00															0.05
Skate Unid	230.85	0.12	0.02	0.00	2.55	0.00	1.44	5.49		0.37	0.39		1.31		0.11	328.02
Soupfin Shark	0.62						0.00	0.11		0.00	0.04				0.25	2.66
Spotted Ratfish	78.99	0.21	0.12	0.01	3.22		1.25	1.13		0.64	0.46			0.00	0.00	86.28
Pacific cod	395.66	0.21			1.23	0.00	0.03	0.11		1.03	0.05	0.00				633.76
Pacific hake	248.94	0.68	0.00	0.00	0.94		0.01	2.42		0.01	0.00					160705.61
Sablefish (North of 36° N. lat.)	1406.04	1.62	205.06	521.72	1115.18	295.25	205.25		8.92	165.30		107.77		1.04	0.65	4701.40

Figure 4: Main species page 4

Color codes
The catch of the species in the fishery under assessment composes >5% of that fishery's catch, or
The species is >1% of that fishery's catch and the fishery causes >5% of the species' total mortality across all fisheries, or
The species is <1% of that fishery's catch and the fishery causes >20% of species' total mortality across all fisheries, or
The species is overfished, depleted, a stock of concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species, and/or subject to overfishing and the fishery causes >1% of species' total mortality across all fisheries.

	IFQ				LE endorsed		LE non-endorsed			Open Access				Nearshore		
Fishery	Trawl	Mid wat. traw	Long line	Pot	Long line	Pot	Long line N	Long line S	Pot	Long line N	Long line S	Pot, N	Pot, S	N	S	Total mortal.
Total Catch -->	**18485**	**216**	**297**	**736**	**1511**	**333**	**269**	**597**	**10**	**215**	**148**	**112**	**23**	**248**	**212**	**210603**
Species																
Sablefish (South of 36° N. lat.)	22.68		1.94	198.02	35.88	27.25	0.00	340.86			51.82		20.66		4.39	704.73
Shortbelly rockfish	5.48															7.45
Shortspine thornyhead (North of 34°27' N. lat.)	686.92	1.12	11.94	1.19	29.18	0.44	9.03	20.64	0.01	1.79	1.90	0.04	0.02		0.12	801.43
Shortspine thornyhead (South of 34°27' N. lat.)	0.59			0.36	0.89		0.00	118.66			6.23				0.97	128.26
Spiny dogfish	340.04	0.21	28.75	0.05	70.45	0.03	2.84	0.45	0.01	5.09	3.36	0.08	0.02	0.01		830.78
Splitnose rockfish (South of 40°10' N. lat.)	59.87				0.00	0.00	0.01	0.10		0.01	0.19	0.00	0.00			61.91
Starry flounder	8.34				0.02					0.01	0.00			0.00	0.13	17.36
Widow rockfish	34.27	10.88			0.08		0.00	0.09		0.01	0.03			0.04	0.00	277.64
Yellowtail rockfish (North of 40°10' N. lat.)	389.45	185.62	0.01		0.53	0.00	0.02			0.05				1.76		1569.76
California halibut	18.78						0.00	0.04		0.12	0.39	0.00	0.02		1.35	346.08
California sheephead															58.74	102.27
Dungeness crab	196.44	0.07		0.56	0.02	0.34	0.07		1.14			3.02	0.09	1.47	1.42	20296.51
Bigmouth Sole										0.00	0.00					0.00
Deepsea Sole	16.29			0.02		0.01	0.00	0.02								16.55
Diamond Turbot	0.11														0.00	0.24
Fantail Sole																0.14
Hornyhead Turbot	0.02														0.00	2.88
Slender Sole	37.22									0.00	0.00					130.79
Speckled Sanddab	0.00															0.08
Aleutian Skate	2.31		0.03		0.29											2.63
Bering Skate	0.00															0.00
Black Skate	18.42		1.01	0.00	0.24		0.00	3.84								23.50
Deepsea Skate	0.33															0.33
Pacific Electric Ray	1.10															1.39
Pelagic Stingray							0.00	0.12								0.12
Round Stingray																0.00
Sandpaper Skate	39.71	0.01	0.18	0.00	1.25		0.06	0.20		0.06	0.04					41.52
Shovelnose Guitarfish	0.00															8.94
Starry Skate	0.12				0.01											0.13
Thornback Skate	0.00															0.59
White Skate	0.43															0.43

Figure 5: Main Species page 5

Appendix C

Marine mammal and seabird bycatch :
The U.S. west coast fisheries rarely catch marine mammals, seabirds, or turtles; such catch was noted for 2% of all observed trips from 2002-2009 (Jannot et al. 2011). It should be noted that observer coverage rates varied substantially between the groundfish sectors during the years 2002-2009; coverage for LE trawl and LE sablefish fixed gear sectors consistently exceeded 20%, while coverage rates for the other fixed gear sectors generally did not exceed 5% (Jannot et al. 2011).

Marine mammals
From 2002-2009, observed bycatch of marine mammals in non-hake, non-California halibut commercial groundfish fisheries was as follows (all data from Jannot et al. 2011):

- Cetaceans

    - Bottlenose dolphin: one animal, LE non-sablefish fixed gear
    - Pacific white-sided dolphin: one animal, LE trawl
    - Risso's dolphin: one animal, LE trawl
    - Sperm whale: one animal (vessel strike with no apparent injury to whale), LE sablefish fixed gear

- Pinnipeds:

    - California sea lion: 44 animals, primarily in LE trawl fishery
    - Harbor seal: four animals, in LE non-sablefish fixed gear, nearshore fixed gear
    - Northern elephant seal: two animals, in LE trawl and LE sablefish fixed gear
    - Steller sea lion: six animals, in LE trawl fishery
    - Sea lion, unspecified: two animals, LE trawl and LE non-sablefish fixed gear

For each year, NOAA classifies commercial fisheries into one of three categories based upon their interactions with marine mammals. Category I are fisheries with frequent interactions, Category II for occasional interactions, and Category III for remote likelihood or no known interactions. For 2012, no west coast groundfish fisheries were assigned to Category I, and one fishery was assigned to Category II; the remainder were Category III (NOAA 2012b). The Category II fishery is actually two fisheries, the LE and OA sablefish pot fisheries. The Category II designation of LE and OA sablefish pot fisheries is the result of an incident in which a humpback whale was entangled in sablefish pot gear in 2006 (NOAA 2012b). This incident gives the sablefish pot fisheries a sufficiently high rate of mean annual mortality and serious injury to qualify for Category II status. The sablefish pot fisheries are not subject to take reduction plans.

Turtles
One incident of turtle entanglement is noted in a review of west coast groundfish fishery observer bycatch data for the period 2002-2009 (Jannot et al. 2011). In this instance, a leatherback turtle was entangled in open-access pot gear.

Seabirds
Seabird bycatch rates are highest for groundfish longline gear. From 2002-2008, the highest seabird bycatch rate came from the LE sablefish longline fishery's bycatch of black-footed albatross (Jannot et al. 2011); there were no observed instances of black-footed albatross bycatch in 2009, however. In 2009, the last year for which observer bycatch data were analyzed, total seabird bycatch in the non-hake, non-California halibut fisheries consisted of the following (all data from Jannot et al. 2011):

- Brandt's cormorant: one animal, nearshore fixed gear

- Common murre: one animal, nearshore fixed gear

- Western gull: one animal, LE non-sablefish fixed gear

- Seabird, unidentified: two animals, nearshore fixed gear

Several species that are listed on the Endangered Species Act have been caught in west coast groundfish fisheries (Table D.1).

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Black-footed albatross are the only species of concern that have been caught as bycatch in the non-hake commercial groundfish fisheries with any degree of regularity in recent years. As such, black-footed albatross will be the only marine mammal, seabird, or turtle species included in this assessment.

References

Arata, J.A., P.R. Sievert, and M.B. Naughton. 2009. "Status Assessment of Laysan and Black-Footed Albatrosses, North Pacific Ocean, 1923-2005." U.S. Geological Survey Scientific Investigations Report.

IUCN. 2012. "Phoebastria Nigripes (Black-Footed Albatross)." http://www.iucnredlist.org/details/106003957/0.

Jannot, J., E. Heery, M. Bellman, and J. Majewski. 2011. "Estimated Bycatch of Marine Mammals, Seabirds, and Sea Turtles in the US West Coast Commercial Groundfish Fishery, 2002-2009." West Coast Observer Program. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA.

Naughton, M.B., M.D. Romano, and T.S. Zimmerman. 2007. "A Conservation Action Plan for Black-Footed Albatross (Phoebastria Nigripes) and Laysan Albatross (P. Immutabilis), Version 1.0."

NOAA. 2012. "2012 List of Fisheries - Office of Protected Resources - NOAA Fisheries." http://www.nmfs.noaa.gov/pr/interactions/lof/final2012.htm#table1.

Appendix D

Co-occurrence of groundfish species in the west coast groundfish FMP :
Number of hauls with occurrence and co-occurences of FMP species in West Coast Groundfish Observer Program (WCGOP) data from bottom trawl fisheries covering the years 2002−2011. Species recorded by port samplers but not associated with specific hauls were not included in this analysis. Percentages indicate the percentage of hauls with any given species in the columns that also caught any given species in the rows. Data from Ian Taylor, NOAA Fisheries, September 2013. Analysis follows that given in the PFMC June Briefing Book at http://www.pcouncil.org/wp-content/uploads/F8b_GMT_JUN2013BB.pdf. Darker shades indicate higher co-occurrence.

These data indicate the likelihood of catching species A when catching species B. They are used here as an indication of the main species caught with each species assessed under Criterion 1 for the ITQ trawl fishery. A data request is pending with the WCGOP to answer this question more directly (as of October 2, 2013), and this assessment will be updated as necessary based on that data.

Species in red are those determined to have scores less than 2.2 in the Seafood Watch criteria. Co-occurrence patterns of big, California and longnose skate are used as a proxy for 'unspecified skates', and co-occurrence patterns of Pacific grenadier are used as a proxy for 'Unspecified grenadiers.' See assessment detail in the main body of this document for more detail on those scores and groupings.

Common name	Dover sole (32418)	Sablefish (29250)	Arrowtooth fl (22768)	Shortspine th (22059)	Rex sole (21300)	Longnose skate (19318)	Petrale sole (17273)	English sole (14637)	Longspine th (14532)	Lingcod (11202)	Pacific sanddab (9101)	Darkblotched rf (6933)	Pacific grenadier (6433)	POP (4358)	Pacific cod (4079)	Sand sole (3232)	Yellowtail rf 1786)	Chilipepper (1779)	Rougheye rf (1521)	Bocaccio (931)	Widow rf (793)	Cowcod (179)	Yelloweye rf (175)
Dover sole	100	94	93	97	89	91	80	67	97	78	62	93	97	91	81	17	81	67	95	64	78	68	80
Sablefish	85	100	83	98	73	82	62	47	99	62	35	90	99	94	53	2	62	61	96	61	77	66	58
Pacific whiting (hake)	68	69	75	70	71	75	65	52	63	60	45	81	52	85	53	9	50	76	89	68	74	83	55
Shortspine thornyhead	66	74	59	100	46	61	27	13	96	18	2	65	96	87	10	0	13	14	89	16	50	10	22
Arrowtooth flounder (turbot)	65	65	100	61	72	71	72	58	48	75	50	89	40	92	82	8	85	30	90	37	75	9	81
Rex sole	58	53	67	45	100	65	78	77	38	80	77	69	31	53	84	31	80	82	56	78	70	84	78
Longnose skate	54	54	60	54	59	100	56	47	49	96	45	65	43	60	44	8	49	76	66	66	51	76	49
Ratfish	44	41	55	31	59	55	68	65	20	76	63	70	11	59	75	25	80	77	54	78	81	68	75
Longspine thornyhead	44	49	30	63	26	37	9	3	100	4	1	22	89	30	1	0	2	4	40	3	12	0	5
Spiny dogfish	43	42	55	35	51	53	63	56	23	64	52	66	18	67	72	37	72	59	60	62	72	61	67
Petrale sole	43	37	55	21	63	50	100	81	11	87	81	61	7	48	89	35	88	93	32	93	71	93	83
English sole	30	24	37	9	53	35	69	100	3	75	91	36	2	20	84	80	76	87	14	85	52	93	75
Lingcod	27	24	37	9	42	33	56	58	3	100	57	42	1	27	76	19	85	61	21	72	61	60	86
Darkblotched rockfish	20	21	27	21	23	33	25	17	11	26	10	100	7	62	15	0	28	16	65	17	49	12	29
Pacific rattail (Pacific grenadier)	19	22	11	28	9	14	3	1	39	1	0	6	100	8	0	0	1	1	8	0	3	0	1
Splitnose rockfish	18	21	23	25	21	22	19	13	15	17	2	45	7	55	7	0	9	25	58	30	49	28	17
Pacific sanddab	17	11	20	1	33	21	42	57	0	46	100	13	0	1	48	65	37	45	3	37	15	44	38
Aurora rockfish	17	19	20	24	17	21	8	3	23	4	1	26	14	30	1	0	1	5	44	4	12	2	4
Finescale codling (Pacific flatnose)	12	14	6	18	6	7	1	0	25	0	0	3	37	4	0	0	0	0	6	0	1	0	1
Pacific ocean perch	12	14	18	17	11	13	12	6	9	10	1	39	5	100	7	0	9	2	55	6	40	1	11

Figure 6: Co-occurence page 1

Common name	Dover sole (32418)	Sablefish (29250)	Arrowtooth fl (22768)	Shortspine th (22059)	Rex sole (21300)	Longnose skate (19318)	Petrale sole (17273)	English sole (14637)	Longspine th (14532)	Lingcod (11202)	Pacific sanddab (9101)	Darkblotched rf (6933)	Pacific grenadier (6433)	POP (4358)	Pacific cod (4079)	Sand sole (3232)	Yellowtail rf 1786)	Chilipepper (1779)	Rougheye rf (1521)	Bocaccio (931)	Widow rf (793)	Cowcod (179)	Yelloweye rf (175)
Greenstriped rockfish	11	10	14	3	16	13	21	21	1	29	19	23	0	8	24	1	42	50	10	48	32	67	57
Pacific cod	10	7	15	2	16	9	21	23	0	28	22	9	0	6	100	9	58	1	4	11	18	1	39
Big skate	9	6	11	1	17	13	23	34	1	25	45	7	1	1	26	70	18	10	1	10	5	17	13
Redbanded rockfish	9	10	12	12	10	10	9	6	5	10	1	29	2	36	4	0	7	9	45	11	30	7	14
Flathead sole	8	6	11	1	12	8	14	15	0	19	15	9	0	2	34	2	31	1	5	3	4	0	20
Canary rockfish	6	6	9	1	10	7	13	14	0	19	11	11	0	4	24	1	46	19	5	29	21	15	59
Rosethorn rockfish	6	7	8	8	6	7	6	4	4	7	1	19	2	30	4	0	8	4	30	8	26	3	24
Rougheye rockfish	4	5	6	6	4	5	3	1	4	3	0	14	2	19	2	0	3	1	100	1	9	0	4
Yellowtail rockfish	4	4	7	1	7	5	9	9	0	14	7	7	0	4	25	1	100	4	4	11	23	0	30
Blackgill rockfish	4	4	4	5	4	5	3	1	4	2	0	9	3	7	0	0	0	3	12	3	6	2	1
Chilipepper	4	4	2	1	7	7	10	11	0	10	9	4	0	1	1	0	4	100	1	68	23	90	6
Stripetail rockfish	2	2	2	1	4	3	4	5	0	5	3	4	0	2	1	0	2	32	1	34	17	49	9
Sharpchin rockfish	2	2	3	3	3	2	3	2	1	4	0	8	0	12	3	0	6	4	12	7	18	4	7
California skate	2	2	0	0	5	5	8	14	0	7	20	0	0	0	0	28	1	27	0	20	3	42	2
Widow rockfish	2	2	3	2	3	2	3	3	1	4	1	6	0	7	3	0	10	10	5	17	100	12	10
Bocaccio	2	2	2	1	3	3	5	5	0	6	4	2	0	1	3	0	6	36	1	100	20	64	10
Shortraker rockfish	2	2	2	2	1	2	1	0	2	1	0	5	1	7	0	0	1	0	18	1	3	0	2
Curlfin sole	2	1	1	0	5	4	8	15	0	9	22	0	0	0	4	37	4	20	0	18	2	17	6
Sand sole	2	0	1	0	5	1	7	18	0	6	23	0	0	0	7	100	1	1	0	0	1	1	2
Rock sole	2	1	2	0	4	3	6	9	0	8	12	0	0	0	10	17	8	8	0	11	2	4	8
Shortbelly rockfish	1	1	1	0	2	2	2	3	0	2	2	1	0	0	0	0	1	22	0	24	9	32	2
Starry flounder	1	0	1	0	3	1	5	16	0	5	21	0	0	0	5	75	1	0	0	0	0	1	1
Bank rockfish	1	1	1	1	1	1	1	1	1	1	0	2	0	1	0	0	0	7	1	6	4	11	1
Redstripe rockfish	1	1	1	1	1	1	1	1	0	1	0	1	0	2	2	0	3	1	1	2	3	0	3

Figure 7: Co-occurence page 2

Common name	Dover sole (32418)	Sablefish (29250)	Arrowtooth fl (22768)	Shortspine th (22059)	Rex sole (21300)	Longnose skate (19318)	Petrale sole (17273)	English sole (14637)	Longspine th (14532)	Lingcod (11202)	Pacific sanddab (9101)	Darkblotched rf (6933)	Pacific grenadier (6433)	POP (4358)	Pacific cod (4079)	Sand sole (3232)	Yellowtail rf 1786)	Chilipepper (1779)	Rougheye rf (1521)	Bocaccio (931)	Widow rf (793)	Cowcod (179)	Yelloweye rf (175)
Silvergray rockfish	1	1	1	1	1	0	1	1	0	1	0	2	0	4	2	0	3	0	3	4	9	1	7
Butter sole	1	0	1	0	1	0	2	3	0	1	4	0	0	0	2	14	1	0	0	0	0	0	0
Greenspotted rockfish	0	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	1	7	0	10	4	19	11
Yelloweye rockfish	0	0	1	0	1	0	1	1	0	1	1	1	0	0	2	0	3	1	0	2	2	2	100
Cowcod	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	0	0	9	0	12	3	100	2
Halfbanded rockfish	0	0	0	0	1	1	1	1	0	1	2	0	0	0	0	0	0	9	0	7	1	26	1
Kelp greenling	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	2	0	0	0	1	0	4
Rosy rockfish	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	1	2
Quillback rockfish	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	0	7
Yellowmouth rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1
Brown rockfish	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	2	0	1	0	0	0	1	0
Black rockfish	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1
Pygmy rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Soupfin shark	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2	0	1	0	1	0	0	1
Vermilion rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Greenblotched rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1
Chameleon rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cabezon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mexican rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Pink rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Tiger rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Copper rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Flag rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Squarespot rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swordspine rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Harlequin rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leopard shark	0	0	0	0	0	0	0	2	0	1	3	0	0	0	0	9	0	0	0	0	0	1	0
California scorpionfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olive rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pinkrose rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speckled rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 8: Co-occurence page 3

Common name	Dover sole (32418)	Sablefish (29250)	Arrowtooth fl (22768)	Shortspine th (22059)	Rex sole (21300)	Longnose skate (19318)	Petrale sole (17273)	English sole (14637)	Longspine th (14532)	Lingcod (11202)	Pacific sanddab (9101)	Darkblotched rf (6933)	Pacific grenadier (6433)	POP (4358)	Pacific cod (4079)	Sand sole (3232)	Yellowtail rf 1786)	Chilipepper (1779)	Rougheye rf (1521)	Bocaccio (931)	Widow rf (793)	Cowcod (179)	Yelloweye rf (175)
Bronzespotted rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Starry rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Black and yellow rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Calico rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
China rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dusky rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dwarf-red rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Freckled rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gopher rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grass rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Honeycomb rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kelp rockfish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treefish	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 9: coocurrence page 4

Appendix E

Habitat impacts and mitigation of impacts :
By their nature, 'groundfish' tend to be demersal species, and the fisheries that target them correspondingly use bottom-tending gears. While the U.S. west coast non-hake commercial groundfish fisheries use a variety of gears, including bottom trawl, longline, pot, and hook and line gears, the common denominator between the gears is that they are expected to contact the bottom during their normal use. As such, the potential for habitat disturbance and destruction is present for all of the gears. A wealth of scientific information suggests that mobile bottom trawl gear should be expected to have the most significant impacts of all of the gears used in these fisheries; bottom longline and trap gears may also cause damage but, being fixed gears, they do not sweep over the seafloor as does trawl gear. In recognition of the potential for bottom-tending gears to damage habitat, a number of spatial restrictions on gear use are in place. These restrictions particularly limit the use of bottom trawl gear, and as such offer a degree of mitigation of bottom trawl habitat impacts.

IFQ Bottom Trawl

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

The IFQ trawl fishery catches a variety of groundfish species, and these species in turn associate with a variety of habitats as adults (Table F.1, PFMC 2005a). Additional evidence of bottom trawl gear interactions with habitat include the observed bycatch of 3.09 tons of *Scleractinia* corals in the pre-IFQ LE bottom trawl fishery in 2010 (WCGOP 2012). The Seafood Watch criteria require a score of "high" concern for a fishery that uses trawls on cobble, boulder, or deep (>60 m) gravel. The fishery's impact on substrate when primarily fishing for those species only found on soft or mixed soft/hard substrate is less of a conservation concern, and is thus deemed a "moderate" concern. This latter score is applied to all flatfish except arrowtooth flounder, all skates, Pacific cod, thornyheads, and sablefish (see Appendix E for evidence for co-occurrence of different species groups).

NEED TO ADD TABLE ON HABITAT ASSOCIATIONS

Factor 4.2 Modifying factor: Mitigation of fishing gear impacts

Key relevant information:

There are several measures in place to mitigate the effect of bottom trawling on fish habitat on the U.S. west coast. Groundfish bottom trawling of any sort is prohibited in approximately 25% of the Essential Fish Habitat that is found in waters shallower than 700 fathoms, and expansion of groundfish bottom trawling into waters deeper than 700 fathoms is prohibited. Additionally, bottom trawling with footrope diameter that exceeds 19" is prohibited in the EEZ, and bottom trawling with footrope gear that exceeds 8" is prohibited in waters shallower than 100 fathoms.

Detailed rationale

The Magnuson-Stevens Act requires that fishery management plans identify habitat that is essential for the full life cycle of fish species, and to minimize 'to the extent practicable' adverse effects on such 'essential fish habitat' (EFH). In addition, federal EFH regulations also suggest the identification of Habitat Areas of Particular Concern (HAPCs), which are specific areas of EFH that have particular importance, sensitivity to disturbance, and/or rarity . Amendment 19 to the Fishery Management Plan, which was implemented in 2006, defined EFH and HAPCs for west coast groundfish species. The current FMP defines all waters in the EEZ less than or equal to 3,500 m in depth as EFH (PFMC 2011c) (see Appendix F for a map of EFH and HAPCs).

In order to minimize the adverse effects of bottom fishing gears on EFH, a number of gear closures have been implemented. The use of dredge, beam trawl, or bottom trawl with footrope diameters >19" is prohibited in all EFH, and the use of bottom trawl gear with footrope diameter >8" is prohibited in EFH shoreward of 100 fm; the latter prohibition covers 7.92% of all EFH (Table F.2; NOAA 2011). Additional measures have also been implemented:

Bottom trawl footprint closure

Amendment 19 established a 'bottom trawl footprint closure', which closed all waters seaward of the 700 fathom contour to all bottom trawling. This depth boundary was selected as it generally represented the boundary of the historical trawl footprint, and the implementation of the bottom trawl prohibition in waters deeper than 700 fathoms was not expected to alter current fishing practices (PFMC 2011c). The intent of this closure was therefore precautionary, to prevent the bottom trawl fishery from expanding into these previously non-trawled areas (PFMC 2005b). The total areal extent of EFH that is protected by the bottom trawl footprint closure is 337,202 km^2, which is 71% of total EFH within the EEZ (Table F.2; NOAA 2011).

EFH Conservation Areas

In addition to the aforementioned general measures, Amendment 19 also established EFH Conservation Areas to protect specific EFH areas. There are 50 such closures in place as of the 2011 FMP (PFMC 2011c; Table F.6). Each closure has one of three gear prohibitions: all bottom contact gears, bottom trawl only, or bottom trawl with the exception of demersal seine gear. In total, the EFH Conservation Areas contain 7.3% of the EFH found within the EEZ, and have the effect of prohibiting bottom trawling in in 25.3% of the EFH found at depths shallower than 700 fathoms (Table F.2; for a detailed list of the EFH Conservation Areas, and the areal extent and gear prohibitions of each, see Table F.6).

ADD TABLE ON EFH CLOSURES

Habitat representation in closed areas

The representation of different habitats in the bottom trawl footprint closure and the EFH Conservation Areas varies substantially: in the final EIS for Amendment 19, 21 of 29 habitats identified north of Point Conception were more than 50% represented in the footprint closure and the EFH Conservation areas, but one of the habitats with the largest areal extent (sedimentary shelf) was only 4% represented (Table 4-16 in NMFS 2005). A more recent review reports that the majority of habitats (defined by substrate, depth zone, and biogeopgraphic sub-region) have <50% representation in EFH gear prohibition areas, and a substantial proportion have <20% representation (Figure 2.4 in (NMFS 2013)). Furthermore, while corals and sponges at some depths/biogeographic sub-regions are very well-protected by these EFH gear prohibition areas, corals and sponges are <20% protected in three of nine such areas (Figure 2.6a in (NMFS 2013)).

IFQ Hook and Line and Pot Fisheries

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

As of June 2012, a small but increasing proportion of IFQ catch is being taken by the IFQ hook and line and IFQ pot fisheries (Matson 2012). The habitat types that are being accessed by these gears are not known, but it is known that sablefish, which associate with soft and mixed soft and hard substrates (see Table F.3), are a target of these fisheries (Matson 2012).

LE Endorsed Fixed Gear Fisheries

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

The LE sablefish-endorsed fisheries use bottom longline and pot gear to target sablefish on soft substrates in deep waters.

Detailed rationale:

Gear in this fishery is set at depths of 100-250 fathoms (WCGOP 2012). A review of the substrate associations of the primary species caught in the fishery shows overlapping preference for soft and mixed soft/hard substrates on the shelf and slope (Table F.3). In 2010, there were no observed instances of bycatch of corals or sponges in the LE sablefish-endorsed longline or pot fisheries (WCGOP 2012).

ADD TABLE ON HABITAT ASSOCIATIONS

LE Non-endorsed Fixed Gear Fisheries

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

The LE non-endorsed longline and pot fisheries primarily catch species that associate with soft substrates. This fishery had no observed bycatch of corals or sponges in 2010.

Detailed rationale:

Gear in this fishery is set at depths of 250-450 fathoms (WCGOP 2012). A review of the substrate associations of the primary species caught in the fishery shows that most share an association with soft and/or mixed hard/soft substrates on the slope, with some others associating with hard substrates on the shelf (Table F.4). In 2010, there were no observed instances of bycatch of corals or sponges in the LE sablefish non-endorsed longline or pot fisheries (WCGOP 2012).

ADD TABLE

OA Fixed Gear Fisheries

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

In 2011, the Open Access fixed gear fishery primarily caught sablefish, which associate with soft substrates. This fishery had no observed catch of coral or sponge in 2010.

Detailed rationale:

Sablefish composed approximately 56% and 98% of the catch in the OA hook and line and pot fisheries, respectively, in the year 2011, with blackgill rockfish and longnose skate making up much of the balance (Appendix C; Bellman et al. 2012). Sablefish associate with soft substrates (Table F.5; PFMC 2005a). There were no observed catches of corals or sponges in this

fishery in 2010 (WCGOP 2012).

ADD TABLE

Nearshore Fixed Gear

Factor 4.1 Impact of the fishing gear on the substrate

Key relevant information:

Hook and line (including troll and longline gear) and trap gears may be used in the Nearshore North and South groundfish fisheries. The 2010 observer data show no instances of bycatch of coral or sponge to indicate habitat impacts by the nearshore fisheries.

ADD TABLE

All Fixed Gear Sectors

Factor 4.2 Modifying factor: Mitigation of fishing gear impacts

Key relevant information:

Bottom longline and pot gears are prohibited from 15 EFH Conservation Areas that contain approximately 4.3% of the EFH in waters shallower than 700 fathoms. There are no habitats that have more than 20% representation in these closed areas. There are no other habitat impact mitigation measures in place for bottom longline and pot fisheries.

Detailed rationale

Bottom Contact Closed Areas prohibit bottom longline and pot gear from a total of 5,903 km^2 of EFH (Tables F.2 and F.6). This represents approximately 4.3% of the EFH that is in waters shallower than 700 fm (Table F.2). There are no habitats that have more than 20% representation in these EFH closures that prohibit bottom longline and pots (Table 4-18 in NMFS 2005).

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— — — . 2011. "Pacific Coast Groundfish Management Plan for the California, Oregon and Washington Groundfish Fishery - Appendix F Overfished Species Rebuilding Plans."

WCGOP. 2012. "West Coast Groundfish Observer Program - Fishery Resource Analysis and Monitoring - Northwest Fisheries Science Center." http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm#tables

ADD TABLE

Appendix F

Ecosystem and food web considerations :
The fisheries addressed in this assessment do not target any species of exceptional ecological importance. While hake are indeed a groundfish species of exceptional ecological importance, they are not targeted by the fisheries addressed in this assessment and the bycatch of hake by these fisheries is minimal (Appendix B).

There is not a substantial portion of the groundfish fishery area that is protected in no-take zones, and there are no ecosystem-based harvest controls in place for any species. Currently, a Fishery Ecosystem Plan (FEP) is being developed. This plan will inform the existing single-species management approach with information regarding the influence of ecosystem considerations on the managed species, and vice versa. As the fishery does not catch exceptional species, and a fishery ecosystem plan is being developed with a clear timeline, a process for incorporation into existing management processes, and suggestions for research to elucidate some broader ecosystem considerations for the groundfish fishery, the score for 'impacts on the ecosystem and food web' is 'moderate' for all west coast groundfish fisheries addressed in this assessment.

Detailed rationale:

The ecosystem and food web

The available information suggests that groundfish biomass production on the U.S. west coast is driven by bottom-up forces, with relative abundances of different groups of groundfish influenced by top-down effects including fisheries. Groundfish production in the northeast Pacific is tightly coupled to variations in primary production (Ware and Thomson 2005). Food web modeling of the Northern California Current (NCC) suggests that fisheries-induced biomass declines of some groundfish species may have released other, commercially viable groundfish species from predation pressure (Field 2004; Brand et al. 2007), and that this effect may have at least partially offset the effect of increased fisheries mortality on one species in particular (longspine thornyhead; Field 2004). Food web modeling also suggests that reducing fishing pressure on groundfish would result in a complex array of biomass tradeoffs between predator and prey species (Brand et al. 2007).

Among the non-hake components of the groundfish assemblage, no one single species stands out as currently playing a particularly outsized ecological role. An Ecopath model of the Northern California Current ecosystem (Field 2004) suggests that non-hake groundfish species assemblages (large flatfish, small flatfish, rockfish, roundfish, and elasmobranchs) have relatively minimal influence on each other or on the remaining species groups in the NCC ecosystem (Figure 2.11 in Field 2004). Indeed, the influence of fishing is greater for many species groups in this model. Likewise, fisheries have a greater effect on the groundfish species assemblages than do most species assemblages in the model (Field 2004). Similarly, an Atlantis model of the California Current ecosystem (Brand et al. 2007) also suggested that fishing mortality is the primary determinant of fish abundance.

It is possible that previous fisheries exploitation has reduced the current ecological influence of groundfish species. Field's model of the NCC shows that groundfish species constituted almost 100% of the identified species groups that experienced reduced biomass during the period 1960-2002; in contrast, the biomasses of forage fish, salmon, and a number of marine mammals increased substantially over this time (Figure 3.14 in Field 2004). Field, referring to groundfish, suggests that "a large group of stocks in this ecosystem no longer fill the functional role that they used to", and presents information to suggest that fisheries have reduced the standing biomasses of three groundfish groups (gadids, sablefish, and rockfish) by over 50% (and, in the case of sablefish, over 90%) (Figure 2.17 in Field 2004).

One example from this study suggests that fisheries-induced reductions of groundfish species of moderate-to-high ecological importance may have non-trivial effects on other species over long time periods. Starting in the late 1970s, a reduction in sablefish abundance (and, to a lesser extent, shortspine thornyhead abundance) may have released at least one other groundfish species (longspine thornyhead) from a primary source of natural mortality and thereby allowed longspine thornyhead biomass to remain relatively constant in the face of increasing fishing mortality (Figure 3.17 in Field 2004). Indeed, longspine thornyhead, despite having the classic characteristics of a species that would not be resilient to increasing

fishing pressure, is one of the very few groundfish species in the model to have maintained its biomass from 1960 to 2002 (Figure 3.14 in Field 2004).

In another model, using Atlantis ecosystem modeling software, Brand and colleagues (2007) similarly found evidence of biomass tradeoffs between different groundfish species groups. When this model was used to simulate a scenario in which F = 0 for 42 years, the results indicated that small deep rockfish (ie, thornyhead) steadily declined through the time period, in part due to an increase in a major predator (sablefish), and midwater rockfish initially increased but then declined after 25 years due to increased predation pressure. Conversely, large demersal fish (ie, lingcod) increased steadily until approximately year 20, and then showed a second, sudden increase as a result of release from predation pressure (Brand et al. 2007).

In summary, there is not information to suggest that the west coast non-hake commercial groundfish fisheries are a primary source of mortality for any species that currently play an ecological role of exceptional importance.

Ecosystem-based fishery management of groundfish species

The Pacific Fishery Management Council is in the process of revising a draft Fishery Ecosystem Plan (FEP) for the California Current Ecosystem. The general purpose of the FEP is to bring broader ecosystem considerations and ecosystem science into the Council's existing species-=. The purpose and need statement for the FEP specifies that one of the FEP's roles will be to provide a basis for the consideration of management tradeoffs (PFMC 2011d); such consideration may address issues such as the apparent sablefish/longspine thornyhead biomass tradeoff identified above. The draft FEP's focus leans more towards improving understanding of the CCE on managed species; it also identifies areas for research, including the trophic dynamics of various commercial species (PFMC 2011d).

References

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Appendix G

Biological reference points : add table/image