Monterey Bay Aquarium Seafood Watch®

Groundfish

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British Columbia, Canada: Northeast Pacific Ocean

Bottom trawls, Jig, Longlines (shallow-set & deep-set), Set longlines, Trolling lines

April 11, 2016

Seafood Watch Consulting Researcher

Seafood Watch Standard used in this assessment: Standard for Fisheries vF2

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

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

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.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wildcatch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

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

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

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

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

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

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

Summary

Of the 90 stock/gear combinations that were assessed in this report, 48 received an overall 'yellow' recommendation, 41 received a 'red' recommendation, and one received a 'green' recommendation. The single greatest factor that reduced scores was a broad lack of up-to-date information for stock status and mortality; many stocks received conservative stock status and fishing mortality scores due to a lack of available information. Strengths for these fisheries include 100% at-sea and dockside monitoring, and habitat conservation measures.

The majority (60) of the stock/gear combinations received a red or yellow rating under Criterion 1. Up- to-date and reliable information is essential for a green rating. For many of the stocks with yellow and red ratings, the primary issue is one of data availability. Many stocks have never been assessed, or have out-of-date assessments and, as such have received conservative ratings for Criterion 1.

Due to the multispecies nature of the integrated groundfish fishery, there are actually few fish species that exclusively qualify as 'bycatch' in the traditional sense. Bocaccio are avoided due to their extremely low stock status and the resulting highly restrictive limits placed on their capture. Grenadier and ratfish are caught during normal fishing operations, but are of no market value. As was the case for Criterion 1, information availability—especially in the form of up-to-date stock assessments—is the primary determinant of many of the Criterion 2 rankings.

The Seafood Watch criteria define effective management via a number of guidelines. To be scored 'highly effective' for any of the guidelines, a fishery must achieve all of that guidelines' requirements. Due to the multispecies nature of these fisheries, achieving all of the requirements for the 'management strategy and implementation' guidelines is challenging. Certain aspects of these fisheries' management regime are very strong. This is especially true for the at-sea and dockside monitoring requirements that are in place. However, challenges noted in 'management strategy and implementation' and 'recovery of stocks of concern' preclude a higher score for Criterion 3.

The groundfish fishing gears used in the British Columbia fisheries are expected to come into contact with the seafloor during their regular use. As such, the potential for disturbance and destruction of habitat is always present with these gears. The destructive potential of mobile gears is well known, and bottom longlines and pots may also cause damage. Many of the species that the groundfish fisheries pursue are known to associate with hard substrates, which are known to be more susceptible to gear disturbance and damage than soft substrates in high-energy areas. Spatial management measures such as the sponge reef trawl closures have helped to minimize the potential for damage to certain habitats, and in 2012 a new suite of management measures for the trawl fishery was implemented in order to minimize and manage this fishery's bycatch of corals and sponges.

Final Seafood Recommendations

SPECIES/FISHERY	CRITERION 1: IMPACTS ON THE SPECIES	CRITERION 2: IMPACTS ON OTHER SPECIES	CRITERION 3: MANAGEMENT EFFECTIVENESS	CRITERION 4: HABITAT AND ECOSYSTEM	OVERALL RECOMMENDATION
Arrowtooth flounder British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (5.00)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.75)**
Canary rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (4.47)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.67)**
Darkblotched rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Longnose skate British Columbia Northeast Pacific, Longline (shallow-set), Canada	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Spiny dogfish British Columbia Northeast Pacific, Longline (shallow-set), Canada	Green (3.32)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.93)**
Greenstriped rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Yellow (2.64)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.34)**
Lingcod British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (4.47)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.67)**
Pacific Ocean perch British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Yellow (3.05)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.43)**

Redbanded rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Redstripe rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Rougheye rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Shortraker rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Silvergray rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (5.00)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.75)**
Quillback rockfish British Columbia Northeast Pacific, Jig, Canada, Inside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Tiger rockfish British Columbia Northeast Pacific, Jig, Canada, Inside Rockfish	Red (2.16)	Yellow (2.57)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Yellowtail rockfish British Columbia Northeast Pacific, Jig, Canada, Inside Rockfish	Green (5.00)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.25)**
Southern Rock sole British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (5.00)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.75)**

Widow rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Red (2.16)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Avoid (2.23)**
Yellowmouth rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (4.47)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.67)**
Yellowtail rockfish British Columbia Northeast Pacific, Bottom trawls, Canada, hard substrate	Green (5.00)	Red (1.34)	Yellow (3.00)	Yellow (2.83)	**Good Alternative (2.75)**
Redbanded rockfish British Columbia Northeast Pacific, Longline (deep-set), Canada	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Rougheye rockfish British Columbia Northeast Pacific, Longline (deep-set), Canada	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Sablefish British Columbia Northeast Pacific, Longline (deep-set), Canada	Green (3.83)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.04)**
Shortraker rockfish British Columbia Northeast Pacific, Longline (deep-set), Canada	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Big skate British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Green (3.32)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.90)**

Dover sole British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Yellow (2.64)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.74)**
English sole British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Green (3.83)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (3.01)**
Longnose skate British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Avoid (2.60)**
Longspine thornyhead British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.76)**
Shortspine thornyhead British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Avoid (2.60)**
Pacific cod British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Yellow (3.16)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.86)**
Petrale sole British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Yellow (3.05)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.84)**
Rex sole British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Yellow (2.64)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (2.74)**

Sablefish British Columbia Northeast Pacific, Bottom trawls, Canada, soft substrate	Green (3.83)	Red (2.05)	Yellow (3.00)	Green (3.46)	**Good Alternative (3.01)**
Lingcod British Columbia Northeast Pacific, Set longlines, Canada, Inside Rockfish	Green (4.47)	Green (4.75)	Yellow (3.00)	Green (4.12)	**Best Choice (4.02)**
Canary rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Green (4.47)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.84)**
Darkblotched rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Greenstriped rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Yellow (2.64)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.49)**
Lingcod British Columbia Northeast Pacific, Midwater trawls, Canada	Green (4.47)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.84)**
Arrowtooth flounder British Columbia Northeast Pacific, Midwater trawls, Canada	Green (5.00)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.92)**
Pacific Ocean perch British Columbia Northeast Pacific, Midwater trawls, Canada	Yellow (3.05)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.58)**

Redbanded rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Redstripe rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Rougheye rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Shortraker rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Silvergray rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Green (5.00)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.92)**
Southern Rock sole British Columbia Northeast Pacific, Midwater trawls, Canada	Green (5.00)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.92)**
Widow rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Red (2.16)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Avoid (2.37)**
Yellowmouth rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Green (4.47)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.84)**

Yellowtail rockfish British Columbia Northeast Pacific, Midwater trawls, Canada	Green (5.00)	Red (1.34)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.92)**
Tiger rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Shortraker rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Rougheye rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Copper rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Lingcod British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Green (4.47)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.16)**
Quillback rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Redbanded rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**

China rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Rougheye rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Redbanded rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Quillback rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Sablefish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Green (3.83)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.04)**
Shortraker rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Big skate British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Green (3.32)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.93)**
Tiger rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**

Longnose skate British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Lingcod British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Green (4.47)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.16)**
Copper rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
China rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
China rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Copper rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Lingcod British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Green (4.47)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.16)**
Quillback rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**

Redbanded rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Rougheye rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Shortraker rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Tiger rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Yellowtail rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Green (5.00)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.25)**
Quillback rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Inside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Tiger rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Inside Rockfish	Red (2.16)	Yellow (2.57)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Yellowtail rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Inside Rockfish	Green (5.00)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.25)**

Yelloweye rockfish British Columbia Northeast Pacific, Jig, Canada, Inside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Yelloweye rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Yelloweye rockfish British Columbia Northeast Pacific, Longline (deep-set), Canada	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Yelloweye rockfish British Columbia Northeast Pacific, Longline (shallow-set), Canada	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Yelloweye rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Yelloweye rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Inside Rockfish	Yellow (2.71)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (2.79)**
Yelloweye rockfish British Columbia Northeast Pacific, Trolling lines, Canada, Outside Rockfish	Red (2.16)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Avoid (2.63)**
Yellowtail rockfish British Columbia Northeast Pacific, Jig, Canada, Outside Rockfish	Green (5.00)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.25)**

Yellowtail rockfish British Columbia Northeast Pacific, Set longlines, Canada, Outside Rockfish	Green (5.00)	Red (2.05)	Yellow (3.00)	Green (3.61)	**Good Alternative (3.25)**

Summary

Of the 90 stock/gear combinations that were assessed in this report, 48 receive an overall "yellow" recommendation, 41 receive a "red" recommendation, and one receives a "green" recommendation. The single greatest factor that reduced scores was a broad lack of up-to-date information for stock status and mortality; many stocks received conservative stock status and fishing mortality scores due to a lack of available information. Strengths for these fisheries include 100% at-sea and dockside monitoring, and habitat conservation measures.

Scoring Guide

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

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

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern[2], 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

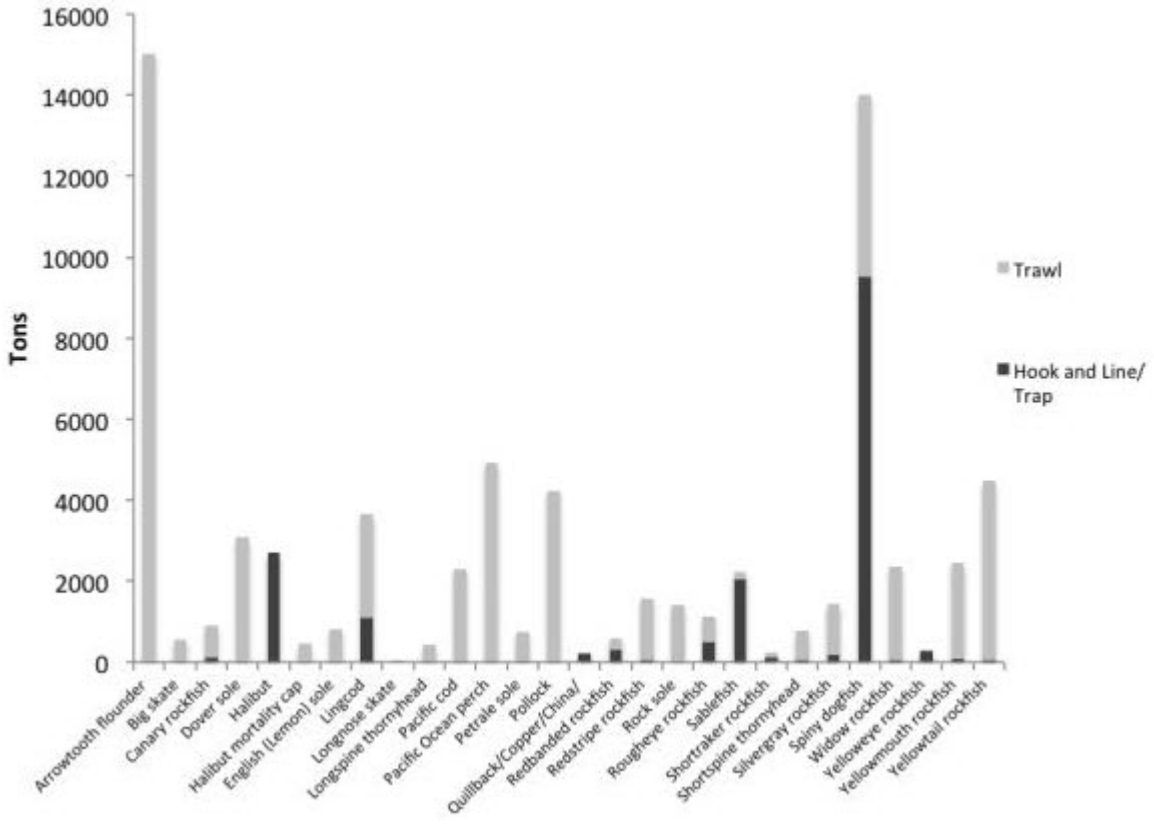
This analysis encompasses the major commercial groundfish species that are caught in the seven integrated commercial groundfish fisheries off of the coast of British Columbia. The species addressed in this analysis include a variety of flatfish, rockfish, and other roundfish. The midwater trawl fishery for Pacific hake and the small (Option A) trawl fishery are not addressed in this report.

Species Overview

The seven fisheries addressed in this assessment are the groundfish bottom trawl fishery and the hook and line fisheries for dogfish, halibut, lingcod, rockfish (inside) and rockfish (outside), and sablefish. The seven integrated groundfish fisheries use trawl, longline, jig, troll, handline, and pot gears to catch a variety of rockfish, flatfish, and roundfish species. These fisheries are unique in that they are managed separately, but in an integrated manner, with one integrated management plan. Key features of this integrated fishery include:

- Individual accountability for all catch of quota species (retained and released),
- An Individual Vessel Quota (IVQ) system,
- Reallocation of IVQs between vessels and fisheries as necessary, and
- 100% at-sea and dockside monitoring

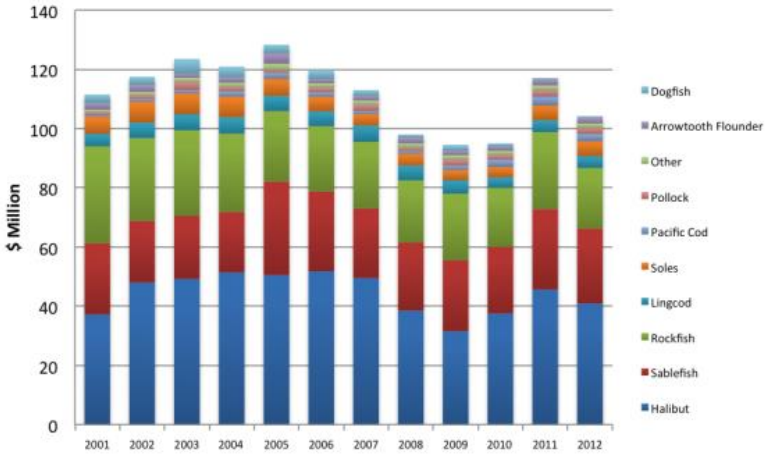
The allocation of TAC to the trawl and hook and line fisheries is depicted in Figure 1.



Allocation of TAC between fisheries, 2013 (DFO 2013a).

Production Statistics

In 2012, the total landed value of B.C.'s non-hake groundfish landings was $104.2 million (Figure 2) (Ministry of Agriculture 2013)). Pacific halibut, sablefish, and rockfish landings are particularly valuable, accounting for approximately 83% of the landed value of the 2012 groundfish landings (Figure 2) (Ministry of Agriculture 2013).



Landed value of non-hake groundfish in B.C., 2001-2012. Data from (Ministry of Agriculture 2013) (Ministry of Environment 2014).
(Ministry of Environment 2014).}

Importance to the US/North American market.

Much of the seafood produced by the groundfish fisheries is destined for export. Fresh and frozen fillets and whole fish are exported to markets along the "I-5 Highway Corridor" that runs along the U.S. west coast (GSGislason & Associates 2010). Rockfish are primarily exported to the U.S., where they are sold as fresh and frozen fillets (BCSeafood 2014); a market for live rockfish exists in the Vancouver region, as well (GSGislason & Associates 2010)(BCSeafood 2014)). The primary market for sablefish is Japan (BCSeafood.ca 2014). Halibut and lingcod are primarily destined for domestic markets and for export to the U.S. (BCSeafood 2014). Lingcod are sold as fresh and frozen fillets, while halibut are sold in a variety of products. Dogfish are exported, primarily to the United Kingdom, Europe, and Asia (BCSeafood 2014). Other notable export markets include China (flounder), Russia (sablefish, dogfish), and Ukraine (pollock, flounder) (Ministry of Agriculture 2012). In 2012, B.C.'s non-hake groundfish exports were valued at approximately $84.2 million, which represented a 16% decline from 2011 (Ministry of Agriculture 2012).

Common and market names.

Table 1. Common, market, and vernacular names of non-rockfish commercial groundfish species (as

used in the US) (FDA 2012).

Common name	Acceptable market names	Vernacular name(s)
Arrowtooth flounder	Flounder, Arrowtooth	Turbot
Dover sole	Sole	Slime sole, Slippery sole
English sole	Sole	Lemon sole
Lingcod	Lingcod	Cultus cod, Blue cod, Buffalo cod, Ling
Pacific cod	Cod, Alaska cod	Alaska cod, Grey cod, True cod
Pacific sanddab	Sanddab	Mottled sanddab, Soft flounder
Petrale sole	Sole or Flounder	California sole, Brill
Rex sole	Sole or Flounder	Longfin sole, Witch
Rock sole	Sole or Flounder	Rock flounder
Sablefish	Sablefish	Black cod, Butterfish, Skil, Skilfish, Coalfish
Spiny dogfish	Shark, dogfish or shark, cape	Spring dogfish, Spiked dogfish, Spur Dog

Table 2. Common and vernacular names for rockfish species (as used in the US) (FDA 2012)

Common name	Acceptable market names	Vernacular name(s)
Canary rockfish	Rockfish	Pacific red snapper, Orange rockfish
China rockfish	Rockfish	Yellowspotted rockcod
Copper rockfish	Rockfish	NA
Darkblotched rockfish	Rockfish	Blackmouth rockfish
Greenstriped rockfish	Rockfish	NA
Longspine thornyhead	Thornyhead	Longspine channel rockfish, spinycheek rockfish
Pacific Ocean perch	Ocean perch, rockfish	NA
Quillback rockfish	Rockfish	Yellowback rockcod, Brown rockcod, Orangespotted rockcod
Redbanded rockfish	Rockfish	NA

Redstripe rockfish	Rockfish	NA
Rougheye rockfish	Rockfish	NA
Sharpchin rockfish	Rockfish	Bigeyed rockfish
Shortraker rockfish	Rockfish	NA
Shortspine thornyhead	Thornyhead	Shortspine channel rockfish, spinycheek rockfish
Silvergray rockfish	Rockfish	NA
Tiger rockfish	Rockfish	Blackbanded rockcod
Widow rockfish	Rockfish	Pacific red snapper
Yelloweye rockfish	Rockfish	Pacific red snapper, Rasphead rockfish
Yellowmouth rockfish	Rockfish	NA
Yellowtail rockfish	Rockfish	Pacific red snapper

Table 3. Common, market, and vernacular names of non-rockfish commercial groundfish species (as used in the US) (FDA 2012).

Common name	**Acceptable market names**	**Vernacular name(s)**
Arrowtooth flounder	Flounder, Arrowtooth	Turbot
Dover sole	Sole	Slime sole, Slippery sole
English sole	Sole	Lemon sole
Lingcod	Lingcod	Cultus cod, Blue cod, Buffalo cod, Ling
Pacific cod	Cod, Alaska cod	Alaska cod, Grey cod, True cod
Pacific sanddab	Sanddab	Mottled sanddab, Soft flounder
Petrale sole	Sole or Flounder	California sole, Brill

Rex sole	Sole or Flounder	Longfin sole, Witch
Rock sole	Sole or Flounder	Rock flounder
Sablefish	Sablefish	Black cod, Butterfish, Skil, Skilfish, Coalfish
Spiny dogfish	Shark, dogfish or shark, cape	Spring dogfish, Spiked dogfish, Spur Dog

Table 4. Common and vernacular names for rockfish species (as used in the US) (FDA 2012).

Common name	Acceptable market names	Vernacular name(s)
Canary rockfish	Rockfish	Pacific red snapper, Orange rockfish
China rockfish	Rockfish	Yellowspotted rockcod
Copper rockfish	Rockfish	NA
Darkblotched rockfish	Rockfish	Blackmouth rockfish
Greenstriped rockfish	Rockfish	NA
Longspine thornyhead	Thornyhead	Longspine channel rockfish, spinycheek rockfish
Pacific Ocean perch	Ocean perch, rockfish	NA
Quillback rockfish	Rockfish	Yellowback rockcod, Brown rockcod, Orangespotted rockcod
Redbanded rockfish	Rockfish	NA
Redstripe rockfish	Rockfish	NA
Rougheye rockfish	Rockfish	NA
Sharpchin rockfish	Rockfish	Bigeyed rockfish
Shortraker rockfish	Rockfish	NA
Shortspine thornyhead	Thornyhead	Shortspine channel rockfish, spinycheek rockfish
Silvergray rockfish	Rockfish	NA

Tiger rockfish	Rockfish	Blackbanded rockcod
Widow rockfish	Rockfish	Pacific red snapper
Yelloweye rockfish	Rockfish	Pacific red snapper, Rasphead rockfish
Yellowmouth rockfish	Rockfish	NA
Yellowtail rockfish	Rockfish	Pacific red snapper

Primary product forms

See "Importance to the US/North American market".

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at http://www.seafoodwatch.org.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown.

The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. 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

Criterion 1 Summary

ARROWTOOTH FLOUNDER				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Midwater trawls | Canada	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

BIG SKATE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	1.00: High	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)

CANARY ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)

CHINA ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

COPPER ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

DARKBLOTCHED ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

DOVER SOLE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)

ENGLISH SOLE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	2.00: Medium	4.00: Low Concern	3.67: Low Concern	Green (3.83)

GREENSTRIPED ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)

LINGCOD				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Set longlines | Canada | Inside Rockfish	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Midwater trawls | Canada	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	2.00: Medium	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)

LONGNOSE SKATE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Longline (shallow-set) | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

LONGSPINE THORNYHEAD				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)

PACIFIC COD				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	2.00: Medium	2.00: High Concern	5.00: Very Low Concern	Yellow (3.16)

PACIFIC OCEAN PERCH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	4.00: Low Concern	2.33: Moderate Concern	Yellow (3.05)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	4.00: Low Concern	2.33: Moderate Concern	Yellow (3.05)

PETRALE SOLE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	2.00: Medium	4.00: Low Concern	2.33: Moderate Concern	Yellow (3.05)

QUILLBACK ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Inside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Trolling lines | Canada | Inside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)

REDBANDED ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Longline (deep-set) | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

REDSTRIPE ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

REX SOLE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)

ROUGHEYE ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Longline (deep-set) | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

SABLEFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Longline (deep-set) | Canada	1.00: High	4.00: Low Concern	3.67: Low Concern	Green (3.83)
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	1.00: High	4.00: Low Concern	3.67: Low Concern	Green (3.83)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	4.00: Low Concern	3.67: Low Concern	Green (3.83)

SHORTRAKER ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Longline (deep-set) | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

SHORTSPINE THORNYHEAD				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | soft substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

SILVERGRAY ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

SOUTHERN ROCK SOLE				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Midwater trawls | Canada	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

SPINY DOGFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Longline (shallow-set) | Canada	1.00: High	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)

TIGER ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Inside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Inside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

WIDOW ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

YELLOWEYE ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Inside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Longline (deep-set) | Canada	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Longline (shallow-set) | Canada	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)
British Columbia/Northeast Pacific Trolling lines | Canada | Inside Rockfish	1.00: High	2.00: High Concern	3.67: Low Concern	Yellow (2.71)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	2.00: High Concern	2.33: Moderate Concern	Red (2.16)

YELLOWMOUTH ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	4.00: Low Concern	5.00: Very Low Concern	Green (4.47)

YELLOWTAIL ROCKFISH				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
British Columbia/Northeast Pacific Jig | Canada | Inside Rockfish	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Bottom trawls | Canada | hard substrate	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Midwater trawls | Canada	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Trolling lines | Canada | Outside Rockfish	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Trolling lines | Canada | Inside Rockfish	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
British Columbia/Northeast Pacific Jig | Canada | Outside Rockfish	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

British Columbia/Northeast Pacific Set longlines | Canada | Outside Rockfish	1.00: High	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

Inherent Vulnerability

Throughout this report, the inherent vulnerability of assessed stocks is informed by the productivity scores presented in Table 1 {Cope et al. 2011}. The vulnerability scores presented in Cope et al. (2011) were not used, as those scores are informed by susceptibility-to-fisheries information that is specific to the U.S. west coast groundfish fisheries. 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 productivity (2), and high productivity (3) (Table 2 in Cope 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, so that high vulnerability is indicated by a productivity score of 1.0-1.67, medium vulnerability is a score of 1.68-2.33, and low vulnerability is a score of 2.34-3.0. These scores are presented alongside FishBase vulnerability scores, which are interpreted in accordance with Seafood Watch criteria. 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.

Management Reference Points

In this assessment, B_{MSY} and SB_{MSY} are the biomass and spawning biomass at maximum sustainable yield, while B_0 or SB_0 are estimates of a stock's biomass and spawning biomass in the absence of fishing, at equilibrium with long-term average recruitment.

Fisheries and Oceans Canada (also known by their previous acronym of DFO) is tasked with managing commercial fisheries in Canada's Pacific waters. DFO recently implemented a harvest strategy that uses reference points to define the status of a given stock and thereby guide decisions regarding allowable removals. The two reference points are the upper stock reference point (USRP) and the limit reference point (LRP). The USRP is not necessarily the management target; a target reference point may be higher than the USRP {DFO 2009a}. DFO suggests that if stock-specific data are not available, $0.80*B_{MSY}$ may be used as the USRP, and $0.40*B_{MSY}$ may be used as the LRP (Annex 1b in DFO 2009a). A third reference, the removal reference, governs allowable mortality rates; the removal rate declines between the USRP and the LRP. In this assessment, the acronyms USRP and LRP will refer to the two biomass reference points. For more information on the precautionary harvest strategy, see the 'Harvest Strategy' section.

Trawl Survey Indices

Throughout this assessment, indices of relative abundance are referenced to inform stock status evaluations. These indices are generally derived from multi-species trawl surveys, but can be based on commercial catch and effort data in the absence of reliable survey estimates. The purpose of the trawl survey biomass indices is to monitor changes in relative abundance. To that end, the index values are not estimates of absolute abundance, but instead should be interpreted relative to the other points in the relevant time series.

The trawl survey biomass indices are derived from multispecies trawl surveys that take place in four areas: West Coast Vancouver Island (WCVI), West Coast Haida Gwaii (WCHG), Queen Charlotte Sound (QCS), and Hecate Strait (HS). These surveys follow a random depth stratified design {Sinclair et al. 2003}. While these survey indices provide the best available information for many species, there are several caveats that precluded this assessment's use of the indices for some stock/area combinations. For one, certain stock/area combinations yield survey biomass estimates with relative errors that are too high to allow for reliable interpretation of trends from survey to survey. In other situations, an area may simply not be a center of abundance for a given stock; trends for such areas say little about the overall abundance of the stock in British Columbia's waters. For these reasons, this report does not use trawl survey biomass index information in situations where the relative error for some index values is too high to allow for confident interpretation of trends in the index, or where the stock being assessed is clearly not abundant in a given survey area.

Interpretation of Fishing Mortality Information

Throughout this assessment, several sources of information are used to evaluate fishing mortality. Where it is available, information from recent stock assessments takes priority over other sources of information. Many stocks in this report have TACs but lack regularly updated stock assessments. In such a situation, the TAC is adjusted by DFO based on trends in survey indices and fishery-dependent data; the metrics and methods for such decisions are not made public. Thus, for stocks with TACs but without recent stock status information, this assessment takes a conservative approach: catches that are less than TACs are generally scored 'moderate' for fishing mortality, unless there is other information to suggest lesser or greater concern (e.g., recent catches well over historic catches, etc.). For stocks without TACs, a fishing mortality score of 'unknown' is the general starting point; this may be revised upwards or downwards based on other sources of information. It should also be noted that data presented for rockfish catches during the late 1980s and early 1990s is considered to be uncertain, as there existed at that time an incentive to misreport catches.

Catch and TAC data

Finally, the origin of catch and TAC data requires explanation. While DFO provided the author with official catch data for the 2012-2013 fishing year, the author uses publically available quota report data for catches and TACs throughout this report (see Appendix A). While the quota report data may, in some cases, vary from data presented in stock assessments, and may not be the "best" data source (A. Sinclair, pers. comm.), the author chose to use quota reports as a primary data source because they offer:

- Consistency across species (i.e., quota reports offer data for species without stock assessments as well as those with stock assessments)

- Area-specific catch and TAC data- Multiple years of data, rather than data for just one year

Summary of findings for Criterion 1

Of the 68 stock/fishery combinations assessed under Criterion 1, 23 have a Criterion 1 rating of green, 14 have a rating of yellow, and 31 have a red rating. Up-to-date and reliable information is essential for a green rating.

For many of the stocks with yellow and red ratings, the primary issue is one of data availability: many stocks have never been assessed, or have out-of-date assessments and, as such, have received conservative ratings for Criterion 1.

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Inherent Vulnerability

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing).*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator). Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

Factor 1.2 - Abundance

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

Factor 1.3 - Fishing Mortality

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

ARROWTOOTH FLOUNDER

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Medium

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

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Very Low Concern

In a draft assessment, arrowtooth flounder biomass was recently estimated to be well above an estimate of SBMSY and to be approximately 60% of SB0 (CSAS 2015a). The stock status of arrowtooth flounder in WCVI, QCS, HS, and WCHG is therefore scored "very low" concern.

Justification:

A recent stock assessment assessed the status of the arrowtooth flounder stock for the entire coast of B.C., with the exception of the area between Vancouver Island and the mainland (CSAS 2015a). The assessment generated a median estimate of SB2015 (296,271 t; 2.5-97.5 percentiles = 146,337-760,905 t) that was approximately 2.5 times greater than estimated SBMSY (117,828 t; 2.5-97.5% = 56,340-302,674 t) and that was approximately 60% of estimated SB0 (495,407 t, 2.5-97.5% = 244,064-1,257,780 t) (Table 2 in CSAS 2015a).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

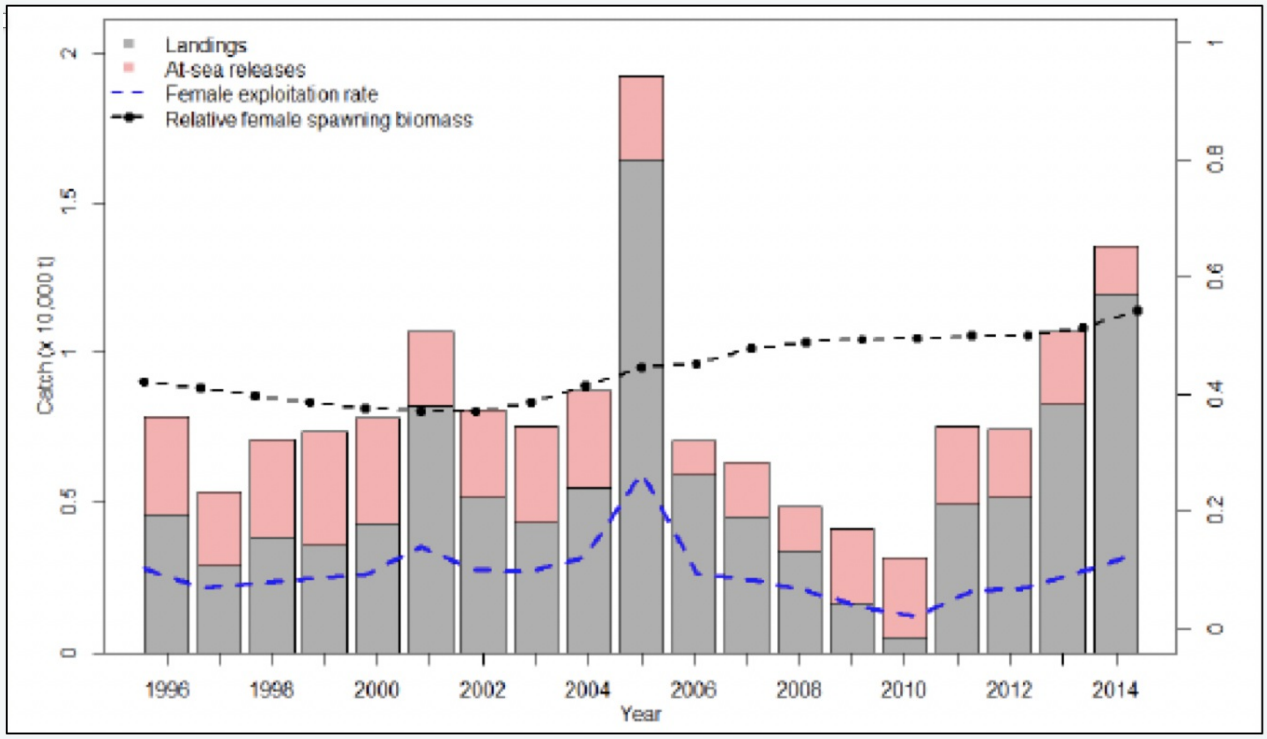
Very Low Concern

The trawl fishery is allocated 100% of the arrowtooth flounder TAC (DFO 2013a). For 2014, estimated fishing mortality is below an estimate of FMSY. Furthermore, age composition data suggest that female arrowtooth flounder spawn for several years before becoming susceptible to the fishery. The fishing mortality of arrowtooth flounder is scored "very low" concern.

Justification:

Until recently, arrowtooth flounder was discarded in substantial quantities, as its marketability was compromised by the fact that its flesh can degrade rapidly after being caught (CSAS 2015a). However, a market has developed in the past five years, and arrowtooth flounder landings have increased (Figure 3; note that there are no reliable data for arrowtooth catch prior to the onset of at-sea observer coverage in 1996) (CSAS 2015a). For 2014, the total catch of arrowtooth flounder was 13,570 t (Table 1 in Grandin & Forrest 2015), while the TAC was 15,000 t (Grandin & Forrest 2015).

In the recent stock assessment, F2014 (median = 0.136, 2.5-97.5 percentiles = 0.064-0.242) was estimated to be below FMSY (median = 0.188); however, the 2.5-97.5 percentiles for FMSY were extremely broad (0.046-0.771; Table 2 in CSAS 2015a). Age composition data show that age-at-50%-selectivity for the trawl fishery is approximately four to five years greater than the age-at-50% for maturity, suggesting that females have the opportunity to spawn several times before being selected by the fishery (CSAS 2015a). This mitigates any concern regarding fishing mortality.



Landings and at-sea discards of arrowtooth flounder in recent years, with estimates of female exploitation rate and relative spawning biomass. Figure from (CSAS 2015a).

BIG SKATE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The FishBase vulnerability score for big skate is 86. The species' productivity rating is 1.37 (Table 1 in (Cope et al. 2011). It should be noted that big skate are identified as "probably the least resilient" of British Columbia's skates (Benson et al. 2001). Big skate is therefore scored "high" vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

A recent assessment was unable to yield reliable biomass estimates for big skate, but noted that there were

no significant trends in survey abundance indices (CSAS 2014a). The stock's status is therefore scored "moderate" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Low Concern

The 2012 catch of Area 5C/D big skate in the trawl fishery was 321.7 t, while the Area 5C/D big skate trawl TAC was 724.9 t (Appendix A). The halibut fishery was also responsible for approximately 7% of big skate catch in groundfish fisheries in 2012 (DFO Pacific Region 2013). Recent catches of big skate have been within, or less than, ranges of MSY estimated from historical catch (Table 1 in (CSAS 2014a)). While the recent assessment suggests that overfishing is not occurring, it does not provide a reliable estimate of sustainable mortality. Fishing mortality of big skate is therefore scored "low" concern.

CANARY ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for canary rockfish is 62. The species' productivity rating in Cope et al. 2011 is 1.28 (Table 1 in (Cope et al. 2011)). Canary rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

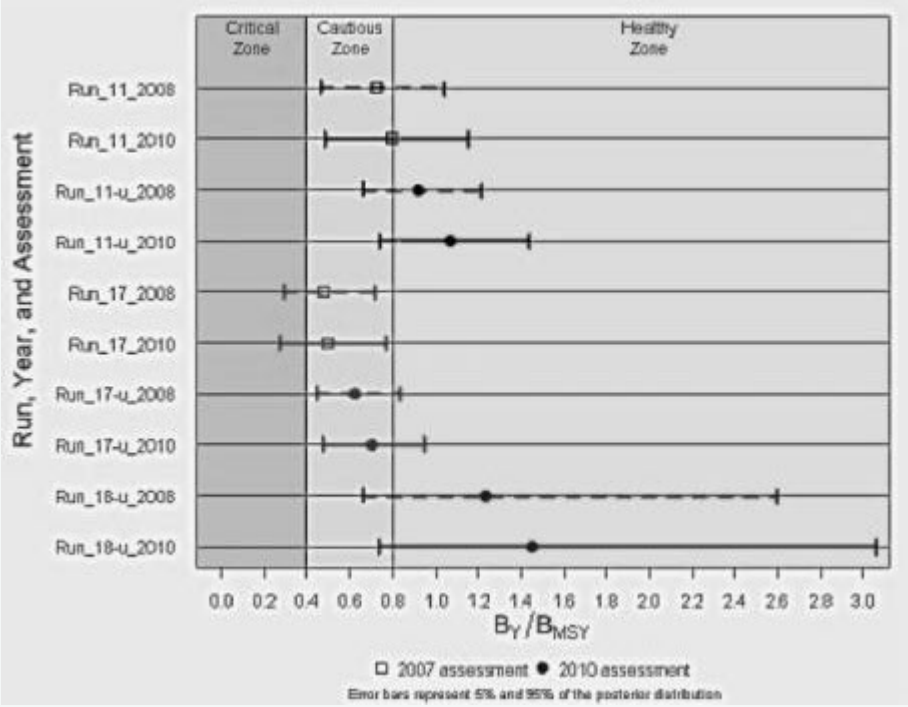
After declining for at least six decades, canary rockfish biomass apparently began to rebuild in 2004. While canary rockfish were listed as "Threatened" by COSEWIC in 2007, a more recent estimate of B_{2010} fell within DFO's "Healthy Zone". The COSEWIC status would usually confer a Factor 1.2 score of "very high" concern, but the information presented in the recent stock assessment moderates concern. The stock status of canary rockfish is therefore scored "low" concern.

Justification:

Canary rockfish were listed as "Threatened" by COSEWIC in 2007 (Appendix D; (COSEWIC 2007a)), but were declined for listing under SARA (Canada Gazette 2011).

Prior to 2004, canary rockfish biomass had been declining for many decades. The decline started in the 1940s and continued through 2004, with only two brief periods of minor increases during that period (Figure 12 in (DFO 2009c)). By 2004, the stock's spawning biomass was estimated to be approximately 20% of B_0 (DFO 2009c). Since 2004, the stock's spawning biomass is estimated to have increased in each year, such that the spawning biomass at the time of the last stock assessment was estimated to be 31% of B_0 (DFO 2009c). While the post-2004 period of rebuilding is brief when compared to the lengthy decline, it appears to

represent the longest sustained increase since the mid-1950s (Figure 12 in (DFO 2009c)). In the recent stock assessment update, the median estimate of B_{2010} generated by the preferred model run (run 11-u) was estimated to be above the USRP (DFO 2009c). The 5-95% credibility intervals from several model runs from two recent stock assessments suggest that B_{2010} is not likely to be less than the LRP (Figure 4).



Comparison of mean and 5th/95th credibility intervals for canary rockfish B_{YEAR}/B_{MSY} estimates generated in two recent stock assessments, which were conducted in 2007 and 2009. YEAR = 2008 or 2010.(Figure from (DFO 2009c).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

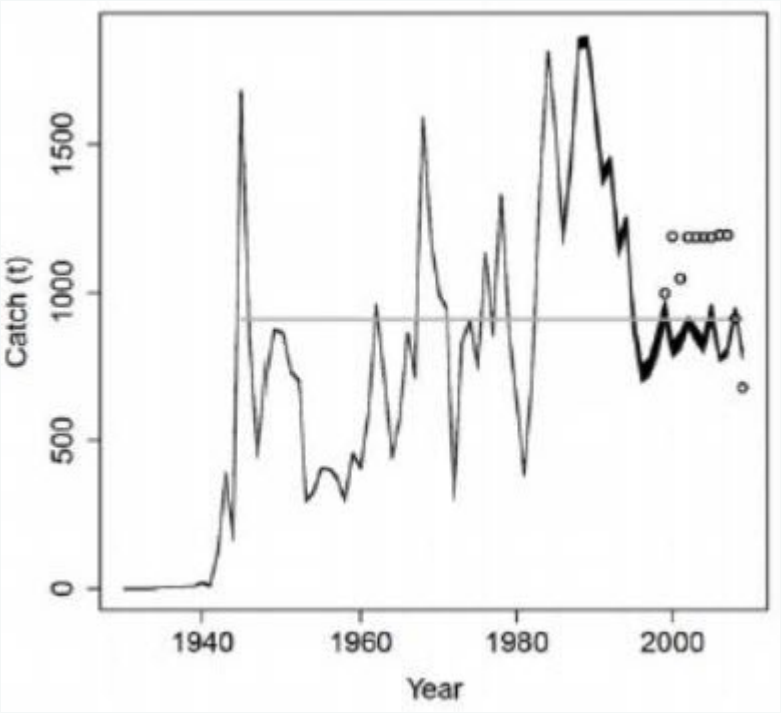
Very Low Concern

The trawl fishery is allocated approximately 87.7% of total canary rockfish TAC (DFO 2013a). The catch of canary rockfish in 2012 was approximately 71.0% of the available coastwide TAC; approximately 96.9% of the 2012 canary rockfish catch was taken in the trawl fishery.

While recent exploitation rates have been similar to historic maximums, the recent stock assessment update indicates that annual catches similar to the 2012 level are highly unlikely to lead to sub-USRP stock status by 2015. Furthermore, the assessment indicates that steady catches similar to the 2012 level are modeled to allow biomass to increase. Fishing mortality of canary rockfish in the trawl fishery is therefore scored "very low" concern.

Justification:

Canary rockfish have been caught in substantial amounts in B.C. waters since the 1940s, with several periods of particularly high catches (Figure 5). Exploitation rates generally increased over this period (Figure 6). Recent catches have been relatively steady (Figure 5), and exploitation rates have begun to drop (Figure 6) as biomass has increased in recent years (see Factor 1.2).



Estimated historical catch of canary rockfish in B.C. waters, with average 1945-2009 catch indicated by dashed line. Catch by hook and line is indicated by solid black area, the remainder is trawl catch. Recent TACs are indicated by the dotted line. (Figure from (DFO 2009b).

Modeled exploitation rates from the reference run (Run 11-u) in the recent stock assessment update for canary rockfish. (Figure from (DFO 2009b).

The 2012 coastwide catch of canary rockfish was 761.9 t, while the total TAC was 1,072.5 t (Appendix A). The trawl fishery, which is allocated approximately 87.7% of total canary rockfish TAC (DFO 2013a), accounted for 738.4 t of the 2012 total catch (Appendix A). The preferred model run from the recent stock assessment update (run 11-u) estimates that annual catches of 800 t are associated with probabilities of 1.0 and 0.98 that SB_{2015}will exceed the LRP and USRP, respectively (Table 14 in (DFO 2009c)). The preferred model run also estimates that spawning biomass will increase over a multi-decade timeframe if annual catches are held constant at 800 t/year (Table 18 in (DFO 2009c)).

The lingcod and dogfish fisheries slightly exceeded their 2012 Area 5C/5D TACs for canary rockfish; no other area-specific TACs were exceeded in 2012 (DFO 2013c).

CHINA ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability scores for china rockfish is 56. The species' productivity rating in Table 1 of (Cope et al. 2011) is 1.33, which likewise indicates "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no up-to-date stock assessment for china rockfish. In light of this species' high inherent vulnerability, stock status is scored "high" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

There are no estimates of sustainable mortality for China, copper, or tiger rockfish. However, the establishment of Rockfish Conservation Areas (RCAs) has set aside substantial amounts of habitat for these species. Fishing mortality is scored "moderate" concern for the china, copper, and tiger rockfish in the halibut and outside rockfish fisheries, and for tiger rockfish catch in the inside rockfish fishery.

Justification:

Note: Quillback, copper, china, and tiger (QCCT) rockfish are managed with one TAC. Mortality of QCCT rockfish is discussed here as one unit, but quillback mortality is addressed in more specific terms in the detailed rationale for that species. The following information informs fishing mortality scores for copper, china, and tiger rockfish.

In 2012, the total catch of QCCT rockfish was 183.8 t, while the total TAC was 257.2 t (Appendix A). Line fisheries dominated the catch of QCCT species; the trawl fishery was responsible for relatively little QCCT catch (Figure 52). The halibut and outside rockfish fisheries were the primary fisheries for all four QCCT species in 2012, and the inside rockfish fishery was responsible for substantial proportions of quillback and tiger rockfish catches (Figure 7).

The 2012 catch can be broken down by catch taken from inside (Area 4B) and outside (remaining areas)

waters. The inside rockfish fishery accounted for 96.3% of the 2012 QCCT rockfish catch in inside waters, but zero percent of the outside catch (DFO 2013d). Conversely, catch of QCCT rockfish in outside waters was dominated by the outside rockfish fishery (69.5% of outside QCCT catch) and the halibut fishery (25.8%) (DFO 2013d).

Area-specific TACs have been exceeded by some fisheries during recent years. In particular, the halibut fishery exceeded its inside (Area 4B) TAC each year from 2009-2012, and the dogfish fishery exceeded numerous area-specific TACs during this same period (DFO 2013d). In 2012, the lingcod fishery slightly exceeded its Area 5B TAC (DFO 2013d).

	China rockfish		Copper rockfish		Quillback rockfish		Tiger rockfish	
Fishery	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*
Trawl	0.03	0.2	2.78	7.1	2.23	1.5	0.00	0.1
Halibut	3.30	23.7	4.17	10.7	39.44	26.6	1.30	25.7
Rockfish Inside	0.51	3.7	1.47	3.8	17.91	12.1	0.49	9.7
Rockfish Outside	9.53	68.3	29.75	76.0	80.27	54.1	2.94	58.3
Other fisheries	0.57	4.1	0.97	2.5	8.61	5.8	0.31	6.2
TOTAL	*13.95*	*100.0*	*39.14*	*100.1*	*148.46*	*100.1*	*5.05*	*100.0*

Total catch of QCCT rockfish in 2012 groundfish fisheries (DFO Pacific Region 2013).

COPPER ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for copper rockfish is 58. The species' productivity rating in Table 1 of (Cope et al. 2011) is 1.36, which likewise indicates "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no up-to-date stock assessment for copper rockfish. In light of this species' high inherent vulnerability, stock status is scored "high" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

There are no estimates of sustainable mortality for China, copper, or tiger rockfish. However, the establishment of Rockfish Conservation Areas (RCAs) has set aside substantial amounts of habitat for these species. Fishing mortality is scored "moderate" concern for the china, copper, and tiger rockfish in the halibut and outside rockfish fisheries, and for tiger rockfish catch in the inside rockfish fishery.

Justification:

Note: Quillback, copper, china, and tiger (QCCT) rockfish are managed with one TAC. Mortality of QCCT rockfish is discussed here as one unit, but quillback mortality is addressed in more specific terms in the detailed rationale for that species. The following information informs fishing mortality scores for copper, china, and tiger rockfish.

In 2012, the total catch of QCCT rockfish was 183.8 t, while the total TAC was 257.2 t (Appendix A). Line fisheries dominated the catch of QCCT species; the trawl fishery was responsible for relatively little QCCT catch (Figure 52). The halibut and outside rockfish fisheries were the primary fisheries for all four QCCT species in 2012, and the inside rockfish fishery was responsible for substantial proportions of quillback and tiger rockfish catches (Figure 7).

The 2012 catch can be broken down by catch taken from inside (Area 4B) and outside (remaining areas) waters. The inside rockfish fishery accounted for 96.3% of the 2012 QCCT rockfish catch in inside waters, but zero percent of the outside catch (DFO 2013d). Conversely, catch of QCCT rockfish in outside waters was dominated by the outside rockfish fishery (69.5% of outside QCCT catch) and the halibut fishery (25.8%) (DFO 2013d).

Area-specific TACs have been exceeded by some fisheries during recent years. In particular, the halibut fishery exceeded its inside (Area 4B) TAC each year from 2009-2012, and the dogfish fishery exceeded numerous area-specific TACs during this same period (DFO 2013d). In 2012, the lingcod fishery slightly exceeded its Area 5B TAC (DFO 2013d).

	China rockfish		Copper rockfish		Quillback rockfish		Tiger rockfish	
Fishery	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*
Trawl	0.03	0.2	2.78	7.1	2.23	1.5	0.00	0.1
Halibut	3.30	23.7	4.17	10.7	39.44	26.6	1.30	25.7
Rockfish Inside	0.51	3.7	1.47	3.8	17.91	12.1	0.49	9.7
Rockfish Outside	9.53	68.3	29.75	76.0	80.27	54.1	2.94	58.3
Other fisheries	0.57	4.1	0.97	2.5	8.61	5.8	0.31	6.2
TOTAL	*13.95*	*100.0*	*39.14*	*100.1*	*148.46*	*100.1*	*5.05*	*100.0*

Total catch of QCCT rockfish in 2012 groundfish fisheries (DFO Pacific Region 2013).

DARKBLOTCHED ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for darkblotched rockfish is 69. The species' productivity rating in Table 1 of (Cope et al. 2011) is 1.39 (Table 1 in Cope et al. 2011), which confirms the species' "high" vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

There is no stock assessment for darkblotched rockfish, and the stock is listed as "special concern" by COSEWIC. Trawl survey biomass indices are characterized by high relative error, and are not used by this assessment. Due to the COSEWIC status, the lack of information regarding stock status, and the "high" inherent vulnerability of the species (see Factor 1.1), darkblotched rockfish are scored "high" concern for Factor 1.2.

Justification:

Darkblotched rockfish are listed as "special concern" by COSEWIC (Appendix D) (COSEWIC 2009). While a summary of available information is available (Haigh & Starr 2008), there is no assessment of the status of the stock. Reliable interpretation of darkblotched rockfish trawl survey biomass index estimates is complicated by the estimates' high relative error (generally >0.40) (DFO 2013b), and therefore the trawl survey biomass indices are not used in this assessment.

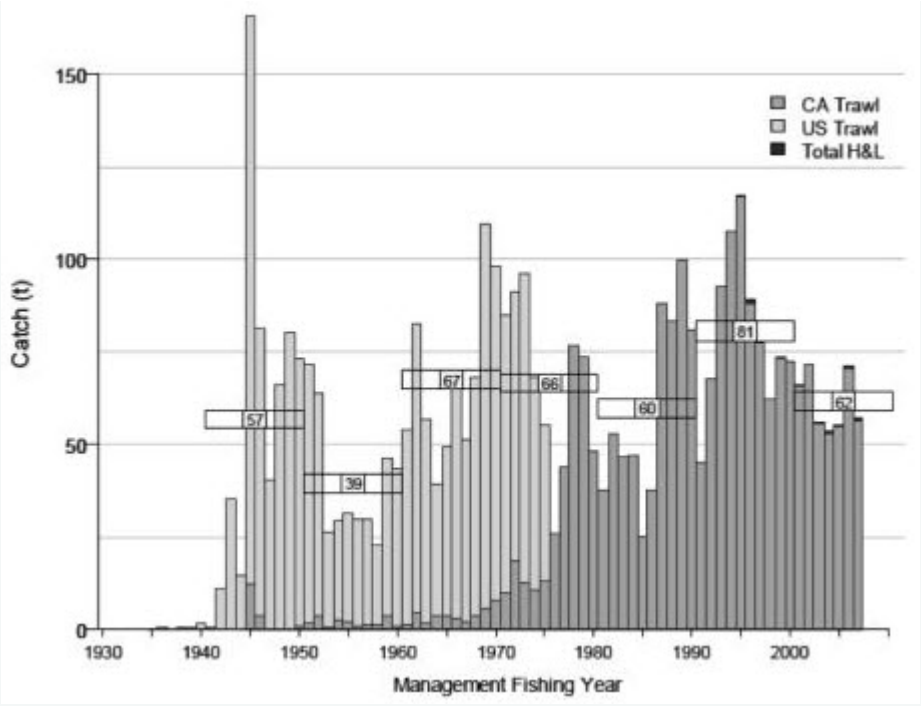
Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In 2012, the total catch of darkblotched rockfish was 65.47 t; 98.7% of this catch was taken in the trawl fishery (DFO Pacific Region 2013). The 2012 catch is roughly similar to catches in recent years (Figure 9). There is no TAC for darkblotched rockfish, and there is no information regarding the appropriateness of current levels of fishing mortality. Fishing mortality of darkblotched rockfish in the trawl fishery is therefore scored "moderate" concern.

Justification:



Reconstructed history of darkblotched rockfish catch (discards + landings) by U.S. and Canadian fisheries operating in Canadian waters. Numbers in boxes represent mean annual catch for the corresponding decade. Figure from (Haigh and Starr 2008).

DOVER SOLE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

The Fishbase vulnerability score for Dover sole is 42. The species' productivity rating in Cope et al. 2011 is 1.80 (Table 1 in (Cope et al. 2011)). Inherent vulnerability for Dover sole is therefore "medium".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

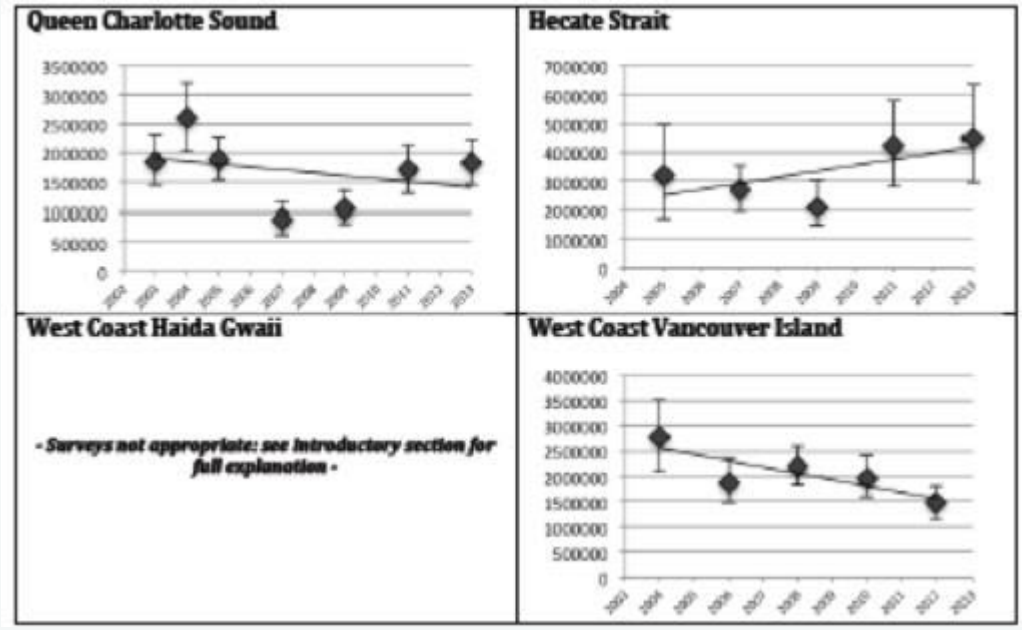
Moderate Concern

There is no stock assessment for Dover sole, and trends in trawl survey biomass indices vary. The stock status of Dover sole is scored "moderate" due to the lack of a stock assessment, and the varying trends seen in trawl biomass indices for the two populations, and moderate (not high) vulnerability.

Justification:

Two populations of Dover sole are found in British Columbia's waters: 1) a southern population off of the west coast of Vancouver Island in Areas 3C/D, and 2) a northern population found in Hecate Strait, Queen Charlotte Sound, and the west coast of Haida Gwaii in Areas 5A-5E (DFO 2001). The QCS and WCVI survey biomass

indices show declining trends, and the index for HS shows an increasing trend (Figure 10).



Trawl survey biomass indices for Dover sole. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

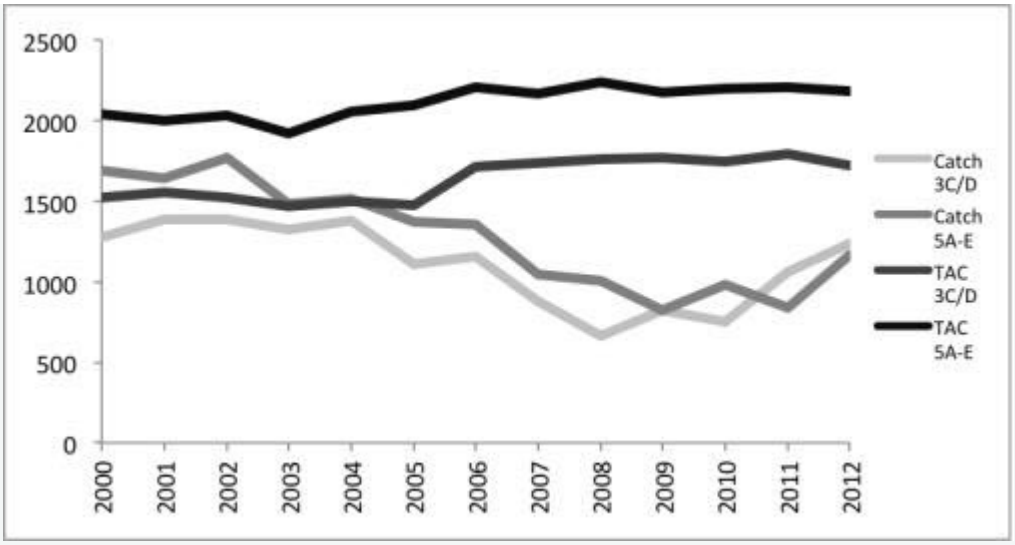
Moderate Concern

The trawl fishery is allocated 100% of the dover sole TAC (DFO 2013a). In 2012, the trawl fishery's catches of Dover sole in Areas 3C/D and Areas 5A-E were approximately 71.8% and 53.3% of the Areas 3C/D and 5A-E TACs, respectively. The 2012 catches (landings + discards) in Areas 3C/D and 5C-E were broadly similar to historical landings levels; this comparison, while not perfect, is conservative in that it compares recent catches (including discards) to historical landings (which exclude discards). The lack of a stock assessment precludes a more detailed analysis of fishing mortality, and therefore, fishing mortality of Dover sole is scored "moderate" concern for the trawl fishery.

Justification:

Trawl catch did not exceed any area-specific TACs during any years of the 2000-2012 period (DFO 2013c). The trawl fishery's catches of Dover sole in Areas 3C/D and 5A-E generally declined from 2002 through 2009 despite increasing TACs; catches have somewhat increased in recent years (Figure 11).

In 2012, the trawl catch in Areas 3C/D (1,236 t) was approximately 71.8% of the Areas 3C/D TAC (1,722 t; Appendix C). In Areas 5A-E, the 2012 catch (1,166 t) was approximately 53.3% of the TAC (2,186 t; Appendix C).



Dover sole catch and TACs in the trawl fishery, 2000-2012 (see Appendix C for data).

Due to the lack of a stock assessment, there are few references against which these catches may be assessed. One point of reference is historical landings: from 1970 to 1997, the average annual Dover sole landings were 863.9 t (± 279.4 t) in Areas 5C-E (Table 1.9 in (Fargo 1999)). For Areas 3C/D, the average annual landings during the period 1988-1997 was 1,199 t (± 412.3 t; Table 1.4 in (Fargo 1999)) (the period 1988-1997 is used for comparison as Areas 3C/D landings were minimal in the years immediately preceding 1988; see Table 1.4 in (Fargo 1999)). It should be noted that these historical data represent only landings, whereas the more recent data represent total catch.

Another potential reference is advice on yield options that, while outdated, may provide an idea of maximum yields. Fargo (1999) presented yield options for Dover sole; the low-risk and high-risk yield options were 1,000 and 1,500 t, respectively, for Areas 3C/D, and 800 and 1,200 t, respectively, t for Areas 5C-E (Fargo 1999). The author of those yield estimates suggested that both populations were likely to be fully exploited (Fargo 1999). While these yield options are obviously not up-to-date, they represent the most recent yield estimates that are available to the public. Due to the lack of up-to-date stock status information (see Factor 1.2), it cannot be assumed that the stock can support higher yields than those presented by Fargo (1999).

While the aforementioned caveats prevent direct comparison of the 2012 catches with the references derived from Fargo (1999), a general comparison suggests that the 2012 catches in Areas 3C/D and Areas 5C-E are between the 1999 low and high-risk yield estimates, and are broadly similar to historical catches and landings (Figure 12).

	2012 Catch (t)	2000-2011 Average Catch	Historical Average Landings	1999 Low-risk Yield	1999 High-risk Yield
Areas 3C/D	1,235.9	1,099.7	1,199.0 (1988-1997)	1,000	1,500
Areas 5C-E	918.8	898.5	863.9 (1970-1997)	800	1,200

2012 Dover sole catch and various references. All units are tons. 2012 catch and 2000-2011 average catch: Appendix C; historical average landings and low/high risk yields: (Fargo 1999)

ENGLISH SOLE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

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

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Low Concern

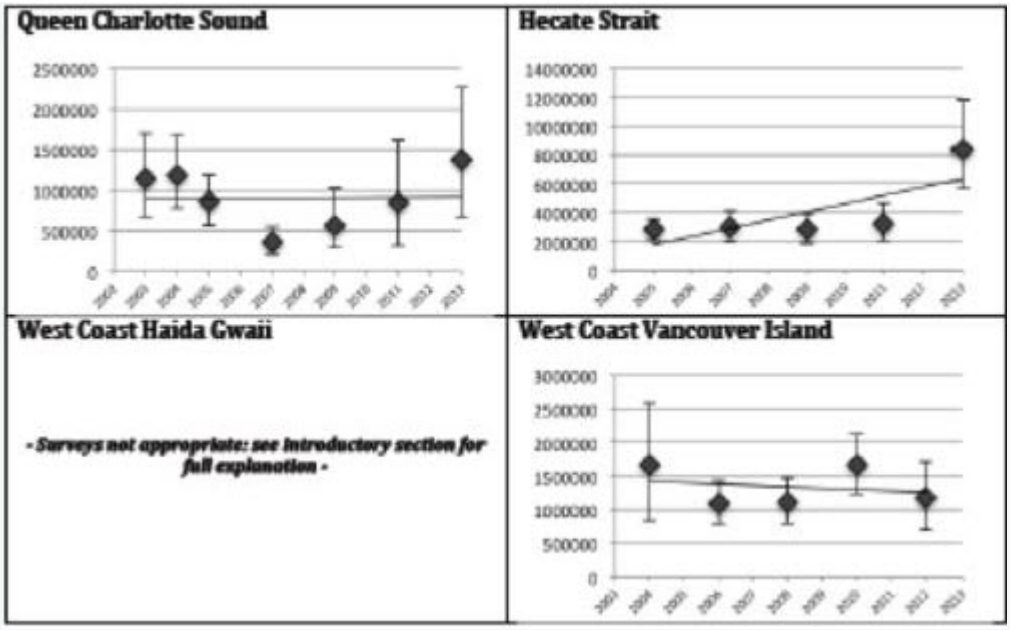
Information from the most recent stock assessment and recent trawl survey biomass indices suggests that the two English sole stocks may be increasing; however, the assessment's age and methodological challenges reduce confidence in its current applicability. The stock status of English sole is scored "low" concern due to the lack of a recent and reliable estimate of stock status, and the species' "medium" inherent vulnerability.

Justification:

There are two stocks of English sole found in British Columbia's waters: one stock is found in Hecate Strait (Areas 5C/D), and the other is found in the waters off of the west coast of Vancouver Island and in Queen Charlotte Sound (Areas 3C/D and 5A/B) (Starr 2009a). The most recent assessment of the English sole stocks was conducted for the 2007/08 year (Starr 2009a).

In the most recent stock assessment, the recommended model's estimates of HS female biomass showed a strong increase since approximately 2000 and resulted in an estimated 2005 biomass that exceeded any other point on the figure; a slight decline was noted for years 2006 and 2007 (Figure D.34 in (Starr 2009a)). The trend for the WCVI/QCS female biomass was similar (Figure D.38 in (Starr 2009a)). It should be noted that a different model run, which differed only in its treatment of catch per unit effort (CPUE), produced results that showed biomass in those same years to have increased, but to have still been less than at several points in the recent past (Figures D.31 and D.36, respectively, in (Starr 2009a)).

The survey biomass indices do not show strong trends, with a slightly increasing trend seen in HS, a slight decline in WCVI, and essentially no change in QCS (Figure 13).



Trawl survey biomass indices for English sole. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

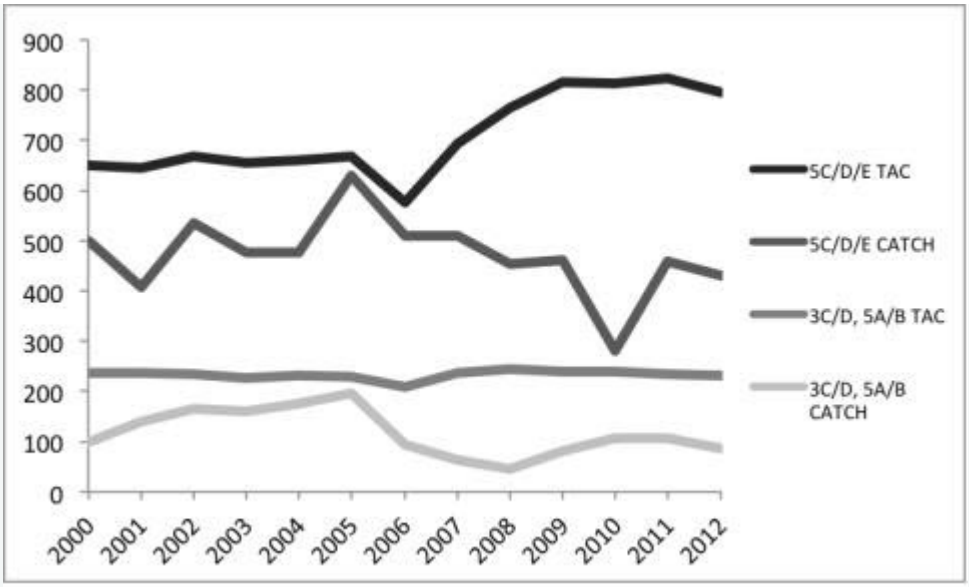
Low Concern

The trawl fishery is allocated 100% of English sole TAC (DFO 2013a). Recent catches of English sole have been some of the lowest of the past several decades. Modeled probabilities presented in an assessment of the 2006/2007 stock suggest that catches during the period 2007-2011 were more likely to have allowed the two stocks' biomasses to increase rather than decrease by the end of that period. Fishing mortality of English sole is scored "low", as the age of the assessment precludes a higher score. However, this score should be revisited if catches begin to increase towards TACs, as TACs have been much higher than recent catches.

Justification:

Catches have generally declined since 2005 (Figure 13), and in recent years have been comparable to the lowest catches recorded during the 1980s and 1990s (compare to Table B.1 in (Starr 2009a)). During the period 2000-2012, no area-specific trawl TACs were exceeded (Figure 14; Appendix A).

In 2012, the trawl fishery's English sole catches were 86.7 t in Areas 3C/D and 5A/B, and 431.5 t in Areas 5C-E (Appendix A). The TACs for these areas were 231.5 t for Areas 3C/D and 5A/B, and 796.3 t for Areas 5C-E (Appendix A).



English sole catch and TACs in the trawl fishery, 2000-2012 (see Appendix C for data).

The author of the most recent stock assessment modeled the probabilities of various 2007-2011 catch levels resulting in a B_{2012} that exceeded various references (Starr 2009a). The mean annual catch during the period 2007-2011 was 79.9 t in Areas 3C/D and 5A/B, and 432.5 t in Areas 5C-E (Appendix C). The approximate modeled probabilities associated with similar catch levels are shown in Figure 15. (Note that the probabilities are shown for Areas 5C/D, while the average 2007-2011 catch is for Areas 5C-E. However, the annual contribution of catches from Area 5E to the total Areas 5C-E catch has been <1 t since 2000, as shown in Table B.1. in (Starr 2009a).

Area	Mean Catch, 2007-2011 (t)	Modeled Catch Amount (t)	Recommended Model Run	Approx. P ($B_{2012}>B_{MIN}$)	Approx. P ($B_{2012}>B_{REF}$)	Approx. P ($B_{2012}>B_{2007}$)
3C/D, 5A/B	79.9	106	cpue_2r=5_estM	0.99	0.89	0.66
5C/D	432.5 (Areas 5C-E)	424	cpue_2r=5_estM	1.00	0.99	0.67

Modeled probabilities of B2012 exceeding various reference points after application of the catches similar to the 2007-2011 mean annual catch. Modeled catch amounts and probabilities from Tables D.9 and D.11 in (Starr 2009a). For this table, BMIN = the minimum biomass over the 1966-2006 period, and BREF = mean biomass during the period 1978-1988 for Areas 5C/D and 1974-1986 Areas 3C/D and 5A/B.

While the modeled probabilities presented in Table 2 indicate that the mean catches of the 2007-2011 period likely allowed the two stocks to increase relative to 2007 levels and were not likely to cause either stock to decline below historical reference points, it should be noted that the same cannot be said for the two stocks' mean 2007-2011 TACs. Modeled probabilities (Figure 16) suggest that catches equal to the 2007-2011 TACs for the two stocks would have had substantially lower probabilities of resulting in B_{2012} values that exceeded those of B_{2007} or the modeled reference points.

Area	Mean TAC, 2007-2011 (t)	Modeled Catch Amount (t)	Recommended Model Run	Approx. P ($B_{2012}>B_{MIN}$)	Approx. P ($B_{2012}>B_{REF}$)	Approx. P ($B_{2012}>B_{2007}$)
3C/D, 5A/B	239.0	212	cpue_2r=5_estM	0.89	0.50	0.20
5C/D	782.4 (Areas 5C-E)	742	cpue_2r=5_estM	0.97	0.78	0.22

Modeled probabilities of B2012 exceeding various reference points after application of catches equal to the mean 2007-2011 TACs for the two stocks. Modeled catch amounts and probabilities from Tables D.9 and D.11 in in (Starr 2009a). For this table, BMIN = the minimum biomass over the 1966-2006 period, and BREF = mean biomass during the period 1978-1988 for Areas 5C/D and 1974-1986 Areas 3C/D and 5A/B.

GREENSTRIPED ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for greenstriped rockfish is 63. The species' productivity rating in Cope et al. 2011 is 1.28 (Table 1 in (Cope et al. 2011)). Greenstriped rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

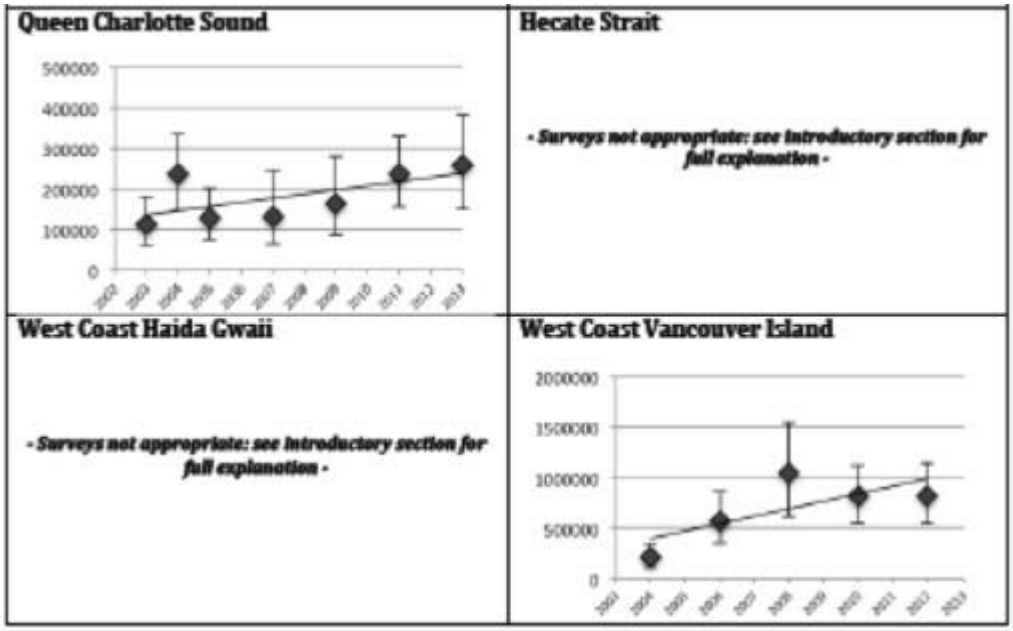
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

There is no stock assessment for greenstriped rockfish. While the Seafood Watch criteria recommend a score of "high" concern for species with "high" inherent vulnerabiilty (see Factor 1.1) and no information for stock status relative to reference points, the trends in the species' trawl survey biomass indices mitigate concerns regarding the status of the stock. Greenstriped rockfish stock status is therefore scored "moderate".

Justification:

In the trawl survey biomass data, greenstriped rockfish are most abundant in WCVI, and are consistently of relatively low abundance in HS and WCHG (DFO 2013b). The trawl survey biomass indices for WCVI and QCS show increasing trends (Figure 17).



Trawl survey biomass indices for greenstriped rockfish. Data from {DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In 2012, the total catch of greenstriped rockfish was 41.90 t; 97.4% of this catch was taken in the trawl fishery (DFO Pacific Region 2013). There is no TAC for greenstriped rockfish, and there is no information regarding the appropriateness of current levels of fishing mortality. Fishing mortality of greenstriped rockfish in the trawl fishery is therefore scored "moderate".

LINGCOD

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Medium

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

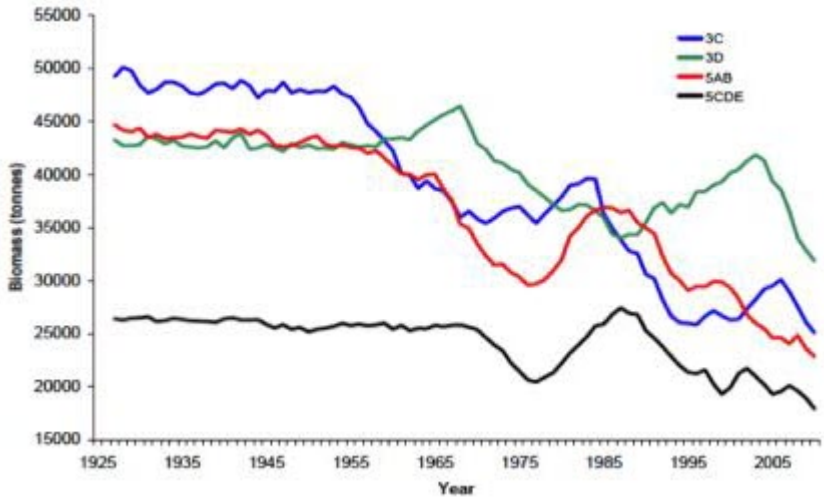
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Low Concern

For lingcod in "outside" waters (Areas 3C, 3D, 5A/B, and 5C/D/E), biomass has generally declined over the course of several decades and has recently been assessed at the lowest values since the late 1920s. Despite the long decline of lingcod biomass in outside waters, each area's estimated B_{2010} exceeded the USRP. However, there was substantial uncertainty regarding this result for Areas 3C and 5AB. The stock status of lingcod in outside waters is therefore scored "low" concern.

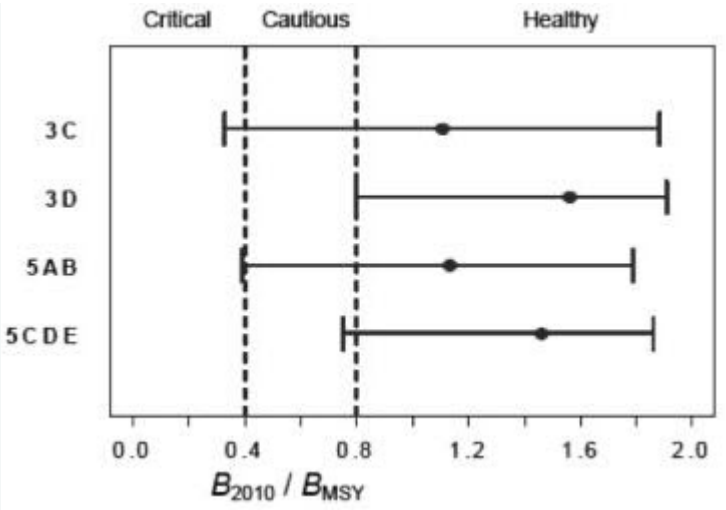
Justification:

The four discrete lingcod stocks in 'outside' waters (Areas 3C, 3D, 5A/B, and 5C/D/E) were assessed in 2011 (DFO 2011c)(CSAS 2011). For all of these stocks, estimated B_{2010} was lower than in any year since 1927 (Figure 18).



Estimates of median biomass for outside lingcod. Figure from (DFO 2011b).

Despite the long-term declining trend noted for each stock's estimated lingcod biomass, each stock's estimated B_{2010} was above the USRP ($0.8*B_{MSY}$) and thus qualified as being within DFO's 'healthy zone' (Table 1 in (DFO 2011c); Figure 19). Due to greater uncertainty in the stock status for Areas 3C and 5A/B, the 90% probability intervals extend through the cautious zone into the critical zone (e.g., $B_{2010}<0.4*B_{MSY}$) for these two areas (Figure 20). The probabilities that B_{2010} exceeded the USRP were 0.67, 0.95, 0.67, and 0.88 for Areas 3C, 3D, 5A/B, and 5C/D/E, respectively (Table 1 in (DFO 2011c)). The probabilities that B_{2010} exceeded the LRP were 0.90, >0.99, 0.95, and >0.99 for these same areas, respectively (Table 1 in (DFO 2011c)).



Estimates of B2010 vs. reference points for outside lingcod. Dots are the posterior median of the ratio B2010:BMSY, and error bars are the 90% probability intervals of this ratio. Figure from (DFO 2011b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Very Low Concern

The trawl fishery is allocated 74.0% of the lingcod TAC for 2013, and the hook and line fisheries are allocated the remaining 26% (DFO 2013a). Total lingcod catch in 2012 was approximately 33.8% of total available TAC. The trawl, lingcod, and halibut fisheries accounted for 44.8%, 32.7%, and 14.6% of the 2012 lingcod catch, respectively.

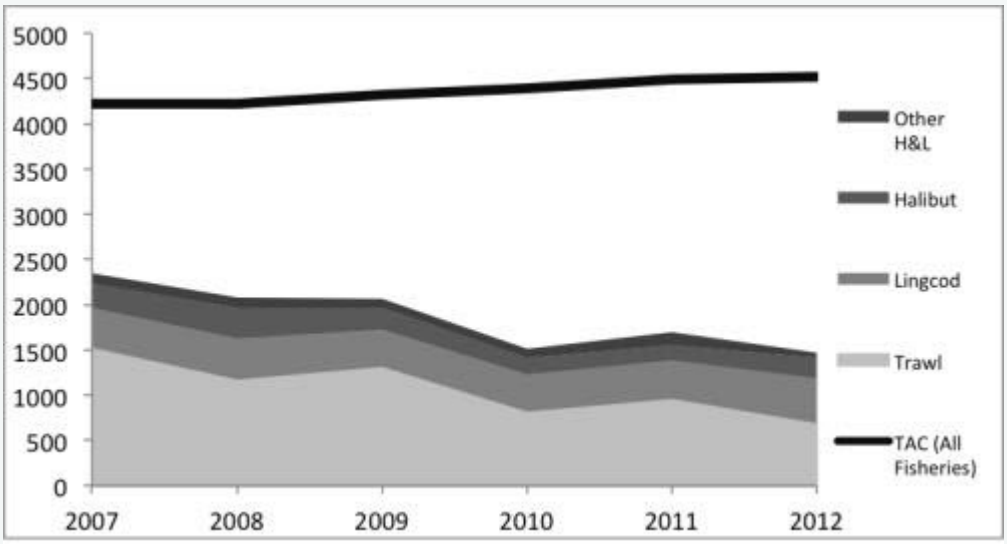
In a recent assessment, median estimates of F_{2010} were less than F_{MSY} for all areas, but these estimates were characterized by substantial uncertainty for Areas 3C, 5A/B, and 5C/D/E. Modeled probabilities indicate that constant application of area-specific TACs similar to the 2012 catches would have probabilities of 69% to 93% of resulting in area-specific B_{2016}>USRP, depending on the area; these probabilities are not substantially lower than those associated with zero harvest scenarios. For these reasons, fishing mortality of lingcod is scored "very low" concern for the trawl, lingcod, halibut, and inside and outside rockfish fisheries. However, this score should be revisited if annual catches begin to increase toward the TAC.

Justification:

Total lingcod catch in 2012 was approximately 1,528 t across all fisheries, while the total TAC was 4,517 t (Appendix A). The trawl, lingcod, and halibut fisheries caught 685, 499, and 223 t, respectively (Appendix A).

Historically, the trawl fishery has been responsible for most of the coastwide catch of lingcod in outside waters, but the catch in hook and line fisheries has increased since the late 1980s (Figure 2 in (DFO 2011c)).

During the period 2007-2012, the trawl fishery's catch of lingcod declined by 55%, while catch in the lingcod and halibut hook and line fisheries remained relatively steady; the total catch of lingcod stayed well below the total TAC during this period (Figure 20). No area-specific TACs were exceeded for the trawl fishery during the period 2000-2012, or for hook and line fisheries during the period 2007-2012 (DFO 2013c)(DFO 2013d).



Lingcod catches by fishery and total TAC, 2007-2012. Data from (DFO 2013b)(DFO 2013d).

The recent stock assessment generated estimates of F_{2010}:F_{MSY}. Median estimates were 0.39 (5-95% = 0.059-2.165) for Area 3C, 0.11 (0.03-0.85) for Area 3D, 0.51 (0.08-2.18) for Area 5A/B, and 0.31 (0.08-1.42) for Area 5C/D/E (Tables 2-5 in (DFO 2011c)).

Lingcod are managed with area-specific TACs for Areas 3C, 3D, 5A/B, 4B (Area 12 only), and 5C/D/E (DFO 2013a). The recent stock assessment projects a variety of area-specific TACs into the future and presents probabilities of B_{2016} exceeding various stock status indicators when each modeled TAC is held constant (Table 2 in (DFO 2011c)). The probabilities that area-specific TACs held constant at 500 t (which is slightly greater than any of the area-specific catches in 2012) will result in B_{2016}>USRP are 0.69, 0.93, 0.69, and 0.84 for the stocks in Areas 3C, 3D, 5A/B, and 5C/D/E, respectively; these probability values are approximately 2.1-10.4% lower than the probability values associated with zero harvest for the same areas (Table 2 in (DFO 2011c)). The probabilities that these same area-specific TACs will result in B_{2016}<LRP are 0.11, 0.01, 0.07, and 0.03 for these same stocks (Table 2 in (DFO 2011c)).

In addition to the catches in the trawl, halibut, and lingcod fisheries, the catch of lingcod in the 2012 inside and outside rockfish fisheries was sufficient to compose >5% of those fisheries' total catch (DFO Pacific Region 2013). This qualifies this species as a "main" species for the inside and outside rockfish fisheries.

LONGNOSE SKATE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for longnose skate is 55, and the species' productivity rating in Cope et al. 2011 is 1.53 (Table 1 in (Cope et al. 2011)). Longnose skate inherent vulnerability is therefore scored "high".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High Concern

A recent stock assessment was not able to generate reliable estimates of longnose skate biomass relative to reference points (CSAS 2014a). That assessment, however, analyzed trawl survey data and found statistically significant declines in longnose skate abundance (CSAS 2014a). Longnose skate stock status is therefore scored "high" concern due to the species' "high" inherent vulnerability (see Factor 1.1) and unknown stock status relative to reference points; the declines in survey abundances noted in the stock assessment support this score.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

The recent stock assessment found that both short-term and long-term catch levels of longnose skate have been above the maximum values presented in a range of catch-based MSY estimates; coastwide, the mean annual catch during the period 2007-2011 was 45.6% greater than the maximum catch-based MSY estimate (Table 1 in (CSAS 2014a)). At the time of this report, DFO has developed preliminary, area-specific TACs for the commercial fishery; these TACs are within the range of values determined by the catch-based MSY method in the assessment (DFO 2014b). As this fishery has a good record of not exceeding TACs (see "Enforcement" section), fishing mortality of longnose skate is scored "moderate" concern under the condition that the TACs do not exceed the MSY estimates presented in the recent assessment.

LONGSPINE THORNYHEAD

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High

The Fishbase vulnerability score for longspine thornyhead is 60. The species' productivity rating in Cope et al. 2011 is 1.47 (Table 1 in (Cope et al., 2011)). Longspine thornyhead therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

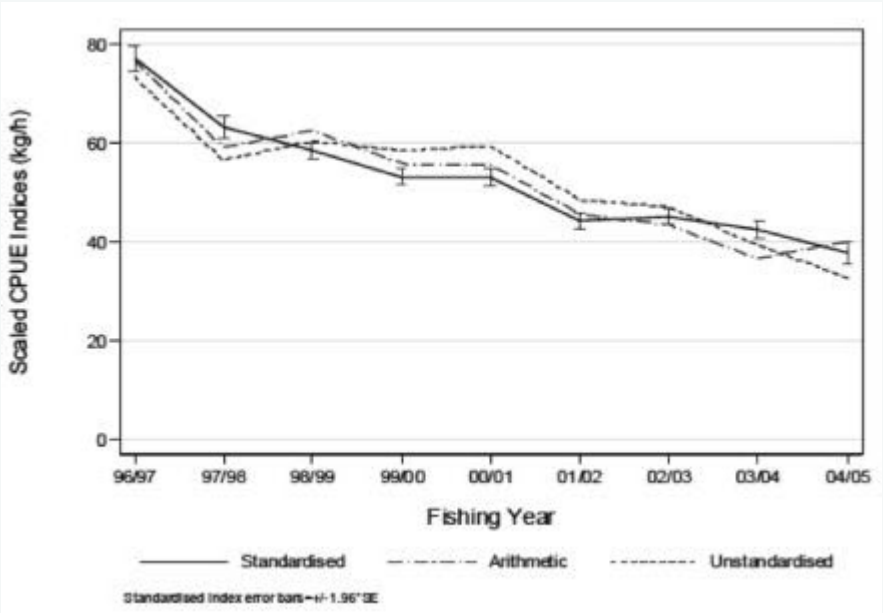
High Concern

There is no stock assessment for longspine thornyhead, and trawl survey biomass indices are unreliable due to instances of high relative error. Declining catch per unit effort (CPUE) trends have been noted for each of the areas that recently hosted the directed fishery. The species was assessed as "Special Concern" by COSEWIC and is listed as "Special Concern" under SARA. For these reasons, longspine thornyhead stock status is scored "high" concern.

Justification:

Longspine thornyhead was assessed as "Special Concern" by COSEWIC (Appendix D), and is listed as "Special Concern" under SARA (Appendix D; (Canada Gazette 2009)).

A directed fishery for longspine thornyhead began in 1996 (Haigh, R., et al., 2005a). The fishery that developed focused primarily on Areas 3C/D, and subsequently and to a lesser extent, on Areas 5A/B and 5E (Haigh et al. 2005a). The CPUE in Areas 3C/D declined by approximately 49% between 1996 and 2004 (Figure 21); CPUE declines of 31% and 65% were also noted for Areas 5A/B and 5E, respectively, over the 2000-2004 period (Haigh et al. 2005a).



Three Areas 3C/D longspine thornyhead CPUE series from the initiation of the directed fishery (1996) through 2004. Figure from (Haigh et al. 2005).

Several issues preclude reliable interpretation of trends in trawl survey biomass indices for longspine thornyhead. There are no records of longspine thornyhead in the HS survey, and for the QCS and WCVI survey indices, the relative error of the biomass estimates is high (>0.40) (DFO 2013b). While the relative errors for the WCHG survey's biomass estimates have been <0.30, interpretation of the trend is complicated by a sampling issue: in 2007, the WCHG trawl survey did not access the deepest stratum due to time limitations (N. Olsen, pers. comm.). This likely affected that year's index for species found at deeper depths, such as longspine thornyhead.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Low Concern

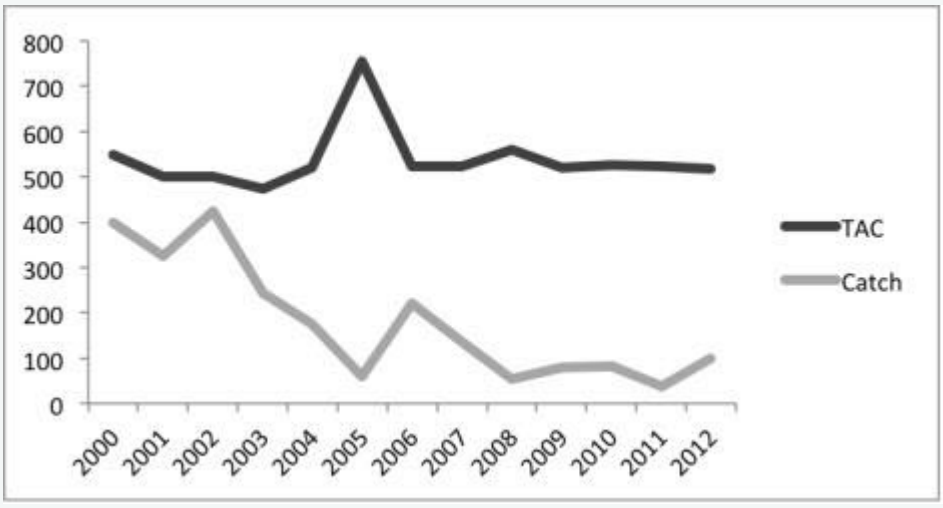
The trawl fishery is allocated 95.35% of the 2013 longspine thornyhead TAC (DFO 2013a). For this reason, only the trawl fishery's catch of longspine thornyhead is considered in this assessment. There is no stock assessment-based estimate of sustainable yield for longspine thornyhead, but due to unfavorable market conditions, recent catches of longspine thornyhead have been low relative to past years. The 2012 catch of longspine thornyhead in the trawl fishery was approximately 19.0% of the available trawl TAC. Longspine thornyhead fishing mortality is scored "low" concern, as the low catch relative to TAC, and a recent closure of large amounts of deep-water habitat, moderates concern. This score should be revisisted if catches increase in the future.

Justification:

Prior to 1996, landings of longspine thornyhead were virtually nil (Haigh et al. 2005a). In 1996, a directed trawl fishery emerged, and landings increased from approximately 5 t in 1995 to over 1,029 t in 1996 (Table 5 in (Haigh et al. 2005a)). From 1997 through 2002, landings remained above 496 t/year (Table 6 in (Haigh et al. 2005a)). Catches then began to decline as less-favorable market conditions emerged (Haigh et al. 2005a), and since 2008, total catches have been less than 100 t/year (Figure 22; Appendix A). The stock was listed as "Special Concern" under SARA in 2009 (Canada Gazette 2009), but the TAC was not reduced after this decision (Appendix A).

For 2012, the total trawl catch of longspine thornyhead (98.3 t) was approximately 19.0% of the available trawl TAC (518.5 t; Appendix C).

It should be noted that a recent management change to the trawl fishery reduced the fishery's access to deep-water habitat such as that in which longspine thornyhead are fished; 64% of waters between 800-999 meters and 95% of waters between 1,000 and 1,199 meters are now off-limits to the bottom trawl fishery (Bodtker et al. 2013).



Longspine thornyhead catch and TACs in the trawl fishery, 2000-2012 (Appendix B).

PACIFIC COD

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

The Fishbase vulnerability score for Pacific cod is 50, and the species' productivity rating in Cope et al. 2011 is 2.11 (Table 1 in (Cope et al. 2011)). Pacific cod inherent vulnerability is therefore scored "medium".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

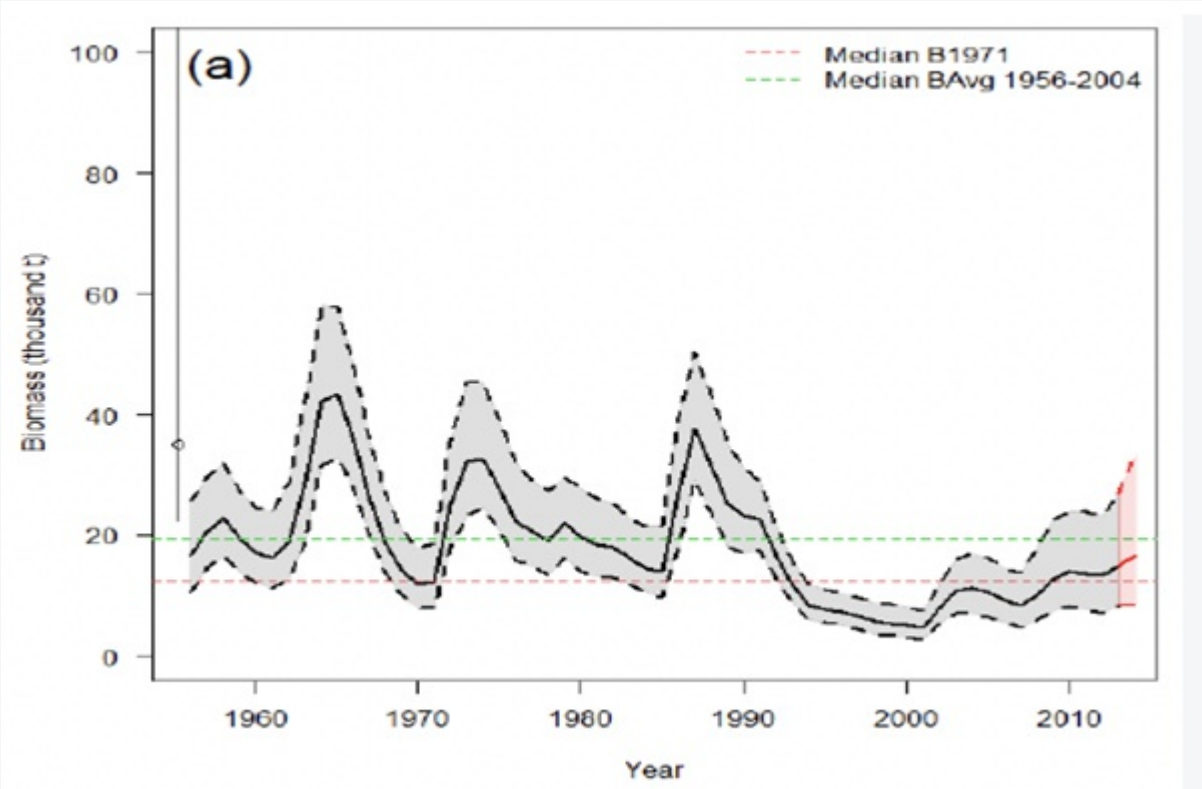
High Concern

A recent stock assessment of Pacific cod in Area 5CD (HS) was characterized by substantial uncertainty and did not generate estimates of MSY or B_0-based reference points. However, that assessment indicates that Pacific cod biomass may have increased in recent years, relative to a recent historical low, and that SB_{2014} was likely to be less than an alternative USR but greater than an alternative LRP.

A recent stock assessment of Pacific cod in Area 5AB (QCS) was characterized by substantial uncertainty and did not generate estimates of MSY or B_0-based reference points. Alternative historical reference points were also rejected. The biomass estimate for Area 5AB Pacific cod is characterized by high uncertainty, and indicates that biomass has remained relatively steady in recent years at a level well below historical averages. Pacific cod stock status is scored "high" concern.

Justification:

The recent Area 5CD stock assessment, which was characterized by substantial uncertainty, suggests that Pacific cod biomass in Area 5CD may be slowly increasing after reaching a historical minimum in the early 2000s (CSAS, 2015b) (Figure 23).



Reference model estimates (median and 2.5-97.5 percentiles) of Area 5CD Pacific cod spawning biomass. The green line is the alternative USR (median biomass, 1956-2004) and the red line is the alternative LRP (median biomass, 1971). Figure from (CSAS 2015b).

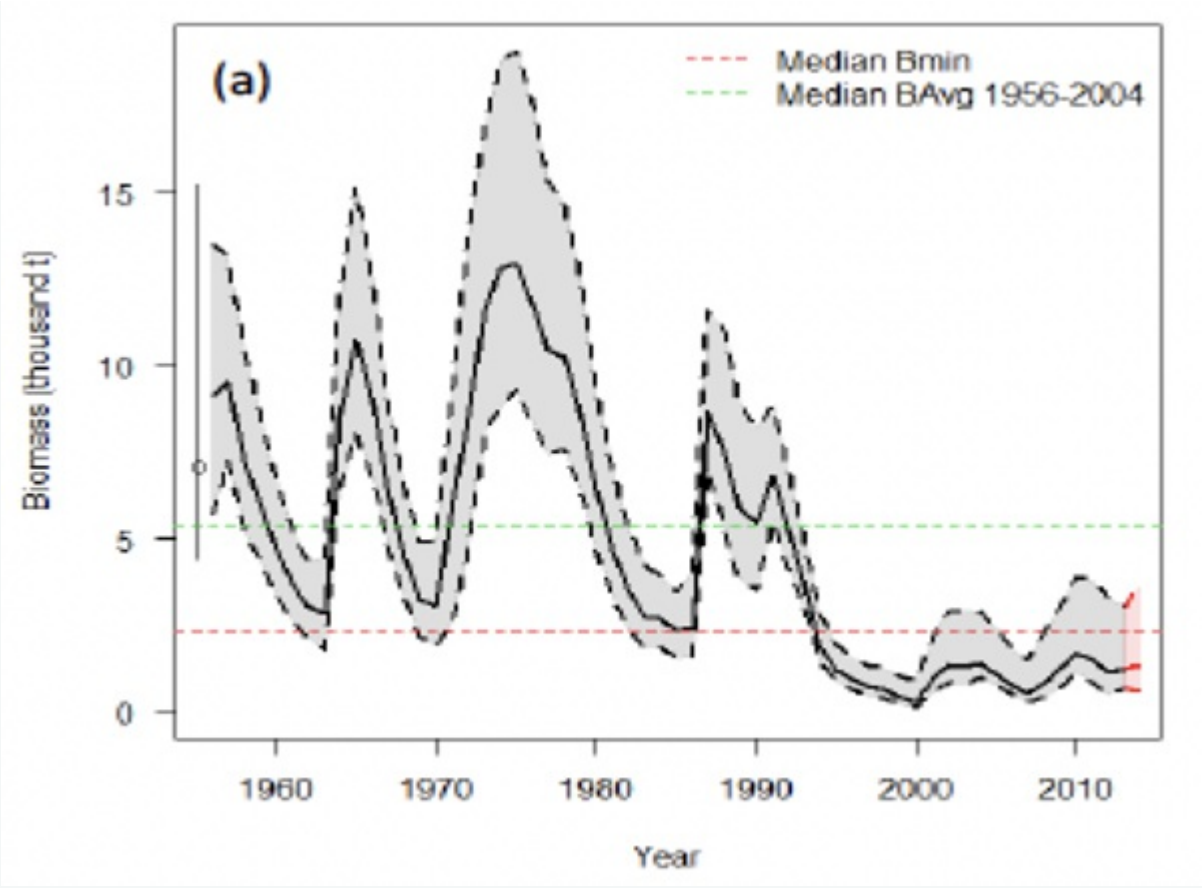
In the recent assessment, MSY-based reference points were highly sensitive to model assumptions and thus were not used (CSAS 2015b). Alternative reference points, derived from estimates of historical biomass and removals, were developed instead. Table 10 shows the estimates of these reference points, SB2014, and F2013, with explanations for each. Despite the considerable uncertainty in these estimates, it appears likely that SB2014 was less than the USR, but above the LRP (Figure 24).

Reference Point	Percentile				
	2.5%	25%	50%	75%	97.5%
SB_{2014}	8.478	13.254	16.701	21.189	33.263
LRP (SB_{1971})	7.902	10.556	12.182	14.143	18.659
USR (Avg. $SB_{1956-2004}$)	15.685	17.752	19.258	21.051	25.567
F_{2013}	0.029	0.042	0.052	0.065	0.097
LRR (Avg. $F_{1956-2004}$)	0.165	0.200	0.220	0.239	0.275

Estimates of reference points, SB2014, and F2013 , for Pacific cod in Area 5CD (all units are metric tons) (CSAS 2015b).

In the recent Area 5AB assessment, MSY-based reference points were highly sensitive to model assumptions and thus were not used. Alternative historical reference points, similar to those used for Area 5CD, were rejected due to the substantial changes in the fleet's behavior toward Pacific cod during the historical period (1956-2004): whereas cod were once targeted during this period, they have been largely avoided in more recent years due to catch limits (CSAS 2015c).

The recent assessment's biomass estimate is therefore characterized by a high degree of uncertainty (CSAS 2015c). This estimate indicates that, following a sharp decline in the mid-1990s, Area 5AB Pacific cod biomass has been relatively steady at a level well below the historical average and below a level (B1985) from which the biomass is known to have recovered to an above-average level (Figure 25) (CSAS 2015b).



Area 5AB Pacific cod biomass estimates, showing median (solid line) and 2.5-97.5% credibility intervals, with estimated equilibrium unfished biomass indicated by open circle and 95% credibility interval on Y axis. Figure from (CSAS 2015c).

Factor 1.3 - Fishing Mortality

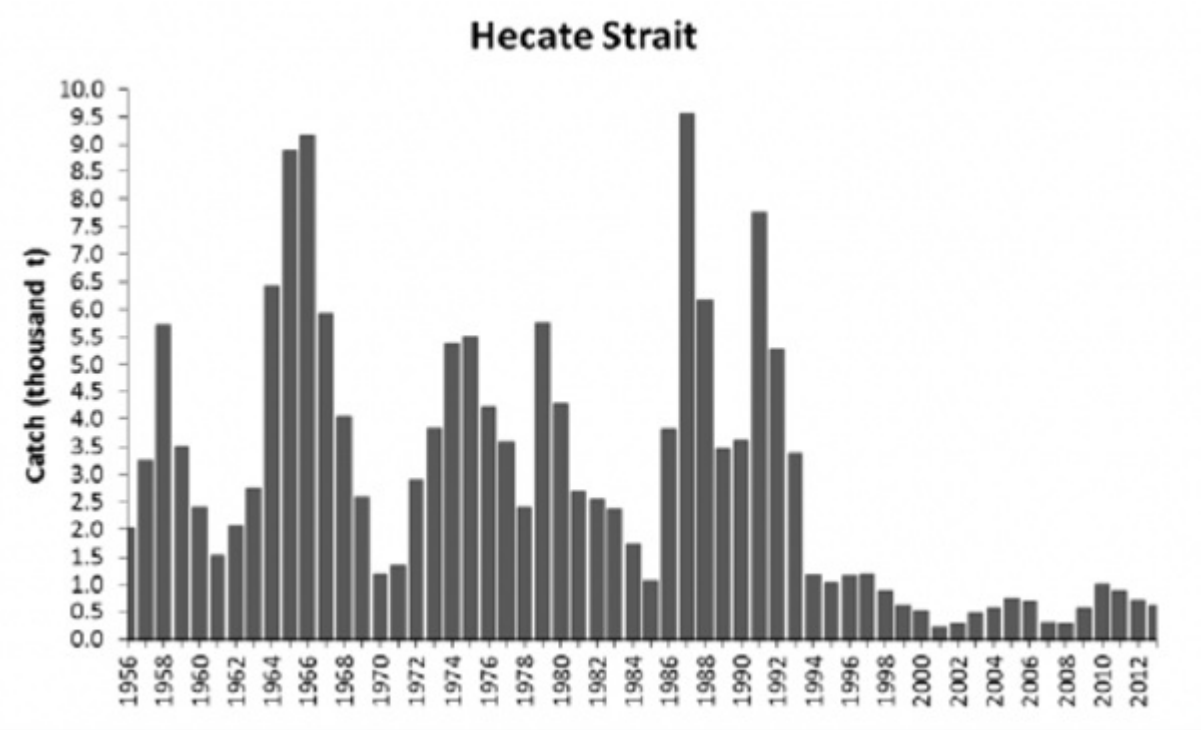
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Very Low Concern

For Hecate Strait, the fishing mortality rate for 2013 was estimated to be well below historical averages, and there is a relatively high probability (P>0.7) that recent catch levels will allow biomass to increase. Catches of Pacific cod in Queen Charlotte Sound have been low, relative to historic levels, in recent years; reduced total trawl effort and active avoidance of Pacific cod due to low available quotas have contributed to these low catches. The estimated F_{2013} was below historic levels, and there is relatively low probability that F_{2014} exceeded historic levels.

Justification:

Since the mid-1990s, catches of Pacific cod in Hecate Strait have been very low, relative to historic catches (Figure 26). The 2013 catch (approximately 700 t; CSAS 2015b continued this trend. The Pacific cod TAC is allocated entirely to the trawl fleet (DFO 2014a).



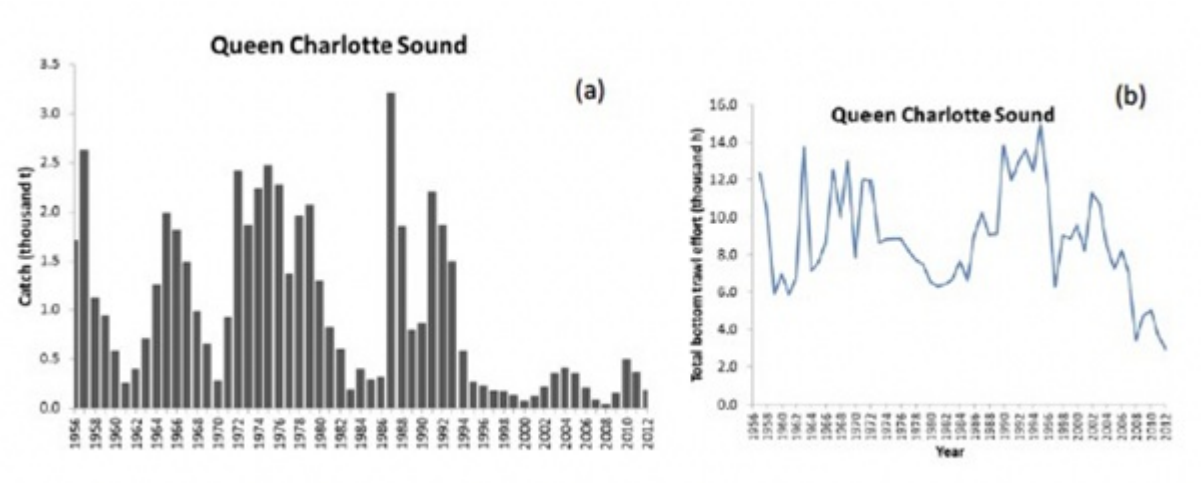
Total catches (thousand tons) of Pacific cod in Hecate Strait, including landings and discards from Canadian vessels and landings from U.S. vessels prior to 1978. Figure from (CSAS 2015b).

In the recent assessment for Hecate Strait, the Limit Removal Rate (LRR) was set as the average fishing mortality rate from 1956-2004 (CSAS 2015b). Fishing mortality in 2013 was substantially lower than this LRR (Figure 26), and the estimated probability of the 2014 fishing mortality rate exceeding the LRR was essentially zero (CSAS 2015b). Finally, there is a relatively high probability (P>0.7) that the 2013 catch level, if repeated in 2014, would allow spawning biomass to increase by 2015 (Table 2 in (CSAS 2015a)).

Since the mid-1990s, catches of Pacific cod in Queen Charlotte Sound have been very low, relative to historic catches (Figure 29). The 2013 catch (approximately 200 t) (CSAS 2015b) continued this trend. The Pacific cod TAC is allocated entirely to the trawl fleet (DFO 2014a). In Queen Charlotte Sound, total trawl effort has declined in recent years (Figure 27), and fishermen report avoidance of Pacific cod due to low quotas (CSAS 2015c).

Reference Point	Percentile				
	2.5%	25%	50%	75%	97.5%
F_{2013}	0.111	0.226	0.289	0.373	0.616
$F_{AVG1956-2004}$	0.210	0.272	0.305	0.337	0.411
$F_{AVG1956-2012}$	0.207	0.269	0.305	0.341	0.420

Estimates of fishing mortality for 2013 and for two historical periods, for Pacific cod in Area 5AB (CSAS 2015b).



Total catches (thousands of tons) of Pacific cod in Area 5AB, including landings from American vessels prior to 1978 and estimated discards from Canadian vessels. Figure 28b: Bottom trawl effort in Area 5AB. Figures from (CSAS 2015c).

In the recent assessment, the average fishing mortality rate for the period 1956-2004 was adopted as a reference point (Figure 29) (CSAS 2015b). Recent mortality estimates (F_{2013}) were below this reference (Figure 28). For a 2014 catch similar to the 2013 level (approximately 200 t), the probabilities that F_{2014} would exceed F_{2013} or $F_{AVG1956-2004}$ were 0.077 and 0.201, respectively (Table 2 in (CSAS 2015b).

PACIFIC OCEAN PERCH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for Pacific Ocean perch is 60. The species' productivity rating in Cope et al. 2011 is 1.44 (Table 1 in (Cope et al. 2011)). The inherent vulnerability of Pacific Ocean perch is therefore scored "high".

Factor 1.2 - Abundance

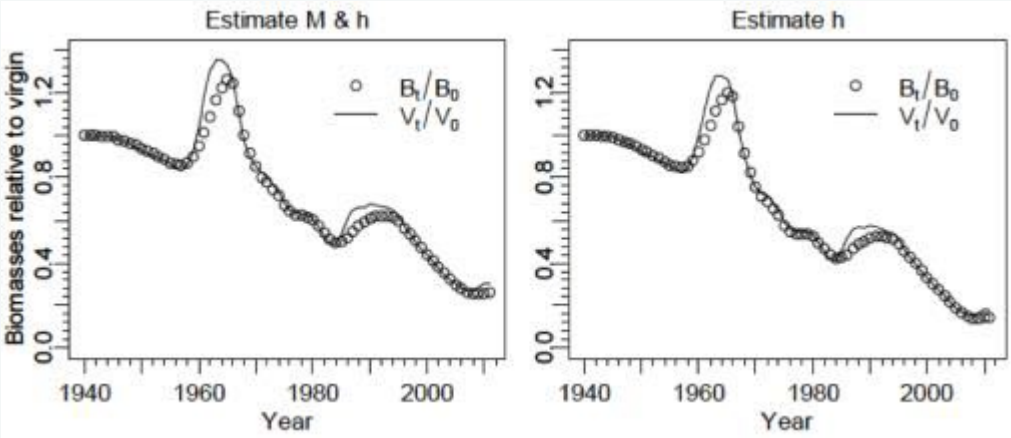
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

The biomass of Pacific ocean perch in Queen Charlotte Sound is close to its lowest point since 1940, but still has a high probability of exceeding the LRP, and a moderate probability of exceeding the USRP. Similarly, the stocks in WCVI and the north and west coasts of Haida Gwaii have recently been estimated to be above the USRP and B_{MSY}, yet remain low relative to historic levels. The stock status of Pacific ocean perch is therefore scored "low" concern.

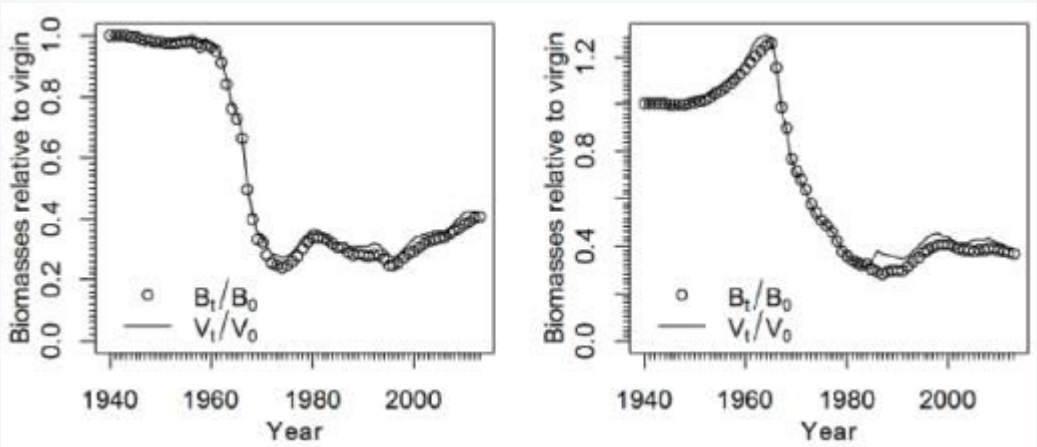
Justification:

An assessment of the Pacific ocean perch stock in Queen Charlotte Sound (PMFC Areas 5A-C) was conducted in 2010. Two model runs, which differed only in the values used for natural mortality, were accepted for that assessment. The two model runs' estimates of biomass relative to unfished equilibrium biomass (B_0) show similar trends (Figure 29). The two model runs generated estimates of SB_{2011} that were 26% (12-43%) or 14% (8%-24%) of SB_0, while estimated SB_{MSY} was 25% (17-35%) or 24% (16-32%) of SB_0 (DFO 2011a). According to these two model runs, the probabilities that SB_{2011} exceeded the LRP were 0.96 and 0.82 (DFO 2011a). One model run yielded a median estimate of SB_{2011} that was above the USRP (with a probability of 0.68 that SB_{2011}>USRP), while the second model yielded a median estimate that was below the USRP (probability of SB_{2011} > USRP = 0.24) (DFO 2011a).



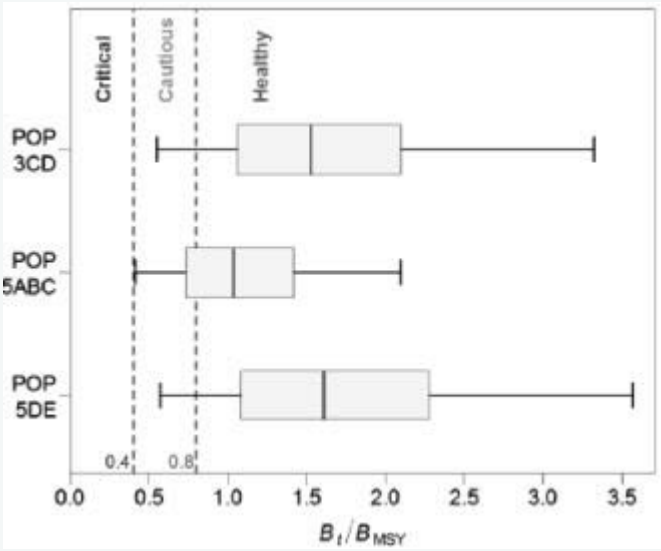
Two modeled estimates of Pacific Ocean perch spawning (B) and vulnerable biomass (V) relative to unfished equilibrium biomass, Queen Charlotte Sound. Figure from (DFO 2011a).

In a very recent assessment, the two stocks of Pacific ocean perch found in WCVI (Areas 3C/D) and the north and west coasts of Haida Gwaii (Areas 5D/E) were assessed. The stocks' biomass trajectories are shown in Figure 30. In Areas 3C/D, the median SB_{2013} estimate was 0.41 (5-95% percentiles = 0.19-0.68) of SB_0, and 1.53 (0.55-3.32) of SB_{MSY} (CSAS 2013a). In Areas 5D/E, SB_{2013} was estimated to be 0.37 (0.16-0.67) and 1.61 (0.57-3.57) of SB_0 and SB_{MSY}, respectively (CSAS 2013a). The modeled probabilities that SB_{2013}>LRP and >USRP were 0.99 and 0.87 for Areas 3C/D, respectively, and 0.98 and 0.88 for Areas 5D/E (CSAS 2013a). It is therefore highly likely that the biomasses of these two stocks of Pacific ocean perch are above the LRP and USRP.



Modeled median estimates of Pacific Ocean perch spawning (B) and vulnerable (V) biomasses relative to unfished equilibrium biomasses, Areas 3C/D (left) and Areas 5D/E (right) (Figure from (CSAS 2013b).

In summary, the Areas 3C/D and 5D/E stocks have recently been estimated to be above the USRP, while one of the two model runs used in the recent assessment of the 5A-C stock shows that stock to be above the USRP (Figure 31).



Recent estimates of three Pacific Ocean perch stocks' B:B_{MSY} ratios, relative to biomass reference points. Figure from (CSAS 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

The trawl fishery is allocated 99.98% of the Pacific ocean perch TAC (DFO 2013a). The coast-wide 2012 Pacific ocean perch catch was 70.7% of available coast-wide quota; no area-specific quotas were exceeded.

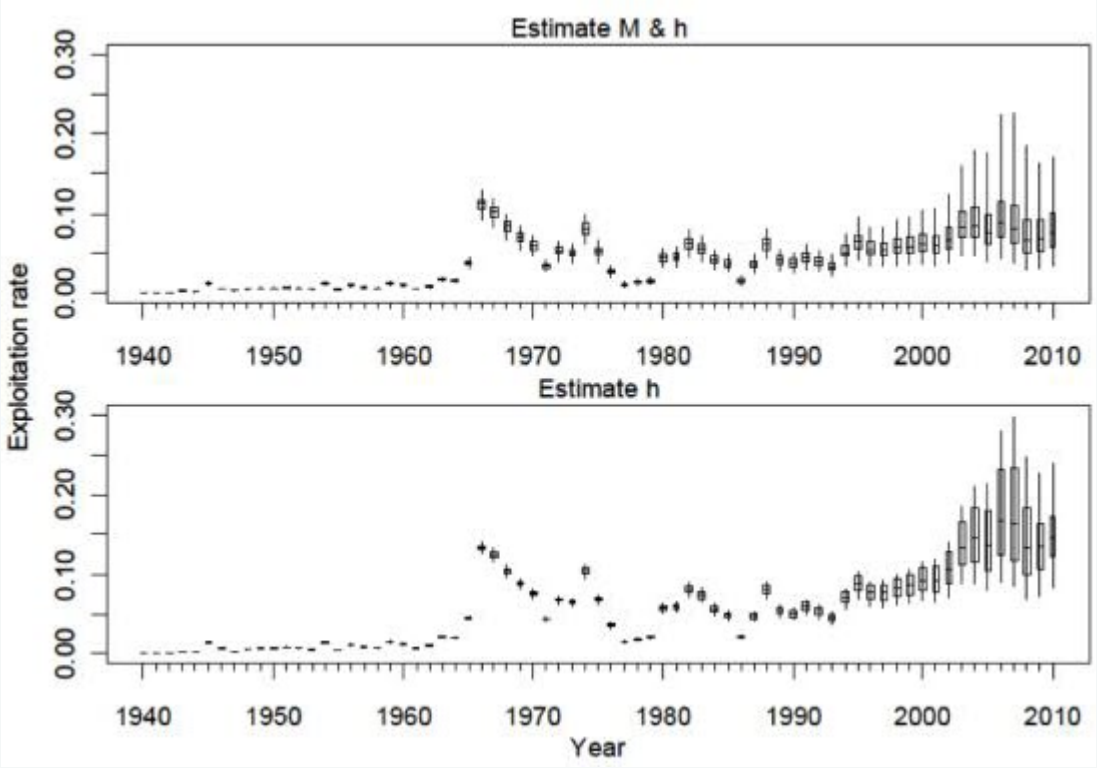
Approximately 75% of the 2012 catch was taken in Areas 5A/B and 5C/D. Estimated exploitation rates for QCS Pacific ocean perch have generally increased over the past 2+ decades, and are now similar to the rates estimated for the peak of the foreign fishery years. When compared to probabilities presented in a recent stock assessment, it is apparent that catches similar to the 2012 Areas 5A-D catch may lead to sub-USRP and possibly sub-LRP stock status within several years. As a result of the recent stock assessment, the TAC for Areas 5ABC has been reduced for 2013. This action mitigates concern, and as such the Factor 1.3 score for Pacific ocean perch is "moderate" concern.

Justification:

In 2012, the total catch of Pacific ocean perch was 1,674.89 t in Areas 5A/B, and 1,450.25 t in Areas 5C/5D (Appendix C). These catches were 75.3% and 60.0% of the Areas 5A/B and 5C/D quotas, respectively (Appendix C). Coast-wide, the 2012 Pacific ocean perch catch (4,168.6 t) was 70.7% of available quota (Appendix C).

In QCS (PMFC Areas 5A-C), two recent stock assessment model runs show that exploitation rates (U) have

increased since the 1990s and are similar to historical high levels that occurred during the era of foreign fishing in the 1960s (Figure 32) (DFO 2011a). The 'estimate M & h' and 'estimate h' runs yield median U_{2010} values that are approximately 0.8 and 1.5 of U_{MSY}, respectively (DFO 2011a). These two runs therefore show that recent exploitation rates in QCS are close to, and may be surpassing, U_{MSY}.



Two modeled estimates of annual exploitation rates for Pacific Ocean perch in Queen Charlotte Sound. Figure from (DFO 2011).

The 2011 assessment of the PMFC Areas 5A-C stock includes decision tables that show modeled probabilities of different catch levels reducing biomass to less than the LRP or USRP by a given year. The probabilities associated with annual catches of 3,000 and 3,500 t in PMFC Areas 5A-C (which bookend the total 2012 GMAs 5A-D catch of 3,125.15 t) are shown in Figure 34. Note that GMAs 5A-C and PMFC Areas 5A-C cover similar areas (see Figure 2 in (DFO 2011a)), and that relatively little Pacific Ocean perch is caught in GMA 5D (Table B3 in 2011 (Edwards et al. 2011)). Therefore the comparison of 2012 GMA 5A-D catches to PMFC Area 5A-C probabilities (Figure 33) is valid.

Annual Catch (t)	Model run	LRP (2013)	LRP (2016)	USRP (2013)	USRP (2016)
2,000	*'M & h'*	0.969	0.968	0.762	0.759
	'h'	0.857	0.844	0.292	0.333
3,000	*'M & h'*	0.961	0.931	0.705	0.674
	'h'	0.801	0.674	0.236	0.197
3,500	*'M & h'*	0.956	0.911	0.679	0.626
	'h'	0.762	0.574	0.209	0.152

Two model runs' probabilities of QCS Pacific Ocean perch spawning biomass being above the LRP and USRP for a given year, assuming constant catches of 2,000, 3,000 or 3,500 t/year, from 2011 onwards (from Tables 1 and 2 in (DFO 2011b).

The recent assessment of the Areas 3C/D and 5D/E stocks estimates that recent exploitation rates have been

lower than historical levels and lower than estimates of U_{MSY} (CSAS 2013a). For Areas 3C/D, the recent assessment's estimate of U_{2012}/U_{MSY} was 0.384 (5^{th} and 95^{th} percentiles = 0.134-1.434), and 0.482 (0.168-1.697) for Areas 5D/E (Table 1 in (CSAS 2013a). The probabilities of $U_{2012}<U_{MSY}$ were 0.89 and 0.84 for Areas 3C/D and 5D/E, respectively (CSAS 2013a). The two model runs, which differ only in the values associated with natural mortality (M), show very different probabilities associated with catch levels similar to the 2012 catch. Still, the stock assessment states that "projections suggest a declining stock if current catches are maintained". It should be noted that the Area 5ABC TAC was reduced in 2013 due to this stock assessment, and catches are expected to be closer to 2,000 t (A. Sinclair, pers. comm.), hence the inclusion of probabilities for this catch level in the above figure.

PETRALE SOLE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

The Fishbase vulnerability score for petrale sole is 55. The species' productivity rating in Cope et al. 2011 is 1.70 (Table 1 in (Cope et al. 2011)). Petrale sole therefore have "medium" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

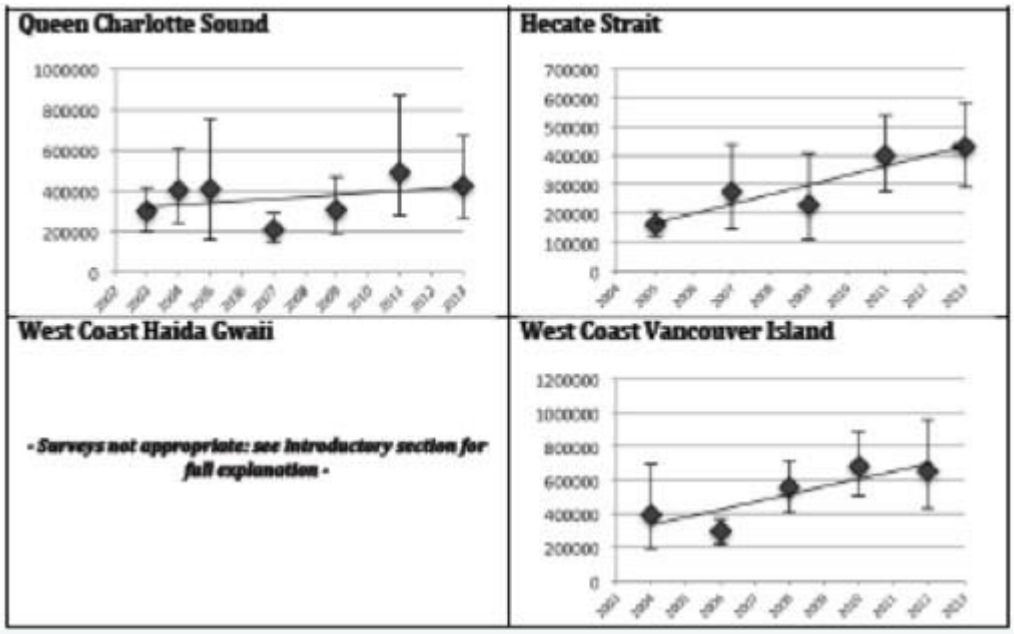
Low Concern

In the most recent stock assessment, northwest Vancouver Island/QCS/HS petrale sole biomass was modeled to be greater than at any time since at least the late 1960s. Recent trends in trawl biomass indices also suggest that petrale sole biomass has increased over the past several years. The stock status of petrale sole is scored "low" concern, as the lack of a recent stock assessment precludes a score of "very low" concern.

Justification:

Two discrete populations of Petrale sole are found in British Columbia's waters: one off of southwest Vancouver Island (Area 3C), and one in the waters off of northwest Vancouver Island, Queen Charlotte Sound, and Hecate Strait (Areas 3D and 5A-D; (DFO 2001)). The most recent stock assessment for the northwest Vancouver Island/QCS/HS population was conducted for 2006 (Starr 2009b).

The 2006 stock assessment (which was published in 2009) presented several modeled population trajectories for the northwest Vancouver Island/QCS/HS population. The trajectory modeled by a recommended model run (Figure D.11 in (Starr 2009b)) shows petrale sole biomass increasing substantially since the early 1990s, and B_{2006} exceeding biomass at any other time since at least 1966. Conversely, model runs that used a different assumption for catchability show a general decline from the late 1960s through the late 1990s, and a moderate increase in the years since (Figures D.7 and D.8 in (Starr 2009b)). The more pessimistic model runs assumed constant catchability for the past 40 years, whereas the runs with the more optimistic outputs assumed that a decrease in catchability occurred between 1995 and 1996 due to the introduction of increasingly tight management measures. Recent trends in petrale sole trawl survey biomass indices support the conclusion that petrale sole biomass is increasing (Figure 34).



Trawl survey biomass indices for petrale sole. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

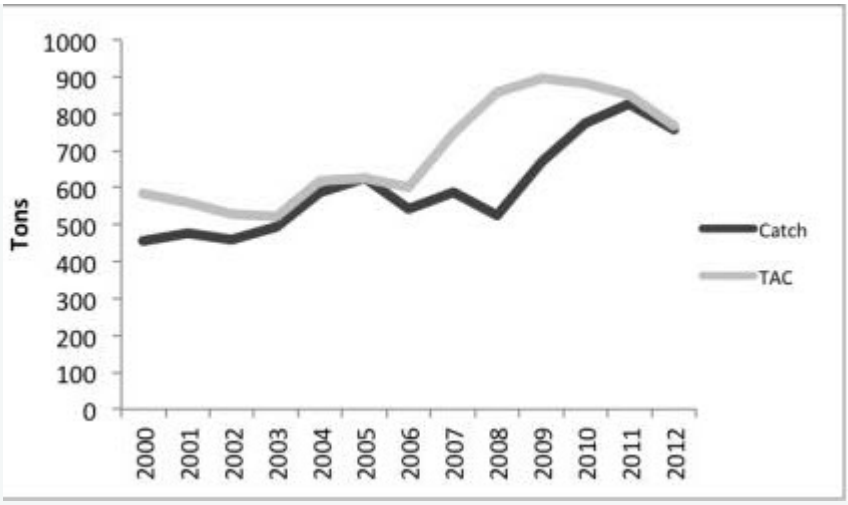
Moderate Concern

The trawl fishery is allocated 100% of the petrale sole TAC. Petrale sole catches have steadily increased since 2000. In 2012, the trawl fishery's catch of petrale sole was 98.7% of the available TAC. Modeled probabilities from a 2006/2007 stock assessment suggest that the 2006-2011 mean annual catch was not likely to have driven B_{2012} below historical minimum or mean levels, but it may have driven B_{2012} to below the B_{2007} level. Fishing mortality of petrale sole is considered a "moderate" conservation concern.

Justification:

Petrale sole landings averaged approximately 513 t during the 1980s and 540 t in the 1990s (Table B.1 in (Starr 2009b)). Catches have steadily increased since 2000: the mean annual catch (landings + discards) was 470.4 t during the 2000-2003 period, 573.7 t during the 2004-2008 period, and 758.1 during the 2009-2012 period (Appendix C). While landings exceeded 700 t on only three occasions from 1979 through 2009 (Table B.1 in (Starr 2009b)), total catches (including discards) have been above 700 t in each year during the 2010-2012 period (Appendix C).

The trawl fishery is allocated 100% of the petrale sole TAC, and this fishery's catch of petrale sole has been tightly linked with available TAC in recent years (Figure 35). Since 2000, the trawl fishery has caught, on average, 87% of available TAC (Appendix C). No TACs were exceeded during this period. In 2012, the catch of petrale sole in the trawl fishery was 758 t, while the TAC was 768 t (Appendix C).



Petrale sole catch and TACs in the trawl fishery, 2000-2012. Data from (DFO 2013b).

The recent assessment of the Areas 3C/D and 5D/E stocks estimates that recent exploitation rates have been lower than historical levels and lower than estimates of UMSY (CSAS 2013a). For Areas 3C/D, the recent assessment's estimate of U2012/UMSY was 0.384 (5th and 95th percentiles = 0.134-1.434), and 0.482 (0.168-1.697) for Areas 5D/E (Table 1 in CSAS 2013a). The probabilities of U2012<UMSY were 0.89 and 0.84 for Areas 3C/D and 5D/E, respectively (CSAS 2013a).

The most recent stock assessment presents the results of a modeling effort from which the application of various constant-catch levels during the period 2007-2011 was modeled, along with the resulting probabilities of B_{2012} exceeding various reference points (Figures 2 through 11 in Starr 2009b). A comparison of the 2007-2011 mean annual catch with those probabilities and reference points is shown in Figure 36.

Recommended Model Run	Approx. P ($B_{2012}>B_{MIN}$)	Approx. P ($B_{2012}>B_{REF}$)	Approx. P ($B_{2012}>B_{2007}$)
cpue2_r=6_CGRCS_estM	0.99	0.94	0.51
cpue2_r=6_wide_estM	0.98	0.74	0.16

Recommended model runs' probabilities of B2012 exceeding various reference points after constant application of a catch level (700 t) similar to the 2007-2011 mean annual catch (678.0 t) for the period 2007-2011. For this table, BMIN = the minimum biomass over the 1966-2006 period, and BREF = mean biomass during the period 1977-1984. Probabilities are from Tables D.10 and D.11 in (Starr, P.J. 2009b).

QUILLBACK ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

High

The Fishbase vulnerability score for quillback rockfish is 64. The species' productivity rating in Table 1 of (Cope et al. 2011) is 1.31, which likewise indicates "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

High Concern

Quillback rockfish have been designated as "Threatened" by COSEWIC. In a recent stock assessment, estimates of inside and outside quillback rockfish B_{2010}: B_{MSY} ratios were less than the USRP, but greater than the LRP. In light of the species' COSEWIC status and the uncertainty regarding the recent biomass estimates (especially for the outside management unit), quillback rockfish stock status is scored "high" concern.

Justification:

Quillback rockfish have been designated as "Threatened" by COSEWIC (Appendix D) and are currently being considered for listing under SARA (DFO 2013a). In a recent assessment of the "inside" and "outside" quillback rockfish management units, the outside unit's B_{2010}:B_{MSY} ratio was 0.736 (95% confidence intervals = 0.266-1.814), and the inside unit's B_{2010}:B_{MSY} ratio was 0.493 (0.252-0.945) (Yamanaka et al, 2011).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Low Concern

A recent stock assessment suggests that the commercial groundfish fishery catch of quillback rockfish in 2010 was at a level that will permit a gradual rebuilding of the stock. Fishing mortality of quillback rockfish is therefore scored "low" concern for the halibut and inside and outside rockfish fisheries.

Justification:

Commercial groundfish fishery catches of both outside and inside quillback rockfish were minimal for many

years, but sharply increased during the 1980s and early 1990s (Tables 1 and 2 in (Yamanaka et al. 2011)). Fishing mortality rates also increased sharply during this time, and at some points during the late 1980s and early 1990s, estimates of F were more than 3 and 6 times the estimates of F_{MSY} for outside and inside quillback rockfish, respectively (Figures 5 and 6 in (Yamanaka et al. 2011)). Catches of both inside and outside quillback began to decline after the mid-1990s (Figures 3 and 4 in (Yamanaka et al. 2011)), and mortality rates have recently dropped below the units' respective F_{MSY} estimates (Figures 5 and 6 in (Yamanaka et al. 2011)). The catches of outside and inside quillback rockfish in commercial groundfish fisheries in 2010 were 116.5 and 24.8 t, respectively (Tables 1 and 2 in (Yamanaka et al. 2011)). These catch levels, if kept constant, are similar to those projected to allow for gradual rebuilding of the stock (Figures 7 and 8 in (Yamanaka et al. 2011)). For the start of the 2015/2016 season, quillback rockfish will be removed from the quillback, copper, China and tiger rockfish aggregate, and will instead be managed with a species-specific TAC (DFO 2014a).

REDBANDED ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for redbanded rockfish is 54. However, the species' productivity rating in Cope et al. 2011 is 1.28 (Table 1 in (Cope et al. 2011)). Redbanded rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

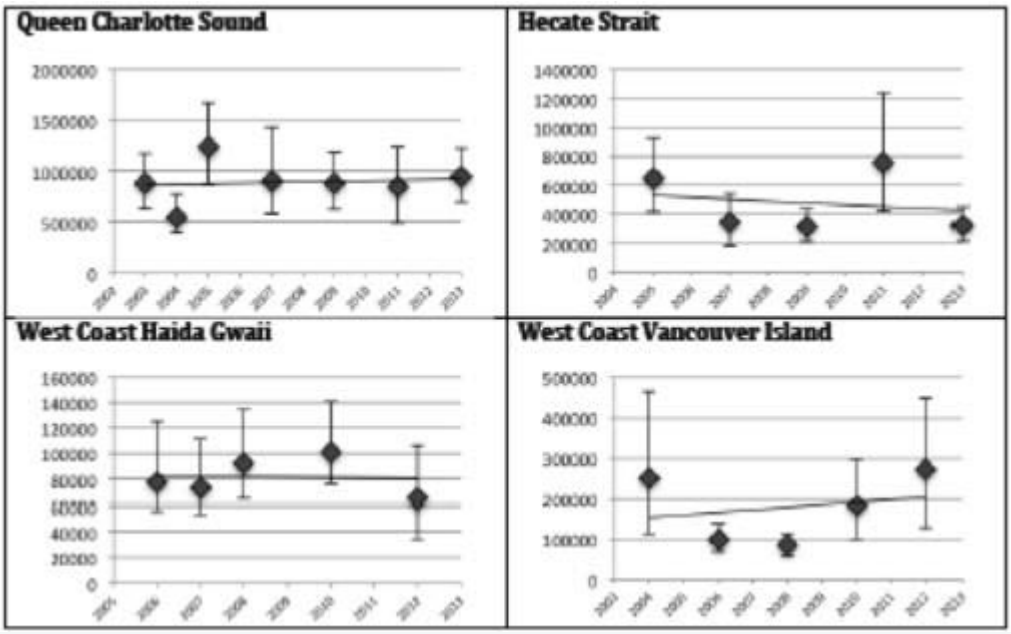
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no information regarding redbanded rockfish biomass or stock status relative to reference points. Trends in trawl survey biomass indices are somewhat variable between the four regions, but do not indicate substantial increases or decreases in any area. Redbanded rockfish stock status is scored "high" concern.

Justification:

There is no stock assessment for redbanded rockfish, and the stock's biomass is not known (Haigh & Starr 2006). Trawl survey biomass indices do not show discinerable trends for any of the four survey areas (Figure 37).



Trawl survey biomass indices for redbanded rockfish. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

The trawl fishery is allocated 50.0% of the redbanded rockfish TAC (DFO 2013a). The total 2012 catch of redbanded rockfish was approximately 69.4% of the total TAC. The trawl fishery accounted for 69.3% of the 2012 redbanded rockfish catch, and the fisheries for halibut (13.5%), outside rockfish (8.6%), and sablefish (8.2%) accounted for most of the remainder. Given the lack of a stock assessment for this stock (see Factor 1.2), fishing mortality is scored "moderate" concern.

Justification:

In 2012, the total catch of redbanded rockfish was approximately 509.2 t, while the total TAC was 734.2 t (Appendix C). The 2012 catch of redbanded rockfish was primarily taken in the trawl fishery (353.1 t), with substantial amounts also taken in the fisheries for halibut (68.6 t), outside rockfish (43.8 t), and sablefish (42.1 t; Appendix C). The 2012 redbanded rockfish catch was similar to the 1986-2005 average catch (542 t; Table 8 in (Haigh & Starr 2006)). In 2011, a coastwide TAC was introduced for redbanded rockfish, with equal amounts assigned to the trawl and hook & line sectors (DFO 2012a).

REDSTRIPE ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for redstripe rockfish is 58, and the species' productivity rating in Cope et al. 2011 is 1.31 (Table 1 in (Cope et al. 2011)). Redstripe rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

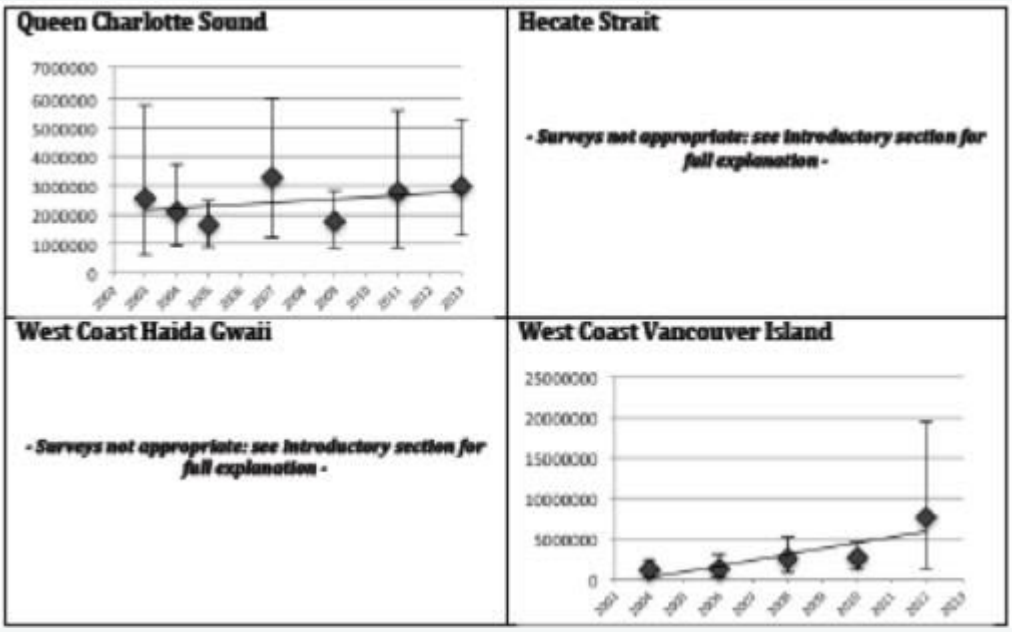
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

There is no assessment of the redstripe rockfish stock. Trawl survey biomass indices indicate a slightly increasing trend for QCS and WCVI (Figure 39), but high relative errors complicates interpretation of these trends. The stock status of redstripe rockfish is therefore scored "high" concern due to the lack of an assessment and the species' "high" inherent vulnerability (see Factor 1.1).

Justification:

Interpretation of trends in trawl survey biomass indices (Figure 38) is complicated by the high relative errors for the WCVI and QCS biomass estimates (DFO 2013b). The mean relative error for the five WCVI biomass estimates is 0.50, and the four highest QCS survey biomass estimates (2003, 2007, 2011, and 2013) have the four highest relative errors in the series (DFO 2013b).



Trawl survey biomass indices for redstripe rockfish. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

The trawl fishery is allocated approximately 97.3% of coastwide redstripe rockfish TAC (DFO 2013a). For this reason, only trawl-caught redstripe rockfish are considered in this assessment. The trawl fishery's catch of redstripe rockfish in 2012 was approximately 50.4% of the available TAC. The 2012 catch was broadly similar to the average catch during the period 2000-2011 and was substantially less than the maximum catches of the late 1980s and early 1990s. Fishing mortality of redstripe rockfish is scored "moderate" concern for the trawl fishery.

Justification:

Annual catches of redstripe rockfish in domestic trawl fisheries were minimal until approximately 1977, and were <500 t through 1984 (DFO 1999a). Catches increased in 1985, and from 1985 through 1993, annual trawl catches of restripe rockfish were >1,000 t (DFO 1999a). The trawl fishery's catch of redstripe rockfish declined from approximately 1,000 t in 2003 to 407 t in 2008, but has increased in recent years (Appendix C). In 2012, the catch of redstripe rockfish in the trawl fishery was approximately 898.6 t, while the total trawl TAC was 1,781.6 t (Appendix C). The 2012 catch was slightly greater than the average catch during the period 2000-2011 (808.0 t; Appendix C) but was substantially less than the maximum trawl catches of approximately 3,000 t that occurred during the late 1980s and early 1990s (DFO 1999a).
No area-specific TACs were exceeded by the trawl fishery during the period 2000-2011 (DFO 2013c). During this period, the average catch (808.0 t) was approximately 42% of the average total TAC (1,921 t; Appendix C).

REX SOLE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

The Fishbase vulnerability score for rex sole is 65. However, the species' productivity rating in Cope et al. 2011 is 2.05 (Table 1 in (Cope et al. 2011)). Rex sole therefore has "medium" inherent vulnerability.

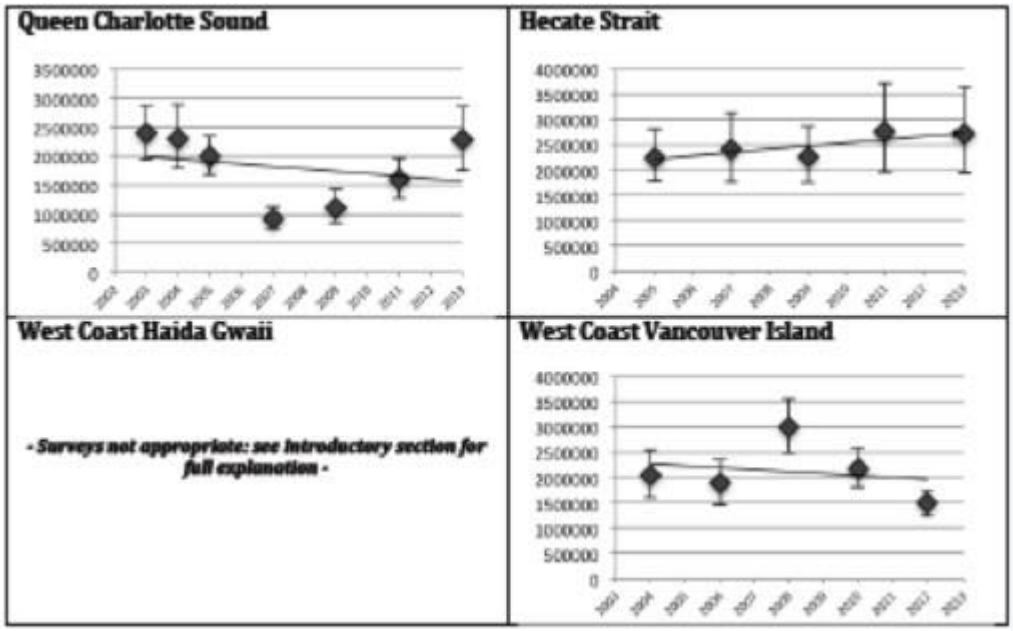
Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

There is no stock assessment for rex sole. In the trawl survey biomass data, rex sole are consistently of relatively low abundance in WCHG (DFO 2013b). Trawl survey biomass indices show a slightly increasing trend in HS, and have increased for four consecutive surveys in QCS (Figure 39). The lack of a stock assessment, the species' "medium" inherent vulnerability, and the variable trends noted in the survey biomass indices compel a score of "moderate" concern.

Justification:



Trawl survey biomass indices for rex sole. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

In 2012, total rex sole catch was 458 t, all of which was taken in the trawl fishery (DFO Pacific Region 2013). There is no TAC for rex sole, and there is no information regarding the appropriateness of current levels of fishing mortality. Fishing mortality of rex sole in the trawl fishery is therefore scored "moderate" concern.

ROUGHEYE ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for rougheye rockfish is 69. The species' productivity rating in Cope et al. 2011 is 1.17 (Table 1 in (Cope et al. 2011)). Rougheye rockfish therefore have "high" inherent vulnerability. Due to the similarities between the two species, this score is extended to blackspotted rockfish, in the absence of a Fishbase vulnerability score for *S. melanostictus*.

Factor 1.2 - Abundance

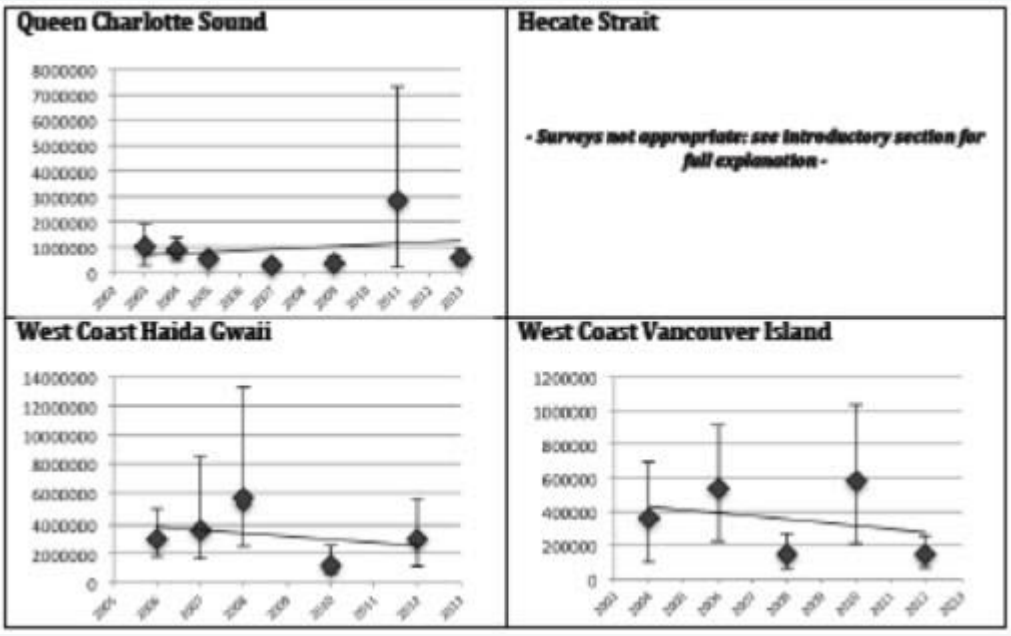
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

Note: Blackspotted rockfish are a recently recognized species that were long combined with rougheye rockfish. At first, DFO referred to the two species as rougheye rockfish types I and II, and this is how they are listed under SARA. These two species are currently managed together, as the two-species rougheye rockfish complex. Due to the lack of species-specific data for blackspotted rockfish, the data presented in this assessment refer to the two-species rougheye rockfish complex.

There is no stock assessment for rougheye rockfish. The COSEWIC assessment of roughey rockfish types I and II found no apparent trends in commercial CPUE for the years 1996-2005 (COSEWIC 2007b). The rougheye rockfish complex is scored "high" concern, because rougheye rockfish types I and II (aka rougheye and blackspotted rockfish) have been assessed as "Special Concern" by COSEWIC (Appendix D (COSEWIC 2007b)) and are listed as “special concern” under SARA (Appendix D; (Canada Gazette 2009)), and because recent trawl biomass indices do not indicate that the biomass of the complex is increasing (Figure 40). It should be noted that the survey biomass estimates for QCS, WCHG, and WCVI are characterized by somewhat high relative error, with mean relative errors of ≥0.35 for each of the three areas (DFO 2013b).

Justification:



Trawl survey biomass indices for rougheye rockfish. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

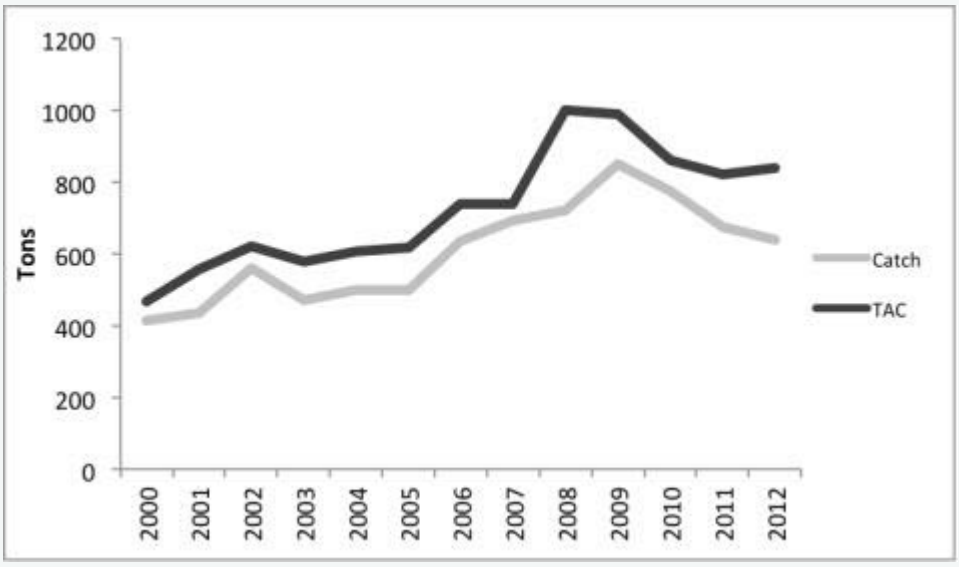
Moderate Concern

The trawl fishery is allocated 55.8% of the rougheye rockfish TAC (DFO 2013a). The 2012 catch of the rougheye rockfish complex was approximately 75.3% of the total TAC; the trawl fishery was responsible for approximately 63.7% of this catch, while the hook and line fisheries for sablefish, outside rockfish, and halibut accounted for 16.1%, 10.5%, and 9.6%, respectively (Appendix C).

There is no stock assessment-based estimate of sustainable mortality for the rougheye rockfish complex. The 2012 catch in the trawl fishery (640 t) is essentially the same as the 1976-2004 average catch in this fishery (646 t), while the 2012 catch in the non-trawl fisheries was approximately 58% of the mean annual catch in non-trawl fisheries during the 1996-2004 period. Recent catches, therefore, are not exceeding historical levels. Fishing mortality of the rougheye rockfish complex is scored "moderate" concern.

Justification:

Annual trawl catches of the rougheye rockfish complex increased from a mean annual catch of 222 t/year during the 1976-1985 period to over 1,000 t/year during the late 1980s and early 1990s (Table 4 in (Haigh et al. 2005b)). Trawl catches reached a maximum of 1,891 t in 1993; the mean annual catch over the 1986-1995 period was 1,164 t (Table 4 in (Haigh et al. 2005b)). Trawl catches declined to approximately 540 t/year from 1996-2004 (Table 4 in (Haigh et al. 2005b)), but have increased somewhat in the years since (Figure 26). Since 2000, the trawl fishery's catch of the rougheye rockfish complex has closely tracked the TAC available to the trawl fishery, which generally increased from 2000-2008 (Figure 41).



Rougheye rockfish catches and TACs for the trawl fishery, 2000-2012. Data from Appendix C.

In 2012, the total catch of the rougheye rockfish complex was 1,004.4 t, and the total TAC was 1,334.7 t (Appendix C). The trawl fishery was responsible for approximately 63.7% of this catch, while the hook and line fisheries for sablefish, outside rockfish, and halibut accounted for 16.1%, 10.5%, and 9.6%, respectively

(Appendix C). The 2012 catch in the trawl fishery (640 t) is essentially the same as the 1976-2004 average catch in this fishery (646 t; Table 4 in (Haigh et al. 2005b)). The total catch in the non-trawl fisheries in 2012 (364.4 t) was approximately 58% of the mean annual non-trawl catch during the period 1996-2004 (Table 2 in (COSEWIC 2007b)).

SABLEFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for sablefish is 49, but the species' productivity rating in Cope et al. 2011 is 1.61 (Table 1 in (Cope et al. 2011)). Sablefish inherent vulnerability is therefore scored "high".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Low Concern

In a recent assessment, sablefish biomass was estimated to be less than B_{MSY}, greater than the LRP, and potentially above the USRP (DFO 2011d). The stock status of sablefish is therefore scored "low" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

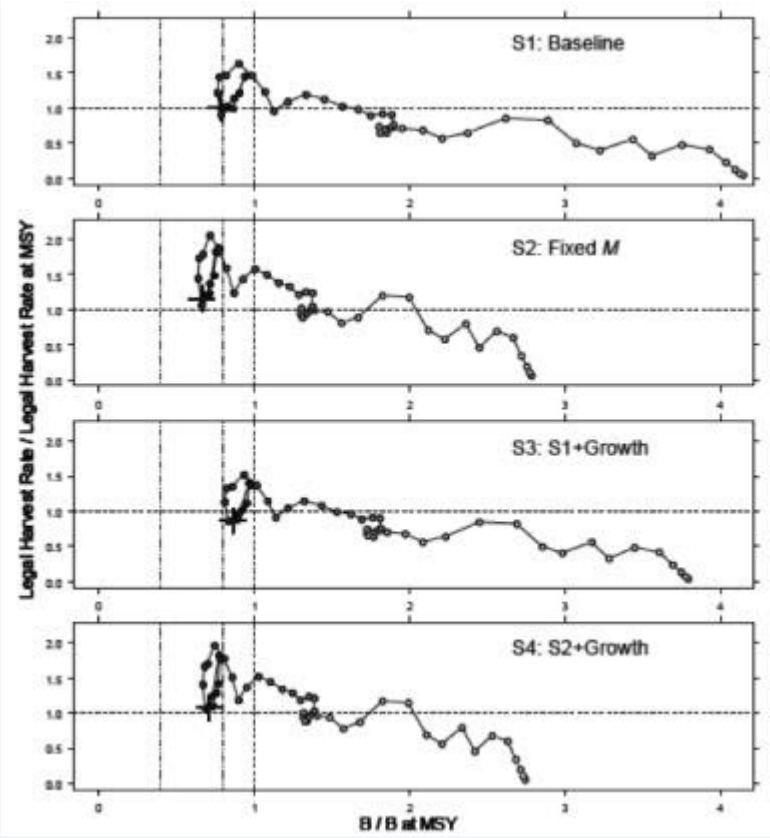
Low Concern

The 2012 sablefish catch was 82.4% of available TAC. Sablefish were primarily caught in the directed sablefish fishery (84.2% of 2012 sablefish catch), with the trawl fishery (9.0%) and halibut fishery (5.0%) catching lesser amounts. Modeled sablefish harvest rates (U) have exceeded U_{MSY} in recent years, with the most recent year (2010) modeled to be very near U_{MSY} (Figure 42). However, the 2012 catch was approximately 83.1% of the annual catch level that was recently identified as being likely to be $\leq U_{MSY}$. Sablefish fishing mortality is therefore scored "low" concern for the sablefish, trawl, and halibut fisheries.

Justification:

In 2012, the total sablefish catch was 1,970.6 t, while the total TAC was 2,390.2 t (Appendix C). In a recent sablefish management evaluation, the average annual catch level associated with the chosen management procedure was 2,370 t (DFO 2011d). This catch level was found to have a high probability of maintaining harvest rates $\leq U_{MSY}$, even when several sources of uncertainty were taken into account.

The 2012 catch was primarily taken in the sablefish fishery (1,660.4 t), with the trawl fishery (177.4 t) and halibut fishery (100.4 t) also catching substantial amounts (Appendix C).



Four modeled estimates of sablefish B:BMSY and U:UMSY, with lighter shading being earlier years, darker shading representing later years, and the most recent modeled year (2010) represented by crosshairs. Figure from (DFO 2011d).

SHORTRAKER ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for shortraker rockfish is 71. The species' productivity rating in Cope et al. 2011 is 1.22 (Table 1 in (Cope et al. 2011)). Shortraker rockfish inherent vulnerability is therefore scored "high".

Factor 1.2 - Abundance

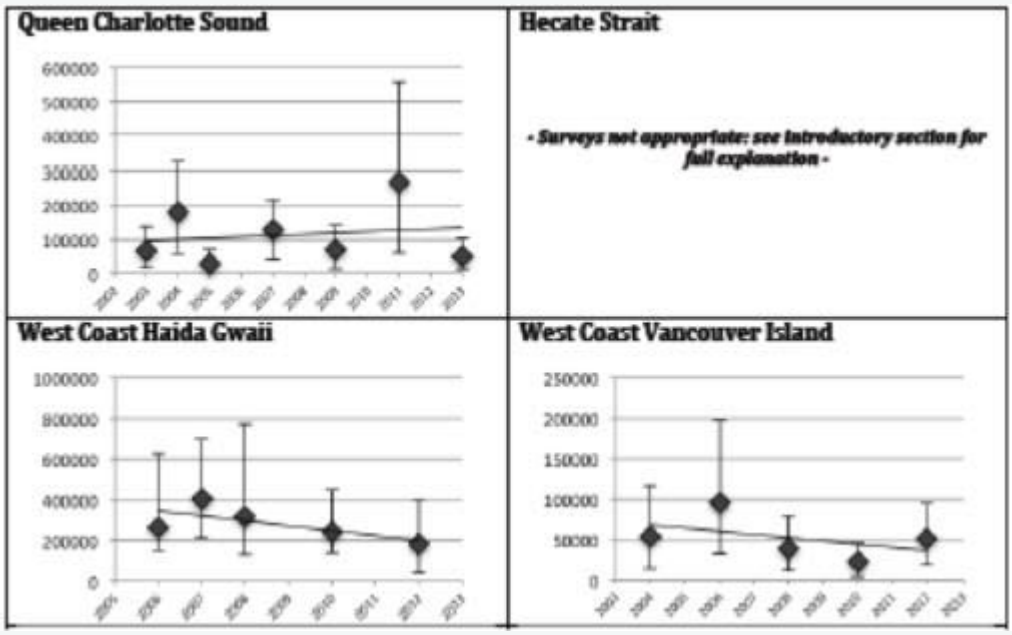
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no stock assessment for shortraker rockfish. Two out of three trawl survey biomass indices show declining trends. Due to the lack of a stock assessment, the species' "high" inherent vulnerability (see Factor 1.1), and declining trends in two survey biomass indices, shortraker rockfish stock status is scored "high" concern.

Justification:

Trawl survey biomass indices for shortraker rockfish show a declining trend in HG and WCVI, and a very slight increase in QCS (Figure 43). Mean relative errors of ≥0.39 for the survey biomass estimates in these three areas complicate reliable interpretation of these potential trends.



Trawl survey biomass indices for shortraker rockfish. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

There is no stock assessment-based estimate of sustainable fishing mortality for the shortraker rockfish stock. The 2012 catch was approximately 44.9% of the TAC, and was caught in the trawl fishery (28.1% of total catch) and the fisheries for sablefish (43.3%), halibut (20.9%), and outside rockfish (7.6%). The 2012 catch was the most since at least 2007. Due to the lack of an assessment-based estimate of sustainable mortality and the fact that the 2012 catch was not insignificant relative to recent levels, the fishing mortality of shortraker rockfish is scored "moderate" concern.

Justification:

Annual catches of shortraker rockfish by the domestic trawl fishery were <60 t until 1990 (Table 2.6.8 in (Schnute et al. 1999)). Catches substantially increased during the early 1990s, reached a maximum of 549 t in 1994, and declined thereafter to 56 t in 1997 (Table 2.6.8 in (Schnute et al. 1999)). Total catches of shortraker rockfish have increased in recent years, from approximately 71 t in 2007 to nearly 137 t in 2012; total TACs have remained relatively steady during this period (Appendix C). The increased total catch has largely been driven by increased catch in the sablefish fishery (Appendix C). No fishery-specific TACs were exceeded during the 2007-2012 period (Appendix C).

In 2012, the total catch of shortraker rockfish was approximately 136.9 t, while the total TAC was 305.0 t (Appendix C). Shortraker catch was primarily taken in the fisheries for sablefish (43.3% of total shortraker rockfish catch), halibut (20.9%), and outside rockfish (7.6%), and the trawl fishery (28.1%) (Appendix C). The 2012 catch was the highest of the 2007-2012 period (Appendix B).

SHORTSPINE THORNYHEAD

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High

The Fishbase vulnerability score for shortspine thornyhead is 70. The species' productivity rating in Cope et al. 2011 is 1.33 (Table 1 in (Cope et al. 2011)). Shortspine thornyhead are therefore scored "high" for inherent vulnerability.

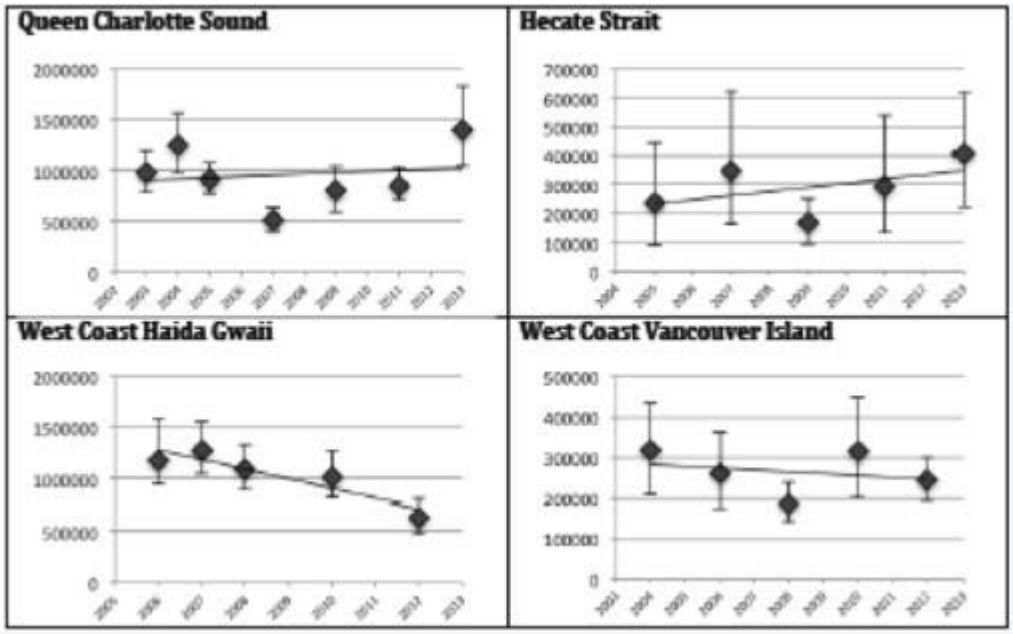
Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High Concern

There is no stock assessment for shortspine thornyhead. Trawl survey biomass indices do not indicate a consistent coastwide trend, as the trends in the two survey areas that yield the highest estimates are essentially flat in QCS and a decline in WCHG (Figure 44). Shortspine thornyhead stock status is scored "high" concern due to its "high" inherent vulnerability and unknown stock status.

Justification:



Trawl survey biomass indices for shortspine thornyhead. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

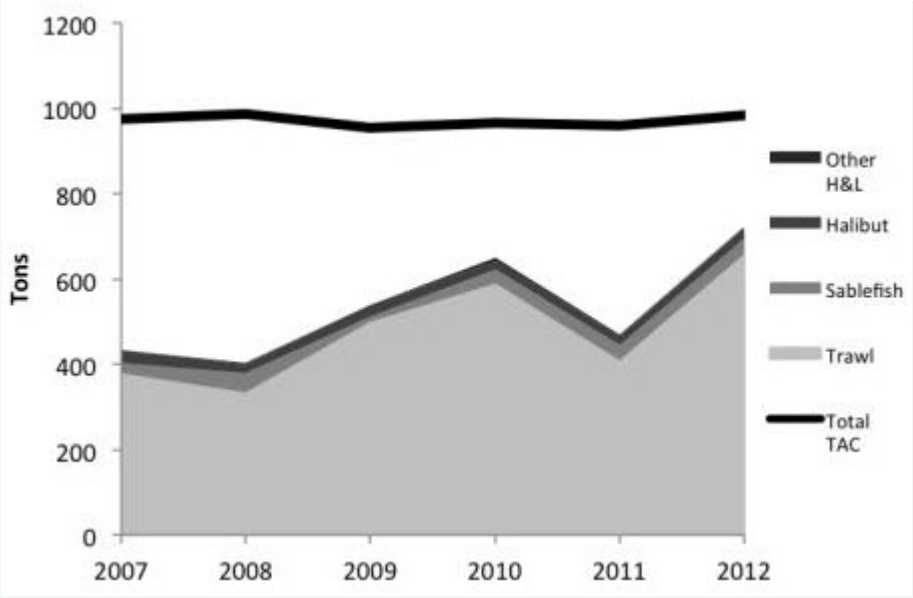
Moderate Concern

There is no stock assessment-based estimate of sustainable mortality for shortspine thornyhead. In 2012, the catch of shortspine thornyhead was approximately 73.2% of total TAC. The trawl fishery accounted for 88.8% of the 2012 catch. The 2012 catch in the trawl fishery was the highest since 2002 and is comparable to some of the higher historical catches. Due to the lack of a stock assessment-based estimate of sustainable mortality and the relatively high 2012 catch, fishing mortality of shortspine thornyhead is scored "moderate" concern.

Justification:

Domestic landings of shortspine thornyhead in the trawl fishery were essentially nil until the early 1980s (DFO 1999b). Catches in this fishery increased rapidly during the early 1990s (DFO 1999b).

In 2012, the total catch of shortspine thornyhead was 721.1 t, while the total TAC was 984.5 t (Appendix C). Catch in the trawl fishery accounted for 659.8 t, with the sablefish (35.9 t) and halibut (22.3 t) fisheries contributing lesser amounts (Appendix C). Shortspine thornyhead catches have been well below the TAC since at least 2007, but the catch in the 2012 trawl fishery represented an increase from recent years (Figure 45) and was the highest trawl catch since 2002 (DFO 2013c). The 2012 trawl catch was similar to the third-highest single-year catch for the 1967-1998 period (DFO 1999b).



Shortspine thornyhead catches and TACs, 2007-2012. Data from (DFO 2013b)(DFO 2013c).

SILVERGRAY ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for silvergray rockfish is 68, and the species' productivity rating in Cope et al. 2011 is 1.22 (Table 1 in (Cope et al. 2011)). Silvergray rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

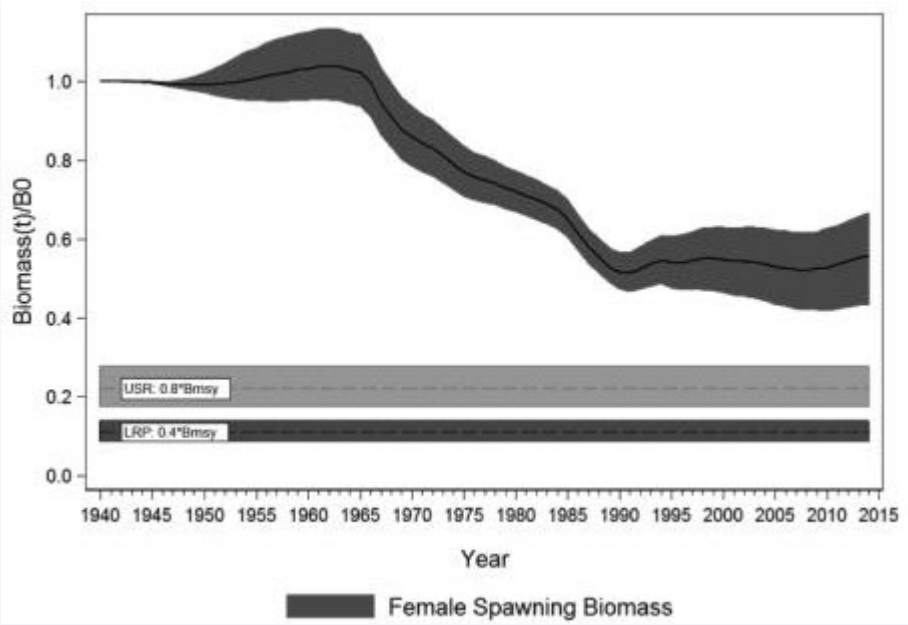
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Very Low Concern

Since 1940, silvergray rockfish spawning biomass has not been less than the USRP, and SB_{2014} is estimated to be well above SB_{MSY}. Silvergray rockfish stock status is therefore scored "very low" concern.

Justification:

Silvergray rockfish spawning biomass declined from the late 1960s through the end of the 1980s, but has remained relatively stable in the years since (Figure 30) (Starr et al. 2013). In the recent assessment, SB_{2014}:SB_0 is estimated to be 0.559 (5-95% range = 0.405-0.698; (Starr et al. 2013)). Silvergray rockfish SB_{2014}:SB_{MSY} is 2.035 (1.223-2.997), and spawning biomass has not been less than the USRP point since 1940 (Figure 46) (Starr et al. 2013).



Posterior median estimates of silvergray rockfish spawning biomass, and 80% credibility intervals, relative to posterior median estimates and 80% credibility intervals for the USRP and the LRP. Figure from (Starr et al. 2013).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

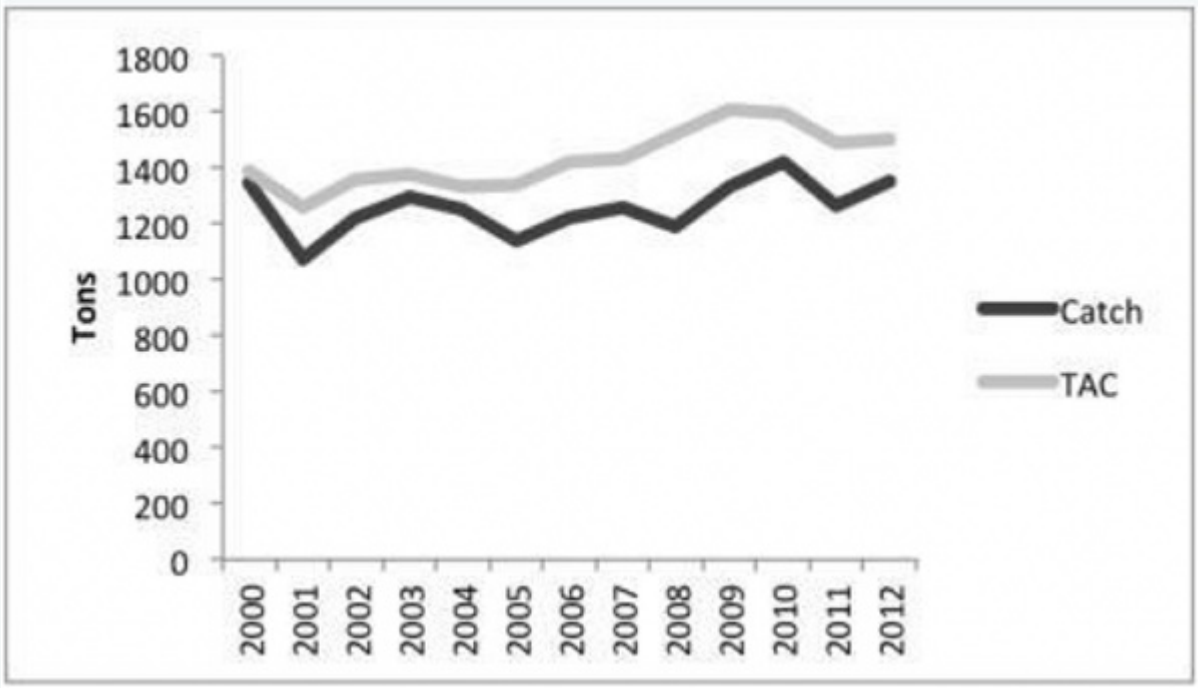
Very Low Concern

The trawl fishery is allocated 88.43% of the silvergray rockfish TAC for 2013, and the ZN hook and line fishery is allocated 10.97% (DFO 2013a).Catches of silvergray rockfish have closely tracked available TAC in recent years, and in 2012, the catch of silvergray rockfish in the trawl fishery was approximately 90.1% of the available trawl TAC. The estimated exploitation rate for silvergray rockfish in 2013 was approximately 30% of the exploitation rate associated with MSY. Recent catch levels, when projected into the next decade, have a very low probability of resulting in sub-target stock status. For these reasons, fishing mortality of silvergray rockfish is scored "very low" concern.

Justification:

The silvergray rockfish exploitation rate in 2013 was 0.044 (5-95% range = 0.030-0.068), while the exploitation rate associated with MSY was estimated to be 0.145 (0.064-0.300) (Table 3 in (Starr et al. 2013)).

Silvergray rockfish catches in the trawl fishery have closely tracked available TAC in recent years (Figure 47), with an average of 88% of available trawl TAC caught each year during the period 2000-2012 (Appendix C). The average catch of silvergray rockfish during the period 2008-2012 was 1,408 t, with the trawl fishery responsible for approximately 96% of annual catches during this period (Starr et al. 2013).



Silvergray rockfish catch and TACs in the trawl fishery, 2000-2012. Data from (DFO 2013b).

A scenario in which annual catches during the period 2014-2024 are held constant at 1,500 t/year (similar to the average catch in the 2008-2012 period) is projected to have a 54% probability of resulting in $SB_{2024}>SB_{2014}$, and a probability of 99% of resulting in $SB_{2024}>0.8*SB_{MSY}$ (Table 5 in (Starr et al. 2013)). If catch levels are increased to 2,000 t/year for this same period, the probabilities that SB_{2024} would exceed SB_{2014} and $0.8*SB_{MSY}$ are 22% and 98%, respectively (Table 5 in (Starr et al. 2013)).

SOUTHERN ROCK SOLE

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Medium

The Fishbase vulnerability scores for southern rock sole is 57. However, the species' productivity rating in Cope et al. 2011 is 1.95 (Table 1 in (Cope et al. 2011)). Rock sole therefore have an inherent vulnerability score of "medium".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Very Low Concern

Over the previous decade, rock sole spawning biomass has steadily increased in Areas 5A/B and 5C/D. A draft assessment indicates that rock sole biomass is above B_{MSY} and associated reference points in Areas 5A/B and 5C/D. The stock's status in Area 3C/D (WCVI) was not assessed, but the WCVI trawl survey biomass index

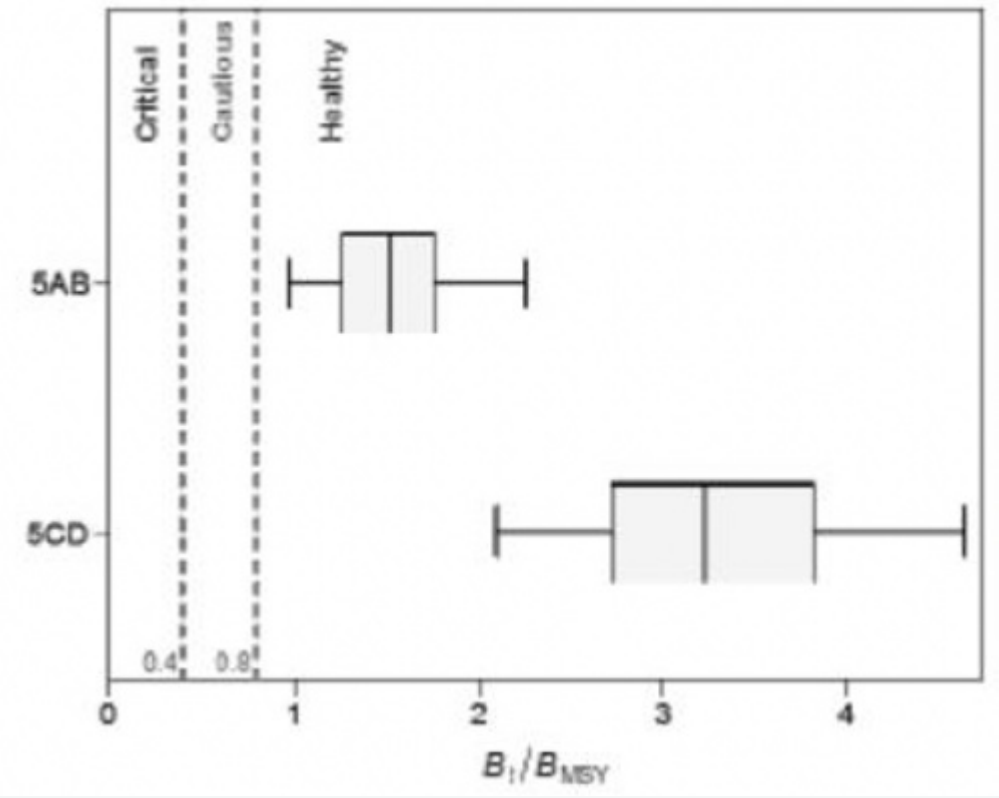
shows a relatively flat trend throughout five surveys. Rock sole stock status is scored "very low" concern.

Justification:

Both northern and southern rock sole are found in British Columbia's waters, with the southern rock sole being the more prevalent of the two (Holt et al. 2013). For this assessment, the term 'rock sole' will be used. There are four discrete rock sole stocks in British Columbia's waters (Fargo 1999).

In a recent stock assessment, Area 5A/B rock sole spawning biomass is estimated to have sharply declined from the late 1950s through the late 1960s, stabilized at approximately 40% of SB_0 until the 1990s, and sharply declined in the early 1990s to a point below the upper stock reference (Figure 5 in (CSAS 2014b)). Since the mid-1990s, Area 5A/B spawning biomass has steadily increased (Figure 5 in (CSAS 2014b)). Similarly, spawning biomass in Area 5C/D declined from the 1950s through the late 1970s, was stable at between 40% to 60% of SB_0through the 1980s and 1990s, and has increased in the years since (Figure 6 in (CSAS 2014b)).

In the assessment, estimates of B_{2014}: B_{MSY} were 1.52 for Area 5A/B (5-95% percentiles = 0.98-2.26) and 3.22 for Area 5C/D (2.10-4.64; Table 1 in (CSAS 2014b)) (Figure 49). The probabilities of B_{2014} being greater than the USRP were 99% for Area 5A/B and 100% for Area 5C/D (CSAS 2014b). The stock's status in Area 3C/D (WCVI) and 5E (WCHG) was not assessed, but the WCVI trawl survey biomass index shows an essentially flat trend over five surveys (DFO 2013b).



Estimates of 2014 rock sole biomass in Areas 5C/D and 5A/B, relative to reference points and showing 2, 25, 50, 75, and 95 percentiles. Figure from (CSAS 2014b).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Very Low Concern

The trawl fishery is allocated 100% of rock sole coastwide TAC (DFO 2013a). In 2012, the catches of rock sole in the two most important regions (Areas 5A/B and Areas 5C/D) were 43.3% and 60.5% of their respective TACs. For 2013, exploitation rates for Areas 5A/B and 5C/D were less than the exploitation rates associated with MSY. Due to the low catch relative to TACs and the analysis of recent exploitation presented in the up-to-date stock assessment, fishing mortality of rock sole is scored "very low" concern.

Justification:

Rock sole catches have generally declined since 2000, and have not exceeded any area-specific TACs during the 2000-2012 period (Appendix C). In 2012, the coastwide catch of rock sole in the trawl fishery was 872.9 t (Appendix C). Approximately 58.0% of this catch was taken in Areas 5C/D, 39.2% in Areas 5A/B, and 2.9% in Areas 3C/D (Appendix C).
For Area 5A/B, the estimated exploitation rate for 2013 was 46.3% of the exploitation rate associated with MSY (5-95 percentiles = 29.9-72.4%; Table 1 in (CSAS 2014b)). For Area 5C/D, this ratio was 7.7% (3.7-16.3%; Table 1 in (CSAS 2014b)).

SPINY DOGFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA

High

The Fishbase vulnerability score for *S. acanthias* is 69. The species' productivity rating in Cope et al. 2011 is 1.11 (Table 1 in (Cope et al. 2011)). Spiny dogfish inherent vulnerability is therefore scored "high".

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA

Moderate Concern

North Pacific dogfish have been assessed by multiple bodies. The IUCN assessed the stock in 2006 and have since listed it as 'vulnerable.' This finding is disregarded here as more recent assessments are available. The most recent stock assessment was in 2010, and concluded 'that there is no immediate conservation concern for either the inside or outside stocks of Pacific spiny dogfish and that, given the perceptions of the current stock status, it is unlikely that deleterious or irreversible declines in stock abundance are likely to occur over the five year time frame established for the next assessment at the current (2000-2009) level of removals" (CSAS 2010). More recently, COSEWIC found the stocks to be 'relatively abundant in BC waters' and that the population did not meet any of the criteria for listing, but that concerns exist because of the biology of the species and the level of uncertainty and so deemed the population a "Special Concern" (COSEWIC 2011). The stock status of spiny dogfish is scored 'moderate' concern due to the uncertainties regarding stock status and the species' COSEWIC status.

Justification:

North Pacific dogfish have been assessed by multiple bodies. The IUCN assessed the stock in 2006 and have since listed it as 'vulnerable.' In 2010, the Canadian stock assessment did not yield reliable estimates of the stock's status, but the assessment's authors concluded that "there is no immediate conservation concern for either the inside or outside stocks of Pacific spiny dogfish and that, given the perceptions of the current stock status, it is unlikely that deleterious or irreversible declines in stock abundance are likely to occur over the five-year time frame established for the next assessment at the current (2000-2009) level of removals" (CSAS 2010). In 2011/2012, the COSEWIC assessment found that the population did not meet any of the criteria for listing, but concerns exist because of the biology of the species and the level of uncertainty. For these reasons, COSEWIC listed the stock as "Special Concern." (Appendix D) (COSEWIC 2011). Spiny dogfish were recently assessed by COSEWIC to be a "Special Concern," and spiny dogfish in the Northeast Pacific are classified as "Vulnerable" by the IUCN (Appendix D). One potential issue noted in the 2010 stock assessment is a potential shift in size distributions of males and females in the inside stock. For this stock, the modal length interval for males caught in longline research surveys declined between the 1980s and the early 2000s (CSAS 2010). For inside females, a shift in size distribution over the same period was apparent in a reduction in the number of large (>100 cm) females, and an increase in smaller individuals (CSAS 2010). The decline in mean size may have been due, in part, to a movement of juvenile dogfish to the seafloor (CSAS 2010).

Factor 1.3 - Fishing Mortality

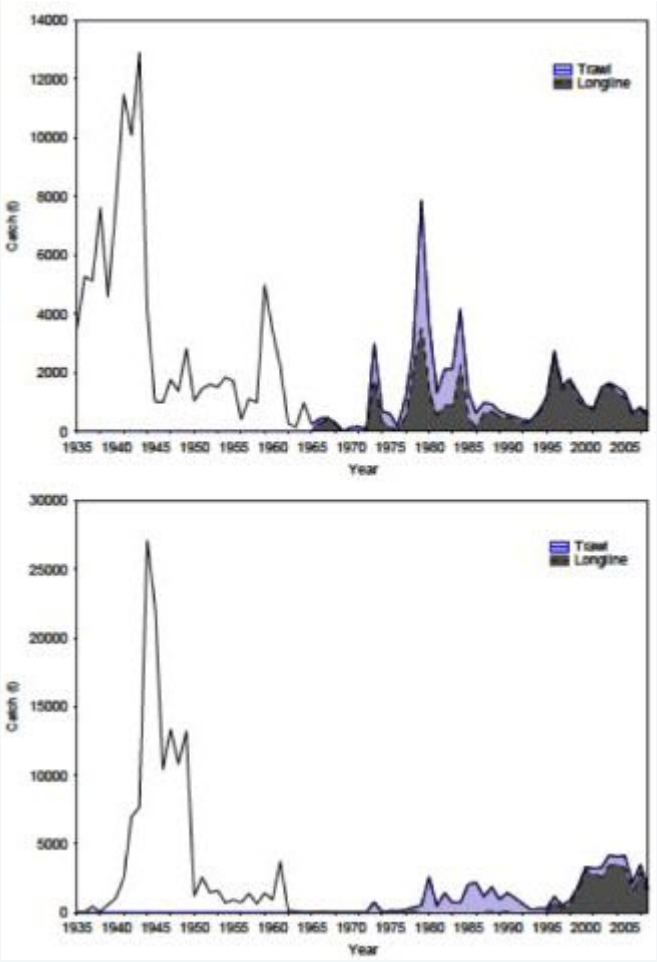
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA

Low Concern

The 2012 catches of inside and outside dogfish were approximately 9.8% and 5.7% of the total available TAC, respectively. The dogfish hook and line fishery was responsible for 83.5% and 48.7% of the catch of inside and outside dogfish, respectively, while the trawl fishery (16.1% and 11.4% of the inside and outside catches, respectively), halibut fishery (29.8% of outside dogfish catch), and outside rockfish fishery (6.9% of outside dogfish catch) also accounted for substantial catches. Recent catches of both inside and outside dogfish have been low, relative to recent levels, and the recent stock assessment considered it "unlikely" that deleterious or irreversible declines in abundance were to occur over the period 2010-2015 (CSAS 2010). However, there are no model-derived estimates of sustainable yield, and total fishing mortality has likely been underestimated (CSAS 2010). Fishing mortality of spiny dogfish is therefore scored "low" concern for the aforementioned fisheries.

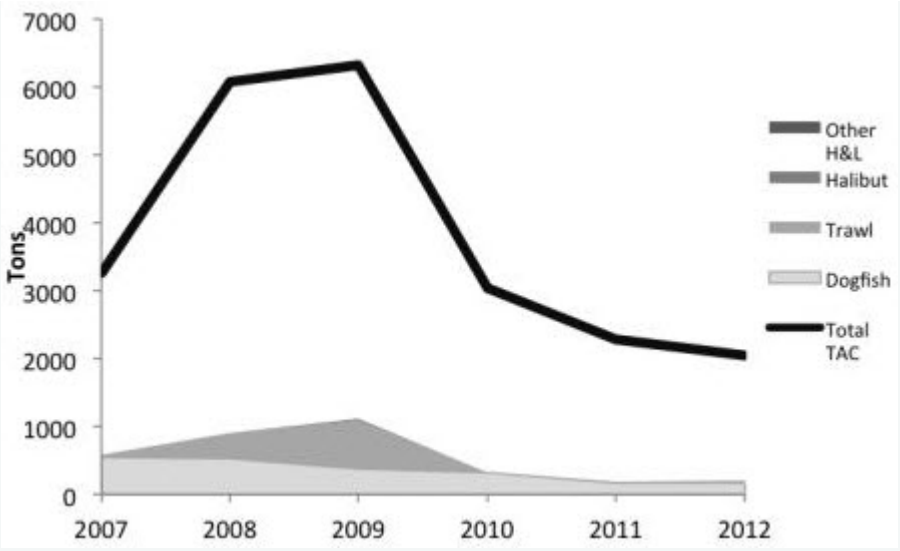
Justification:

A period of very high exploitation occurred from the late 1930s through the 1940s (Figure 49), as B.C. dogfish were targeted due to the use of their livers in the procurement of Vitamin A. After the 'liver' fishery ended, dogfish became the target of a food fishery in the late 1970s (Galluci et al. 2011).

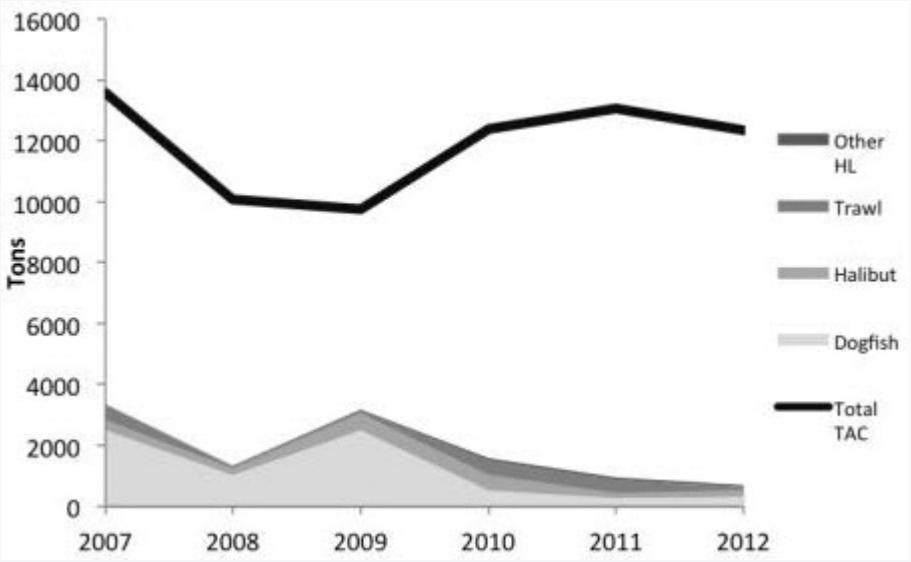


Estimated historical fishing mortality of inside (top) and outside (bottom) stocks of spiny dogfish. Figure from (Galluci et al. 2011).

In 2012, the total catches of inside and outside dogfish were approximately 200 and 699 t, respectively, while the total available TACs for inside and outside dogfish were 2,044 and 12,358 t, respectively (Appendix C). Catches of both dogfish stocks have declined since 2009 (Figures 50 and 51). In 2012, the directed dogfish hook and line fishery was responsible for 83.5% and 48.7% of the catch of inside and outside dogfish, respectively (Appendix C). The trawl fishery caught 16.1% and 11.4% of the inside and outside catches, respectively, and the halibut and outside rockfish fisheries accounted for 29.8% and 6.9% of outside dogfish catch, respectively (Appendix C).



Inside (Area 4B) dogfish TACs (black line) and catches by fishery (shaded areas), 2007-2012. Data from (DFO 2013b)(DFO 2013d).



Outside (Area 3C, 3D, 5A/B, 5C/D/E) dogfish TACs (black line) and catches by fishery (shaded areas), 2007-2012. Data from (DFO 2013b)(DFO 2013d).

TIGER ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

High

The Fishbase vulnerability score for tiger rockfish is 71. The species' productivity rating in Table 1 of (Cope et al. 2011) is 1.25, which likewise indicates "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

High Concern

There is no up-to-date stock assessment for tiger rockfish. In light of this species' high inherent vulnerability, stock status is scored "high" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Moderate Concern

There are no estimates of sustainable mortality for China, copper, or tiger rockfish. However, the establishment of Rockfish Conservation Areas (RCAs) has set aside substantial amounts of habitat for these species. Fishing mortality is scored “moderate” concern for the china, copper, and tiger rockfish in the halibut and outside rockfish fisheries, and for tiger rockfish catch in the inside rockfish fishery.

Justification:

Note: Quillback, copper, china, and tiger (QCCT) rockfish are managed with one TAC. Mortality of QCCT rockfish is discussed here as one unit, but quillback mortality is addressed in more specific terms in the detailed rationale for that species. The following information informs fishing mortality scores for copper, china, and tiger rockfish.

In 2012, the total catch of QCCT rockfish was 183.8 t, while the total TAC was 257.2 t (Appendix A). Line fisheries dominated the catch of QCCT species; the trawl fishery was responsible for relatively little QCCT catch (Figure 52). The halibut and outside rockfish fisheries were the primary fisheries for all four QCCT species in 2012, and the inside rockfish fishery was responsible for substantial proportions of quillback and tiger rockfish catches (Figure 7).

The 2012 catch can be broken down by catch taken from inside (Area 4B) and outside (remaining areas) waters. The inside rockfish fishery accounted for 96.3% of the 2012 QCCT rockfish catch in inside waters, but zero percent of the outside catch (DFO 2013d). Conversely, catch of QCCT rockfish in outside waters was dominated by the outside rockfish fishery (69.5% of outside QCCT catch) and the halibut fishery (25.8%) (DFO 2013d).

Area-specific TACs have been exceeded by some fisheries during recent years. In particular, the halibut fishery exceeded its inside (Area 4B) TAC each year from 2009-2012, and the dogfish fishery exceeded numerous area-specific TACs during this same period (DFO 2013d). In 2012, the lingcod fishery slightly exceeded its Area 5B TAC (DFO 2013d).

	China rockfish		Copper rockfish		Quillback rockfish		Tiger rockfish	
Fishery	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*	*Tons*	*%*
Trawl	0.03	0.2	2.78	7.1	2.23	1.5	0.00	0.1
Halibut	3.30	23.7	4.17	10.7	39.44	26.6	1.30	25.7
Rockfish Inside	0.51	3.7	1.47	3.8	17.91	12.1	0.49	9.7
Rockfish Outside	9.53	68.3	29.75	76.0	80.27	54.1	2.94	58.3
Other fisheries	0.57	4.1	0.97	2.5	8.61	5.8	0.31	6.2
TOTAL	*13.95*	*100.0*	*39.14*	*100.1*	*148.46*	*100.1*	*5.05*	*100.0*

Total catch of QCCT rockfish in 2012 groundfish fisheries (DFO Pacific Region 2013).

WIDOW ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for widow rockfish is 65. The species' productivity rating in Cope et al. 2011 is 1.31 (Table 1 in (Cope et al. 2011)). Widow rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

There is no recent stock assessment for widow rockfish. Due to their semi-pelagic nature, widow rockfish may not be well-sampled by the trawl surveys (P. Starr, pers. comm.), and as such the survey abundance indices are not used here. Due to the lack of a stock assessment and the species' "high" inherent vulnerability, widow rockfish stock status is scored "high" concern.

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In the 2013 IFMP, the trawl fishery is allocated 98.21% of widow rockfish TAC (DFO 2013a).Widow rockfish landings (excluding discards) reached a maximum of over 4,000 t in the early 1990s, and catches have averaged approximately 1,843 t since 2000. The 2012 catch of widow rockfish in the trawl fishery was approximately 67.3% of the available TAC. There is no stock assessment-based estimate of sustainable mortality for widow rockfish, but at the time of the last stock status review in 1999 (DFO 1999c), fishing mortality was thought to be "close to maximum exploitation". Fishing mortality of widow rockfish is therefore scored "moderate" for the trawl fishery.

Justification:

Widow rockfish landings in B.C. were minimal until the start of a commercial trawl fishery in the mid-1980s, whereupon landings increased rapidly to a maximum of over 4,000 t/y in the early 1990s (DFO 1999c). Since 2000, annual catches of widow rockfish have fluctuated between approximately 1,270 t and 2,350 t; there is no apparent trend in the catches, and widow rockfish TACs have remained steady at 2,747 t – 3,076 t throughout this period (Appendix C). Catches did not exceed TACs during the 2000-2012 period (Appendix C). The 2012 catch of widow rockfish was 1,932 t, while the TAC was 2,871 t (Appendix C). The 2012 catch was slightly greater than the 2000-2012 average (1,843 t; Appendix C).
At the time of the 1999 stock status report, the stock was considered to be "probably close to maximum exploitation" at 1,137 t caught in 1997 (DFO 1999c).

YELLOWEYE ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for yelloweye rockfish is 73, and their productivity rating in Cope et al. 2011 is 1.22 (Table 1 in (Cope et al. 2011)). Yelloweye rockfish therefore have "high" inherent vulnerability.

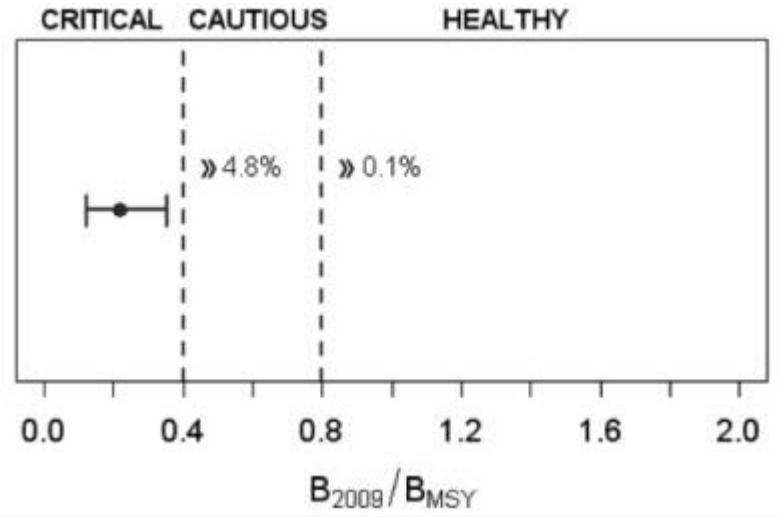
Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

High Concern

A recent assessment of the "inside" yelloweye rockfish population estimated a 90% probability that B_{2009} was less than the LRP (DFO 2011b); the median biomass estimate and associated confidence intervals are shown along with the LRP and URSP in Figure 54. The inside population has been assessed as "special concern" by COSEWIC (COSEWIC 2008), and yelloweye rockfish are listed as "Special Concern" under SARA (Canada Gazette 2011b) (Appendix D). Stock status is scored "high" concern for the "inside" population.

Justification:



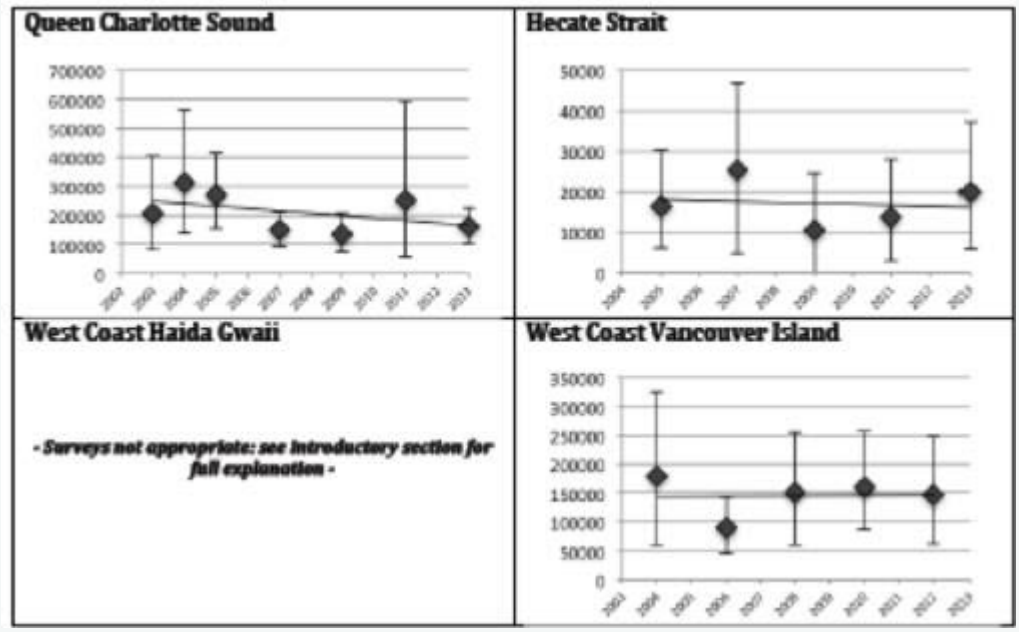
Reference case median estimate for "inside" yelloweye rockfish biomass in 2009, and associated 90% confidence intervals, with the LRP and USRP represented as dashed lines. Figure from (DFO 2011b).

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no recent stock assessment of the "outside" population. A review of information relating to “outside” yelloweye, including analyses of commercial fishery and survey CPUE data, was done in 2006 (Yamanaka et al. 2006). The analyses of CPUE data did not reveal clear trends (Yamanaka et al. 2006). The outside stock has been assessed as "special concern" by COSEWIC (COSEWIC 2008), and yelloweye rockfish are listed as "Special Concern" under SARA (Canada Gazette 2011b) (Appendix D). Trawl survey biomass indices in WCVI and HS show a flat trend, while there is a slight decline in the QCS index (Figure 56). Stock status is scored “high” concern for the “outside” population of yelloweye rockfish.

Justification:



Trawl survey biomass indices for yelloweye rockfish. Data from (DFO 2013b).

Factor 1.3 - Fishing Mortality

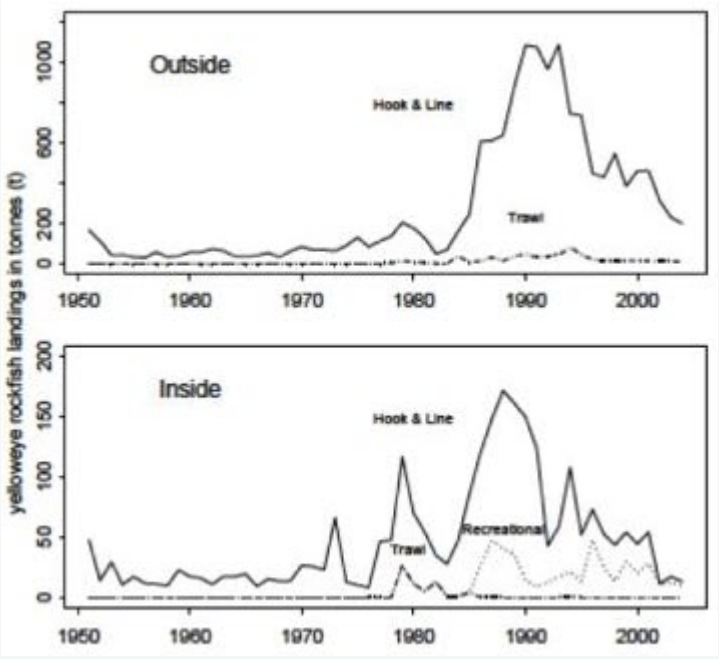
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Low Concern

Recent annual catches of "inside" rockfish have been steady at approximately 4.0 t/year, primarily caught by the dogfish and inside rockfish fisheries. This level of mortality is projected to allow the stock's biomass to rebuild, with probabilities of attaining certain reference points that are similar to zero-harvest options. Therefore, the fishing mortality of inside rockfish is scored "low" concern for the dogfish and inside rockfish fisheries.

Justification:

Annual catches of both "inside" and "outside" populations of yelloweye rockfish were relatively steady and minimal for most of the 1950s, 1960s, and 1970s (Figure 55). Catches of both populations increased rapidly during the early 1980s, and remained high until the early to mid-1990s (Figure 55).



Historical catches of "outside" and "inside" populations of yelloweye rockfish, by gear type (solid line = hook and line, dash-dot = trawl, light dots = recreational fisheries). Figure from (Yamanaka et al. 2006).

Catches of “inside” yelloweye rockfish have been very steady since 2007, varying only between 3.440 and 4.73 t over the 2007-2012 period (Appendix C). The 2012 catch of ‘”inside” yelloweye was 3.97 t, with the dogfish (2.14 t) and inside rockfish (1.60 t) fisheries accounting for approximately 94% of the total catch (Appendix C). The inside TAC was 6.30 t (Appendix C). In the recent assessment of the “inside” stock, annual catches of 5 t are projected to allow “inside” yelloweye rockfish biomass to increase (Table 2 in (DFO 2011b)). For reference, the probability that B_{2029} will exceed the LRP after 20 years of zero harvest is only 4.8% greater than the probability that B_{2029}>LRP after constant annual catches of 5 over the same period (Table 2 in (DFO 2011b)).

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

The total catch of “outside” yelloweye rockfish in 2012 was 69.9% of the available TAC. The 2012 “outside” catch was primarily taken in the fisheries for halibut (55.7% of total “outside” yelloweye catch), outside rockfish (27.9%), and sablefish (7.8%). There is no current, stock assessment-based estimate of sustainable mortality for the “outside” population. Recent catches are substantially lower than the maximum levels seen during the 1980s and 1990s, but they are above the annual catch levels of the 1950s, 1960s, and 1970s. Fishing mortality of the “outside” population of yelloweye rockfish is scored "moderate" concern.

Justification:

Annual catches of both “inside” and “outside” populations of yelloweye rockfish were relatively steady and minimal for most of the 1950s, 1960s, and 1970s (Figure 33). Catches of both populations increased rapidly during the early 1980s, and remained high until the early to mid-1990s (Figure 55).

During the period 2007-2012, the commercial fisheries mean annual catch of "outside" yelloweye rockfish was 225.1 t, while the mean annual TAC was 322.0 t (Appendix C). The 2012 commercial catch of "outside" yelloweye rockfish was approximately 244.2 t, and was primarily caught in the fisheries for halibut (55.7% of total outside yelloweye catch), outside rockfish (27.9%), and sablefish (7.8%) (Appendix C). The total 2012 TAC for outside yelloweye rockfish was approximately 329.1 t, of which 322.1 t was allocated to the hook and line fisheries (Appendix C). The 2007-2012 mean annual catch is much less than the maximum catches of the 1980s and 1990s, but is greater than the annual catches of the 1950s, 1960s, and 1970s (Figure 55).

YELLOWMOUTH ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for yellowmouth rockfish is 63, and their productivity rating in Cope et al. 2011 is 1.61 (Table 1 in (Cope et al. 2011)). Yellowmouth rockfish therefore have "high" inherent vulnerabiity.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

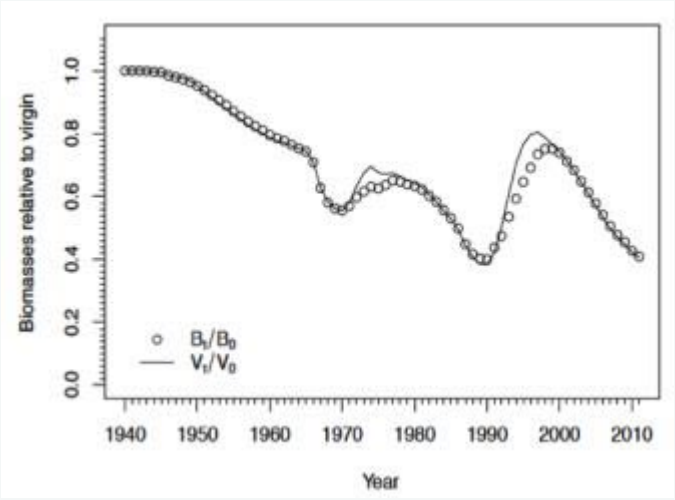
Yellowmouth rockfish biomass sharply increased during the 1990s as a result of strong recruitment, but has steadily declined since approximately 2000. Despite the decline, yellowmouth rockfish stock is considered to be in DFO's "healthy zone", as the recent stock and recovery potential assessment's modeled estimates of SB_{2011}: SB_{MSY} (2.62 and 1.90) are above the USRP ($0.8*SB_{MSY}$). Yellowmouth rockfish have been assessed as "Threatened" by COSEWIC and are being considered for SARA designation. While the Seafood Watch criteria require a stock status score of "very high" concern for a species that has been assessed as "threatened" by a national scientific body such as COSEWIC, it should be recognized that a new stock assessment, conducted since the COSEWIC designation, indicates that yellowmouth rockfish biomass is above the USRP, though there is considerable uncertainty. The rating of 'low' concern is based primarily on the stock assessment but with added precaution because fo the COSEWIC assessment.

Justification:

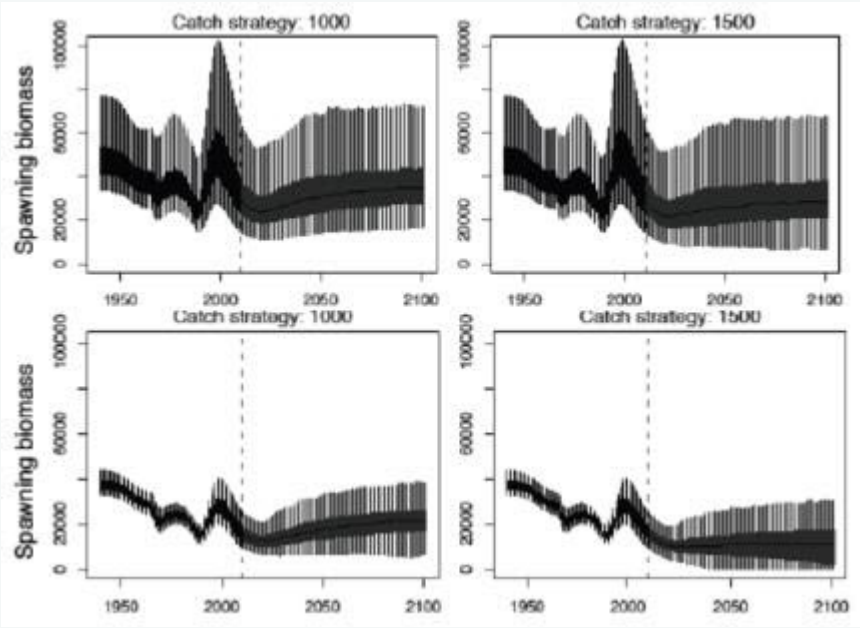
Yellowmouth rockfish have been assessed as "Threatened" by COSEWIC (Appendix D), and are being considered for listing under SARA (DFO 2013a).

In a recent assessment of stock status and recovery potential, two stock assessment model runs (which differed only in whether M was estimated or fixed) show similar patterns of increases and declines, relative to virgin biomass, over the decades (Figures 57, 58). Declines in the 1960s and 1970s/1980s are attributed to heavy catches by foreign and domestic fleets, respectively, while the brief recovery in the early 1970s is attributed to cessation of foreign fishing and strong recruitment, and the substantial recovery in the 1990s is attributed to a "major recruitment event" (Edwards et al. 2012). The gains made during the 1990s recovery were largely erased by a steady decline in the subsequent years, however, and the 2012 stock assessment estimated that SB_{2011}:SB_0 was 0.614 (0.431-0.829) and 0.409 (0.289-0.547) for the 'Estimate M' and 'Fix M'

models, respectively (Edwards et al. 2012). Estimates of SB_{MSY}: SB_0 were 0.233 (0.149-0.314) and 0.216 (0.147-0.298) for the 'Estimate M' and 'Fix M' runs, respectively (Edwards et al. 2012). Therefore, despite the recent decline, estimated SB_{2011} was above SB_{MSY}.



Changes in yellowmouth rockfish spawning biomass (open circles) and vulnerable biomass (lines) relative to virgin levels in recent stock assessment's two model runs (Model runs 'Estimate M' on top and 'Fix M' on bottom). Figures from (Edwards et al. 2012).



Projections of yellowmouth rockfish spawning biomass under two constant catch levels, as modeled by the "Estimate M" (top) and "Fix M" (bottom) model runs. Figures from (Edwards et al. 2012).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Very Low Concern

The trawl fishery is allocated 96.77% of the yellowmouth rockfish TAC (DFO 2013a). The 2012 trawl catch

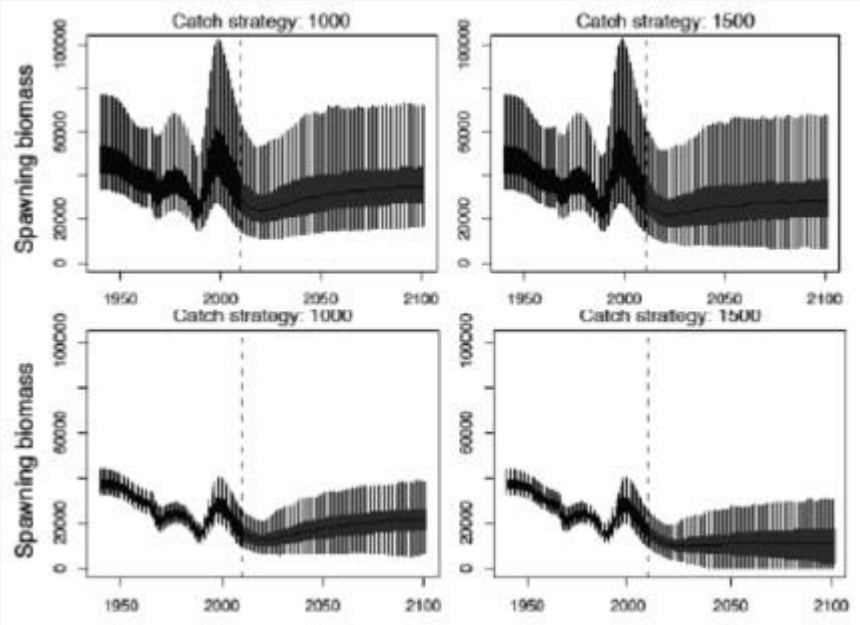
(1,140 t) was approximately 37.1% of the available trawl TAC. Annual catches of yellowmouth rockfish in recent years have been less than MSY, and recent catch levels are similar to those that are modeled to have <30% probability of driving the stock's biomass below the USRP within 30 years. Yellowmouth rockfish fishing mortality is therefore scored "very low" concern for the trawl fishery.

Justification:

A recent yellowmouth rockfish stock and recovery assessment presents a variety of information regarding historical and recent fishing mortality. Estimates of historical exploitation rates indicate that exploitation rates exceeded the MSY level for only one year (1966), declined from the middle 1980s (when rates approached 0.10) through the middle 1990s, and since then have varied between approximately 0.02 and 0.05 (Edwards et al. 2012).

The 2012 assessment's estimated median MSYs were 2,567 t (5-95% credible interval = 1,717-4,297) and 1,693 t (1,236-2,108 t) for the 'Estimate M' and 'Fix M' runs, respectively (Edwards et al. 2012). The average catch during 2010-2012 (1,162 t; (DFO 2013b)) is less than the lower end of the credible interval for both estimates. The 2012 trawl catch (1,140 t) was approximately 37.1% of the available trawl TAC (Appendix C).

Projection tables show that the probabilities that an annual catch of 1,250 t (which is slightly greater than the 2010-2012 average of 1,162 t) will result in $SB_{2016}<SB_{MSY}$ are 0.7% (for the Estimate M' run) and 11.3% (for the 'Fix M' run) (Tables 5 and 8 in (Edwards et al. 2012)). When steady catches of 1,500 t are projected 30 years into the future, the probabilities that $SB_{2041}<0.8*SB_{MSY}$ are 2% and 25% for the 'Estimate M' and 'Fix M' runs, respectively (Tables 9 and 10 in (Edwards et al. 2012)). In the coming decades, biomass is projected to stay essentially steady, or perhaps slightly increase, if catches are held steady at 1,000 – 1,500 t (Figure 58).



Projections of yellowmouth rockfish spawning biomass under two constant catch levels, as modeled by the "Estimate M" (top) and "Fix M" (bottom) model runs. Figures from (Edwards et al. 2012).

YELLOWTAIL ROCKFISH

Factor 1.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for yellowtail rockfish is 56. The species' productivity rating in Cope et al. 2011 is 1.33 (Table 1 in (Cope et al. 2011)). Yellowtail rockfish therefore have "high" inherent vulnerability.

Factor 1.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

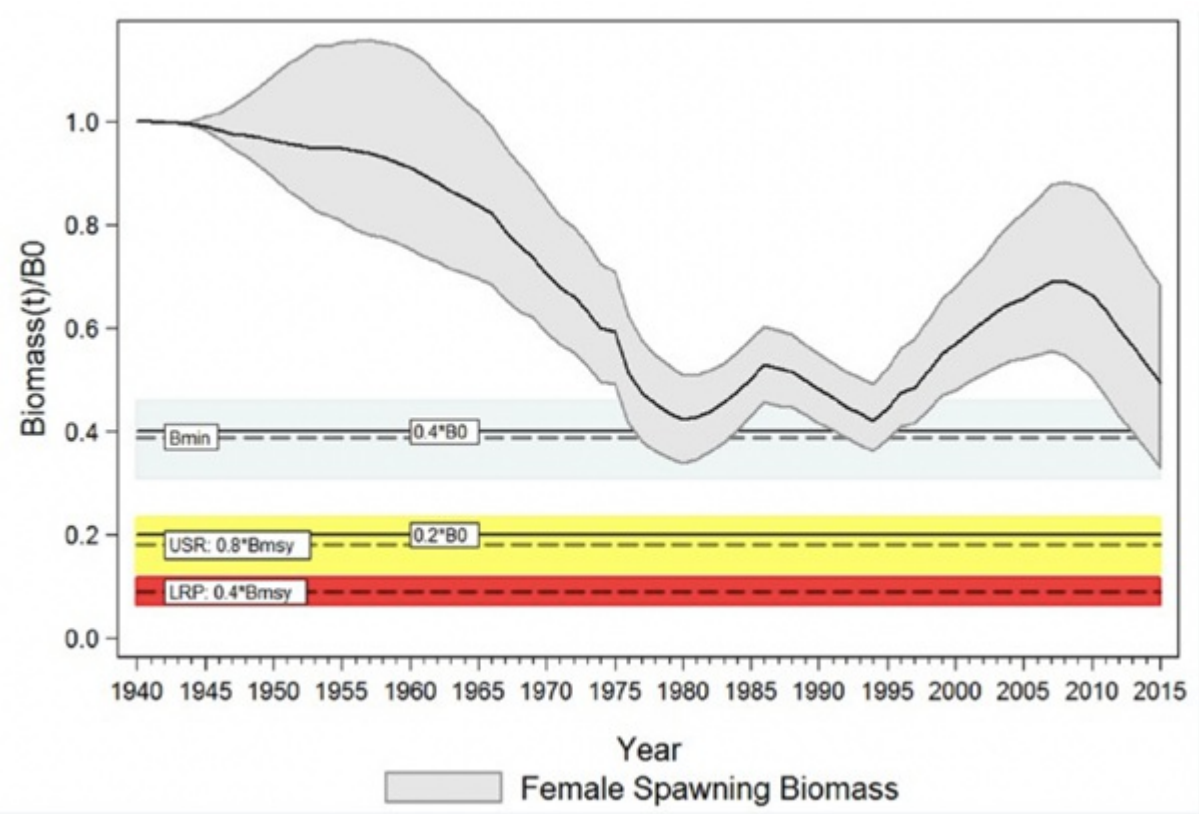
Very Low Concern

For 2015, estimated yellowtail rockfish spawning biomass exceeded estimated SB_{MSY}, and thus exceeded the USR. Yellowtail rockfish stock status is scored "very low" concern.

Justification:

Yellowtail rockfish abundance steadily declined during the 1960s and 1970s, reaching minimum levels in the early 1980s and again in the mid-1990s (Figure 59). Above-average recruitment contributed to an increasing trend in abundance from approximately 1994 through the mid-2000s, but recruitment declined in the early 2000s and abundance steadily declined in the subsequent years (Figure 59) (DFO, 2015a).

In 2015, a new assessment was produced for yellowtail rockfish. The updated assessment yielded a median estimate for SB_{2015} (18,390 t) that was 49.5% (5-95 percentiles = 29.8-75.5%) of SB_0 and approximately 228% of the median estimate for SB_{MSY} (8,293 t) (Table 1 in (DFO, 2015a)). Thus, while yellowtail rockfish abundance has trended downwards in recent years, it remains above the USR (Figure 59). The probabilities that SB_{2015} was above the USR and SB_{MSY} were 0.995 and 0.977, respectively (Table 2 in (DFO, 2015a).



Estimated spawning biomass for yellowtail rockfish. Figure from (DFO 2015a).

Factor 1.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Very Low Concern

The estimated exploitation rate for yellowtail rockfish in 2014 was 40% of the estimated exploitation rate at MSY. If recent catch levels are maintained in the next decade, there is high probability (P=0.773) that SB_{2025} will exceed SB_{MSY}, and very low probability (P = 0.056) that SB2025 will be less than the LRP (Table 2 in (DFO 2015a).

Justification:

For 2014, the median estimate for yellowtail rockfish exploitation rate was 0.098 (5-95 percentiles = 0.054-0.174); this was approximately 40.0% of the median estimate for U_{MSY} (0.245) (Table 1 in (DFO 2015a).

For the period 2009-2013, the mean annual catch of yellowtail rockfish was approximately 4,333 t (DFO 2015a). If this catch level is continued into the next decade, it is highly likely that SB_{2025} will exceed relevant reference points: the probabilities that SB_{2025} will exceed the LRP, USR, and SB_{MSY} after 2015-2024 annual catches of 4,500 t are 0.944, 0.843, and 0.773, respectively (Table 2 in (DFO 2015a).

Criterion 2: Impacts on other species

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing.

To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. 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

Criterion 2 Summary

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

ARROWTOOTH FLOUNDER - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

ARROWTOOTH FLOUNDER - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

BIG SKATE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)

Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

BIG SKATE - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)

Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

CANARY ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

CANARY ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

CHINA ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH

Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

CHINA ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

CHINA ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

COPPER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

COPPER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

COPPER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

DARKBLOTCHED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

DARKBLOTCHED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

DOVER SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

ENGLISH SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)	

Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

GREENSTRIPED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

GREENSTRIPED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - INSIDE ROCKFISH					
Subscore:	**5.00**	**Discard Rate:**	**0.95**	**C2 Rate:**	**4.75**
Species	**Inherent Vulnerability**	**Abundance**		**Fishing Mortality**	**Subscore**
No other main species caught					

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**		**Fishing Mortality**	**Subscore**
Rougheye rockfish	1.00:High	2.00:High Concern		2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern		2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern		2.33:Moderate Concern	Red (2.16)

Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LINGCOD - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LONGNOSE SKATE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)	
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)	
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)	

Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

LONGNOSE SKATE - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (SHALLOW-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)	

LONGNOSE SKATE - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

LONGSPINE THORNYHEAD - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

PACIFIC COD - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)

Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

PACIFIC OCEAN PERCH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

PACIFIC OCEAN PERCH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

PETRALE SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

QUILLBACK ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

QUILLBACK ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

QUILLBACK ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

QUILLBACK ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

QUILLBACK ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH

Subscore:	2.16	Discard Rate:	0.95	C2 Rate:	2.05

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (DEEP-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH

Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDBANDED ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDSTRIPE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**		**Subscore**
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern		Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern		Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern		Yellow (2.64)

Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REDSTRIPE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

REX SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)

Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)

Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)

Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (DEEP-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)	

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

ROUGHEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SABLEFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Shortspine thornyhead	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)

SABLEFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (DEEP-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)

SABLEFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)

Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (DEEP-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTRAKER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SHORTSPINE THORNYHEAD - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - SOFT SUBSTRATE					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Giant rattail	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Pacific grenadier	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Dover sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Flathead sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Rex sole	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Longspine thornyhead	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Petrale sole	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Pacific cod	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	Yellow (3.16)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
English sole	2.00:Medium	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

SILVERGRAY ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	

Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SILVERGRAY ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SOUTHERN ROCK SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SOUTHERN ROCK SOLE - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	

Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

SPINY DOGFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (SHALLOW-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	

TIGER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - INSIDE ROCKFISH					
Subscore:	**2.71**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.57**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)	
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)	

TIGER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

TIGER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

TIGER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - INSIDE ROCKFISH					
Subscore:	**2.71**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.57**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)	
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)	

TIGER ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

WIDOW ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

WIDOW ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)	
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)	

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (DEEP-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - LONGLINE (SHALLOW-SET) - CANADA					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)

Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWEYE ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWMOUTH ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)

Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWMOUTH ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA

Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Yellowtail rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - BOTTOM TRAWLS - CANADA - HARD SUBSTRATE					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)	
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)	

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - JIG - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - MIDWATER TRAWLS - CANADA					
Subscore:	**1.41**	**Discard Rate:**	**0.95**	**C2 Rate:**	**1.34**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Bocaccio	1.00:High	2.00:High Concern	1.00:High Concern	Red (1.41)	
Darkblotched rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Green sturgeon	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Redstripe rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	
Widow rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)	

Greenstriped rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sharpchin rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Splitnose rockfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Spotted ratfish	1.00:High	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.64)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific Ocean perch	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Steller sea lion	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Canary rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Yellowmouth rockfish	1.00:High	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)
Arrowtooth flounder	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Silvergray rockfish	1.00:High	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)
Southern Rock sole	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.00)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - SET LONGLINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)

Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Longnose skate	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
School shark	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Pacific halibut	1.00:High	4.00:Low Concern	2.33:Moderate Concern	Yellow (3.05)
Big skate	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Sablefish	1.00:High	4.00:Low Concern	3.67:Low Concern	Green (3.83)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - INSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Yelloweye rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)

Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

YELLOWTAIL ROCKFISH - BRITISH COLUMBIA/NORTHEAST PACIFIC - TROLLING LINES - CANADA - OUTSIDE ROCKFISH					
Subscore:	**2.16**	**Discard Rate:**	**0.95**	**C2 Rate:**	**2.05**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
China rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Copper rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Redbanded rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Rougheye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Shortraker rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Tiger rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Yelloweye rockfish	1.00:High	2.00:High Concern	2.33:Moderate Concern	Red (2.16)
Quillback rockfish	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Sixgill shark	1.00:High	2.00:High Concern	3.67:Low Concern	Yellow (2.71)
Spiny dogfish	1.00:High	3.00:Moderate Concern	3.67:Low Concern	Green (3.32)
Lingcod	2.00:Medium	4.00:Low Concern	5.00:Very Low Concern	Green (4.47)

Due to the multi-species nature of the integrated groundfish fishery, there are actually few fish species that exclusively qualify as 'bycatch' in the traditional sense. Bocaccio are avoided due to their extremely low stock status and the resulting highly restrictive limits placed on their capture. Grenadier and ratfish are caught during normal fishing operations, but are of no market value. As was the case for Criterion 1, information availability – especially in the form of up-to-date stock assessments – is the primary determinant of many of the Criterion 2 rankings.

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Inherent Vulnerability
(same as Factor 1.1 above)

Factor 2.2 - Abundance
(same as Factor 1.2 above)

Factor 2.3 - Fishing Mortality
(same as Factor 1.3 above)

BOCACCIO

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for bocaccio is 63, and the species' productivity rating in Cope et al. 2011 is 1.28 (Table 1 in (Cope et al. 2011)). Bocaccio inherent vulnerability is therefore scored "high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

In the most recent assessment of the bocaccio stock, the median estimate of B_{2012} was 7.0% (90% confidence intervals = 2.9-18.2%) of B_{MSY}, and 3.5% (90% C.I. = 1.4-9.1%) of B_0 (DFO 2012b). That assessment also found that the probability of B_{2012} being less than the LRP is 99% (DFO 2012b); the stock is thus within DFO's "critical zone" (Figure 18 in (Stanley, R.D., et al., 2012)). Furthermore, the 2012 assessment indicated a probability of >90% that the stock's abundance had declined over the previous decade, despite low catches (DFO 2012b). COSEWIC recently moved bocaccio from its original risk category of "Threatened" to "Endangered"; this change was done as a result of a review of updated information that indicated a 28% decline in abundance since the initial assessment (COSEWIC 2014a). Finally, bocaccio is listed as "critically endangered" by the IUCN (Appendix B; (IUCN 2012)). For these reasons, bocaccio stock status is scored "high" concern.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

In British Columbia, bocaccio are primarily caught by the trawl fishery (Figure 4 in (DFO 2012a)).

In the recent assessment, the median estimate of F_{2012}/F_{MSY} was 1.90 (10^{th} and 90^{th} percentiles = 1.03 and

3.58, respectively) (Table 1 in (DFO 2012a)). The ratio of catch to the replacement yield (the yield required to maintain the biomass) was estimated at 0.990 (10th and 90th percentiles = 0.570 and 1.811) (Table 1 in (DFO 2012a)). Beginning in 2013, a trawl fleet-wide cap on bocaccio and individual vessel license allocations for the species were implemented; these measures are in addition to a decade-old voluntary program in which proceeds of bocaccio landings were donated for groundfish research (DFO 2013a). Bocaccio fishing mortality is scored "high" concern for the trawl fishery.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SCHOOL SHARK

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for tope (aka soupfin) shark is 74, and the species' productivity score in (Cope, J.M., et al., 2011) is 1.11. The species' inherent vulnerability is scored "high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High Concern

There is no estimate of the current abundance of tope in British Columbia's waters (DFO 2012c). The species was assessed as "Special Concern" by COSEWIC and is listed as "Special Concern" under SARA, and is listed as "Vulnerable" by the IUCN (Appendix E). In accordance with the Seafood Watch criteria, the stock status of tope is scored "high" concern, due to its COSEWIC, SARA, and IUCN statuses.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

Catches of tope shark in the 2012 halibut and spiny dogfish fisheries were abnormally high relative to catches in previous years. Catches in the trawl fishery slightly exceeded recent averages. Together, the catch in these three fisheries exceeded a level that is considered to be “unlikely” to cause significant impacts to the stock. Fishing mortality is scored "moderate" concern.

Justification:

In the SARA management plan for tope shark, bycatch mortality in fishing activities is identified as the primary threat (DFO 2012c). In this plan, it is reported that the average annual bycatch of tope shark in the groundfish trawl fishery was 0.48 t/year during the period 2001 and 2009 (DFO 2012c). The amount of tope shark caught as bycatch in the 2012 trawl fishery (0.546 t; Appendix E) exceeded this average, and exceeded tope shark bycatch in this fishery for but one year during the period 1997-2009 (Table 3 in (DFO 2012c)).
In addition to the catch of tope sharks in the trawl fishery, a total of 217 instances of tope sharks being caught and released in the hook and line fisheries were reported for 2012 (Appendix E). These catches occurred in the fisheries for halibut (105 releases), halibut/sablefish trips (58 releases), and spiny dogfish (53 releases); the outside rockfish fishery also had one release (DFO Pacific Region 2013). The total number of tope sharks caught in the 2012 hook and line fisheries substantially exceeds the 2001-2009 average (18 instances/year; Table 5 in (DFO 2012c)), and in fact exceeds the total estimated number caught by hook and line fisheries from 2001 through 2009 (Table 5 in (DFO 2012c)). The catch of tope sharks in the 2012 hook and line fisheries is also significantly greater than the catches in any year from 2009-2011 (none of which exceeded 25 releases/year; (DFO Pacific Region 2013)).

The management plan for tope sharks states that approximately 85 sharks are caught in total in the trawl and hook and line fisheries on an annual basis, and that catches at that level are “unlikely” to result in significant impacts on the tope shark population (DFO 2012c). The total 2012 catch of tope shark in the trawl and hook and line fisheries was nearly 3 times greater than this level, however.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is

no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

GREEN STURGEON

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for green sturgeon is 80. Green sturgeon inherent vulnerability is therefore scored “high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High Concern

Green sturgeon have been assessed as "Special Concern" by COSEWIC, are listed as "Special Concern" under SARA, and are listed as "Near Threatened" by the IUCN (Appendix E). Stock status for green sturgeon is therefore scored “high" concern.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In 2012, approximately 0.50 t of green sturgeon were noted as bycatch in the trawl fishery (Appendix E). While there is no estimate of sustainable mortality for this species in Canadian waters, the 2012 bycatch amount is less than 1/3 of the average annual bycatch in the trawl fishery during the period 1996-2002 (Table 3 in (COSEWIC 2004)). Fishing mortality associated with green sturgeon bycatch in the trawl fishery is scored “moderate" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line

groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

LINGCOD

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Medium

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

Factor 2.2 - Abundance

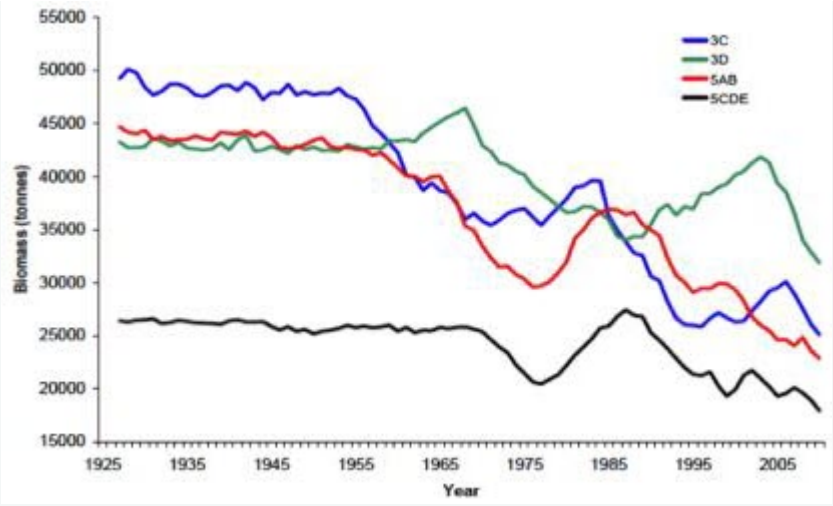
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Low Concern

For lingcod in "outside" waters (Areas 3C, 3D, 5A/B, and 5C/D/E), biomass has generally declined over the course of several decades and has recently been assessed at the lowest values since the late 1920s. Despite the long decline of lingcod biomass in outside waters, each area's estimated B_{2010} exceeded the USRP. However, there was substantial uncertainty regarding this result for Areas 3C and 5AB. The stock status of lingcod in outside waters is therefore scored "low" concern.

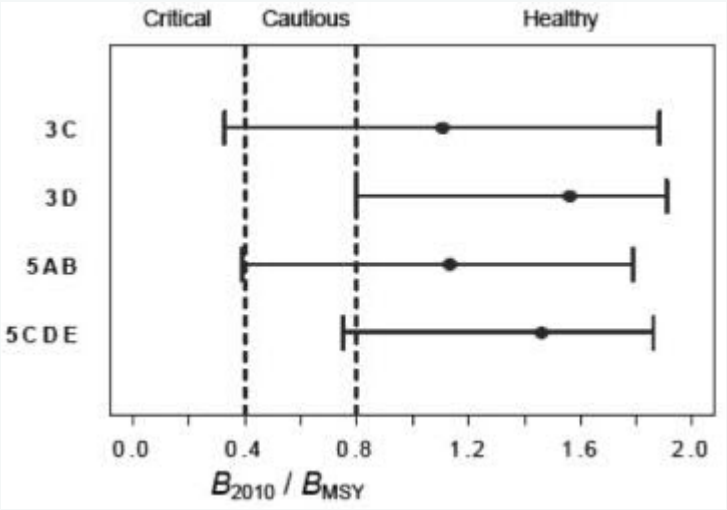
Justification:

The four discrete lingcod stocks in 'outside' waters (Areas 3C, 3D, 5A/B, and 5C/D/E) were assessed in 2011 (DFO 2011c)(CSAS 2011). For all of these stocks, estimated B_{2010} was lower than in any year since 1927 (Figure 18).



Estimates of median biomass for outside lingcod. Figure from (DFO 2011b).

Despite the long-term declining trend noted for each stock's estimated lingcod biomass, each stock's estimated B_{2010} was above the USRP ($0.8*B_{MSY}$) and thus qualified as being within DFO's 'healthy zone' (Table 1 in (DFO 2011c); Figure 19). Due to greater uncertainty in the stock status for Areas 3C and 5A/B, the 90% probability intervals extend through the cautious zone into the critical zone (e.g., $B_{2010}<0.4*B_{MSY}$) for these two areas (Figure 20). The probabilities that B_{2010} exceeded the USRP were 0.67, 0.95, 0.67, and 0.88 for Areas 3C, 3D, 5A/B, and 5C/D/E, respectively (Table 1 in (DFO 2011c)). The probabilities that B_{2010} exceeded the LRP were 0.90, >0.99, 0.95, and >0.99 for these same areas, respectively (Table 1 in (DFO 2011c)).



Estimates of B2010 vs. reference points for outside lingcod. Dots are the posterior median of the ratio B2010:BMSY, and error bars are the 90% probability intervals of this ratio. Figure from (DFO 2011b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Very Low Concern

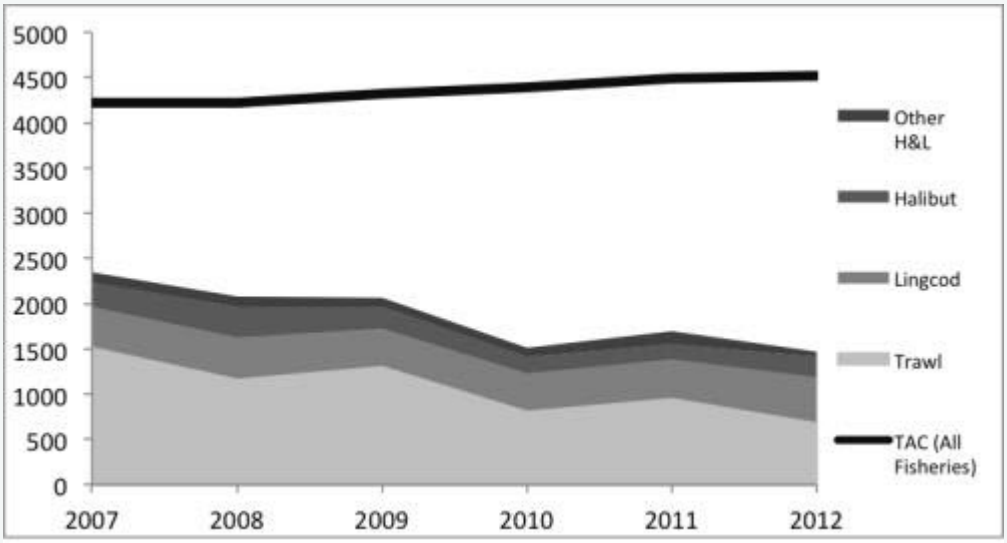
The trawl fishery is allocated 74.0% of the lingcod TAC for 2013, and the hook and line fisheries are allocated the remaining 26% (DFO 2013a). Total lingcod catch in 2012 was approximately 33.8% of total available TAC. The trawl, lingcod, and halibut fisheries accounted for 44.8%, 32.7%, and 14.6% of the 2012 lingcod catch, respectively.

In a recent assessment, median estimates of F_{2010} were less than F_{MSY} for all areas, but these estimates were characterized by substantial uncertainty for Areas 3C, 5A/B, and 5C/D/E. Modeled probabilities indicate that constant application of area-specific TACs similar to the 2012 catches would have probabilities of 69% to 93% of resulting in area-specific B_{2016}>USRP, depending on the area; these probabilities are not substantially lower than those associated with zero harvest scenarios. For these reasons, fishing mortality of lingcod is scored "very low" concern for the trawl, lingcod, halibut, and inside and outside rockfish fisheries. However, this score should be revisited if annual catches begin to increase toward the TAC.

Justification:

Total lingcod catch in 2012 was approximately 1,528 t across all fisheries, while the total TAC was 4,517 t (Appendix A). The trawl, lingcod, and halibut fisheries caught 685, 499, and 223 t, respectively (Appendix A).

Historically, the trawl fishery has been responsible for most of the coastwide catch of lingcod in outside waters, but the catch in hook and line fisheries has increased since the late 1980s (Figure 2 in (DFO 2011c)). During the period 2007-2012, the trawl fishery's catch of lingcod declined by 55%, while catch in the lingcod and halibut hook and line fisheries remained relatively steady; the total catch of lingcod stayed well below the total TAC during this period (Figure 20). No area-specific TACs were exceeded for the trawl fishery during the period 2000-2012, or for hook and line fisheries during the period 2007-2012 (DFO 2013c)(DFO 2013d).



Lingcod catches by fishery and total TAC, 2007-2012. Data from (DFO 2013b)(DFO 2013d).

The recent stock assessment generated estimates of F_{2010}:F_{MSY}. Median estimates were 0.39 (5-95% = 0.059-2.165) for Area 3C, 0.11 (0.03-0.85) for Area 3D, 0.51 (0.08-2.18) for Area 5A/B, and 0.31 (0.08-1.42) for Area 5C/D/E (Tables 2-5 in (DFO 2011c)).

Lingcod are managed with area-specific TACs for Areas 3C, 3D, 5A/B, 4B (Area 12 only), and 5C/D/E (DFO 2013a). The recent stock assessment projects a variety of area-specific TACs into the future and presents probabilities of B_{2016} exceeding various stock status indicators when each modeled TAC is held constant (Table 2 in (DFO 2011c)). The probabilities that area-specific TACs held constant at 500 t (which is slightly greater than any of the area-specific catches in 2012) will result in B_{2016}>USRP are 0.69, 0.93, 0.69, and 0.84 for the stocks in Areas 3C, 3D, 5A/B, and 5C/D/E, respectively; these probability values are approximately 2.1-10.4% lower than the probability values associated with zero harvest for the same areas (Table 2 in (DFO 2011c)). The probabilities that these same area-specific TACs will result in B_{2016}<LRP are 0.11, 0.01, 0.07, and 0.03 for these same stocks (Table 2 in (DFO 2011c)).

In addition to the catches in the trawl, halibut, and lingcod fisheries, the catch of lingcod in the 2012 inside and outside rockfish fisheries was sufficient to compose >5% of those fisheries' total catch (DFO Pacific Region 2013). This qualifies this species as a "main" species for the inside and outside rockfish fisheries.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

GIANT RATTAIL

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High

The Fishbase vulnerability sores for giant and Pacific grenadiers/rattails are 70 and 79, respectively. Pacific grenadier's productivity rating in Cope et al. 2011 is 1.44 (Table 1 in (Cope et al. 2011)). Inherent vulnerability scores for these two species are therefore scored "high".

Factor 2.2 - Abundance

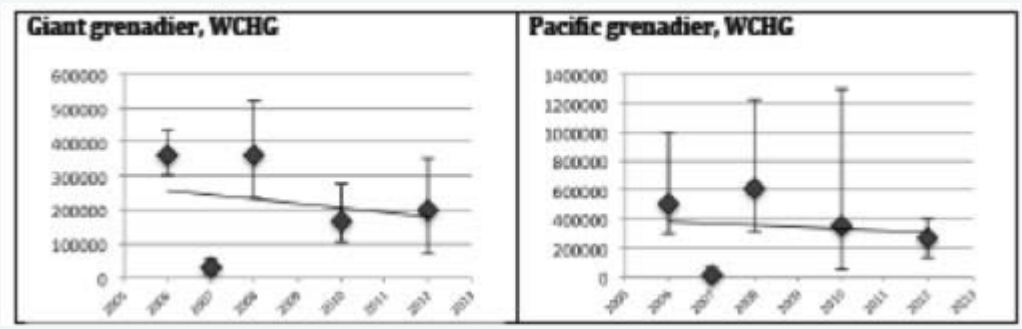
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High Concern

There is little information for the stock status of giant or Pacific grenadiers in British Columbia's waters. WCHG trawl survey biomass indices show roughly similar trends for the two species, but high relative error and a sampling issue in 2007 reduce confidence in interpretation of the apparent trend. Due to the lack of information and the high inherent vulnerability of the two species, giant and Pacific grenadiers are considered "high" concern for this assessment.

Justification:

There is little information for the status of grenadier stocks in British Columbia. Giant and Pacific grenadiers are commonly caught in the WCHG trawl survey (Figure 61); relative errors for these two species' WCHG survey biomass estimates range from very low (0.09) to very high (0.8), with relative errors for giant grenadier generally being lower that those for Pacific grenadier (DFO 2013b). Giant grenadiers are also caught in the WCVI and QCS surveys, but the relative errors associated with biomass estimates from those two surveys are high (DFO 2013b). As the 2007 survey did not sample the deepest depth stratum (800-1,300 m), the 2007 index likely under-represents those species that live at greater depths, such as grenadier species (N. Olsen, pers. comm.).



Trawl survey biomass indices for two grenadier species. Data from (DFO 2013b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

In 2012, the trawl fishery caught 24.90 t of giant grenadier, 17.47 t of grenadiers, and 15.62 t of Pacific grenadier; the sablefish fishery caught approximately 1.5 t of giant and Pacific grenadier combined, and no grenadier catch was recorded for the other fisheries (DFO Pacific Region 2013). There are no TACs for grenadier species, and no estimates of sustainable catch for the various grenadier species in Canada's Pacific waters. Fishing mortality of grenadier species is thus scored a "moderate" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

PACIFIC GRENADIER

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High

The Fishbase vulnerability sores for giant and Pacific grenadiers/rattails are 70 and 79, respectively. Pacific grenadier's productivity rating in Cope et al. 2011 is 1.44 (Table 1 in (Cope et al. 2011)). Inherent vulnerability scores for these two species are therefore scored "high".

Factor 2.2 - Abundance

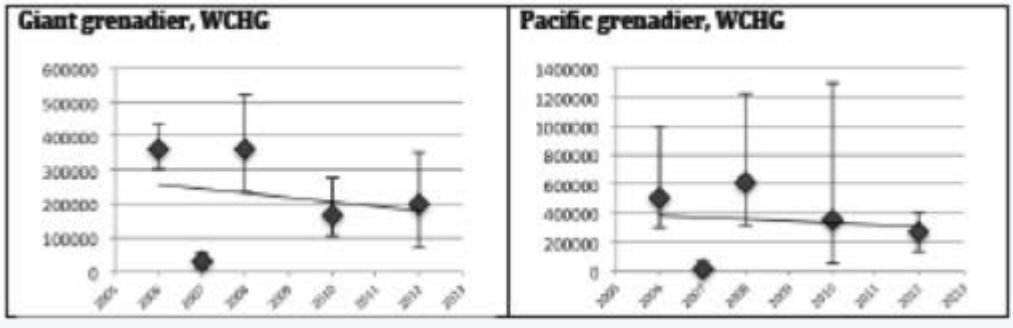
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

High Concern

There is little information for the stock status of giant or Pacific grenadiers in British Columbia's waters. WCHG trawl survey biomass indices show roughly similar trends for the two species, but high relative error and a sampling issue in 2007 reduce confidence in interpretation of the apparent trend. Due to the lack of information and the high inherent vulnerability of the two species, giant and Pacific grenadiers are considered "high" concern for this assessment.

Justification:

There is little information for the status of grenadier stocks in British Columbia. Giant and Pacific grenadiers are commonly caught in the WCHG trawl survey (Figure 61); relative errors for these two species' WCHG survey biomass estimates range from very low (0.09) to very high (0.8), with relative errors for giant grenadier generally being lower that those for Pacific grenadier (DFO 2013b). Giant grenadiers are also caught in the WCVI and QCS surveys, but the relative errors associated with biomass estimates from those two surveys are high (DFO 2013b). As the 2007 survey did not sample the deepest depth stratum (800-1,300 m), the 2007 index likely under-represents those species that live at greater depths, such as grenadier species (N. Olsen, pers. comm.).



Trawl survey biomass indices for two grenadier species. Data from (DFO 2013b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

In 2012, the trawl fishery caught 24.90 t of giant grenadier, 17.47 t of grenadiers, and 15.62 t of Pacific grenadier; the sablefish fishery caught approximately 1.5 t of giant and Pacific grenadier combined, and no grenadier catch was recorded for the other fisheries (DFO Pacific Region 2013). There are no TACs for grenadier species, and no estimates of sustainable catch for the various grenadier species in Canada's Pacific waters. Fishing mortality of grenadier species is thus scored a "moderate" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SPINY DOGFISH

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for *S. acanthias* is 69. The species' productivity rating in Cope et al. 2011 is 1.11 (Table 1 in (Cope et al. 2011)). Spiny dogfish inherent vulnerability is therefore scored "high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

North Pacific dogfish have been assessed by multiple bodies. The IUCN assessed the stock in 2006 and have since listed it as 'vulnerable.' This finding is disregarded here as more recent assessments are available. The most recent stock assessment was in 2010, and concluded 'that there is no immediate conservation concern for either the inside or outside stocks of Pacific spiny dogfish and that, given the perceptions of the current stock status, it is unlikely that deleterious or irreversible declines in stock abundance are likely to occur over the five year time frame established for the next assessment at the current (2000-2009) level of removals" (CSAS 2010). More recently, COSEWIC found the stocks to be 'relatively abundant in BC waters' and that the population did not meet any of the criteria for listing, but that concerns exist because of the biology of the species and the level of uncertainty and so deemed the population a "Special Concern" (COSEWIC 2011). The stock status of spiny dogfish is scored 'moderate' concern due to the uncertainties regarding stock status and the species' COSEWIC status.

Justification:

North Pacific dogfish have been assessed by multiple bodies. The IUCN assessed the stock in 2006 and have since listed it as 'vulnerable.' In 2010, the Canadian stock assessment did not yield reliable estimates of the stock's status, but the assessment's authors concluded that "there is no immediate conservation concern for either the inside or outside stocks of Pacific spiny dogfish and that, given the perceptions of the current stock status, it is unlikely that deleterious or irreversible declines in stock abundance are likely to occur over the five-year time frame established for the next assessment at the current (2000-2009) level of removals" (CSAS 2010). In 2011/2012, the COSEWIC assessment found that the population did not meet any of the criteria for listing, but concerns exist because of the biology of the species and the level of uncertainty. For these reasons, COSEWIC listed the stock as "Special Concern." (Appendix D) (COSEWIC 2011). Spiny dogfish were recently assessed by COSEWIC to be a "Special Concern," and spiny dogfish in the Northeast Pacific are classified as "Vulnerable" by the IUCN (Appendix D). One potential issue noted in the 2010 stock assessment is a potential shift in size distributions of males and females in the inside stock. For this stock, the modal length interval for males caught in longline research surveys declined between the 1980s and the early 2000s (CSAS 2010). For inside females, a shift in size distribution over the same period was apparent in a reduction in the number of large (>100 cm) females, and an increase in smaller individuals (CSAS 2010). The decline in mean size may have been due, in part, to a movement of juvenile dogfish to the seafloor (CSAS 2010).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

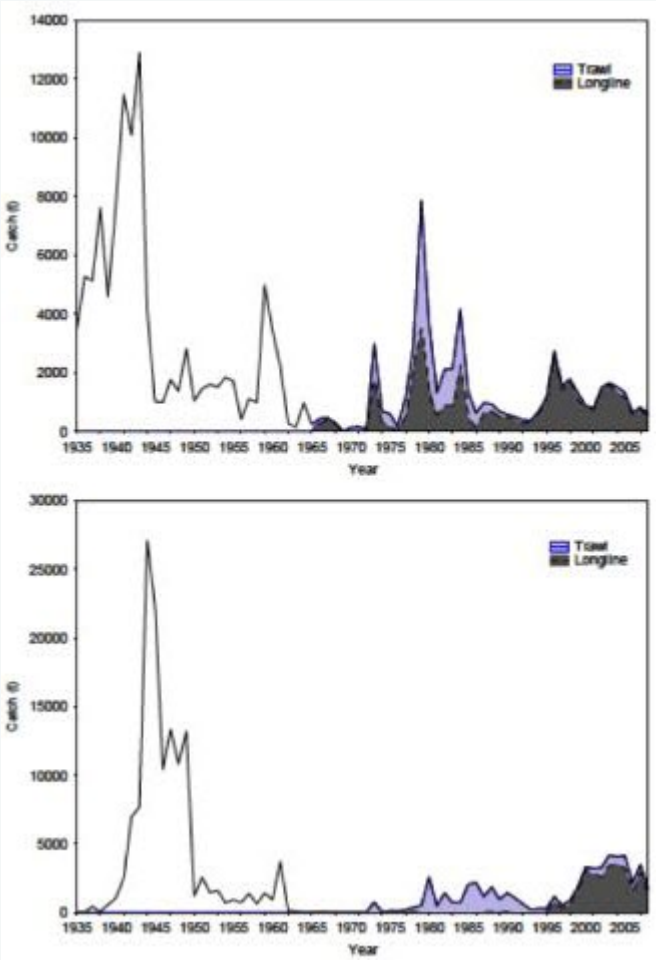
Low Concern

The 2012 catches of inside and outside dogfish were approximately 9.8% and 5.7% of the total available TAC, respectively. The dogfish hook and line fishery was responsible for 83.5% and 48.7% of the catch of inside and outside dogfish, respectively, while the trawl fishery (16.1% and 11.4% of the inside and outside catches, respectively), halibut fishery (29.8% of outside dogfish catch), and outside rockfish fishery (6.9% of outside dogfish catch) also accounted for substantial catches. Recent catches of both inside and outside dogfish have been low, relative to recent levels, and the recent stock assessment considered it "unlikely" that deleterious or irreversible declines in abundance were to occur over the period 2010-2015 (CSAS 2010). However, there are no model-derived estimates of sustainable yield, and total fishing mortality has likely been

underestimated (CSAS 2010). Fishing mortality of spiny dogfish is therefore scored "low" concern for the aforementioned fisheries.

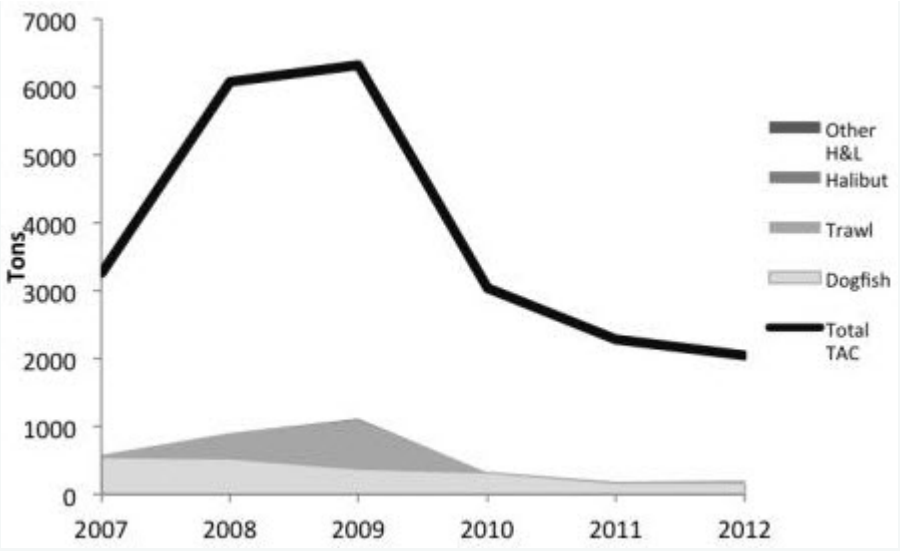
Justification:

A period of very high exploitation occurred from the late 1930s through the 1940s (Figure 49), as B.C. dogfish were targeted due to the use of their livers in the procurement of Vitamin A. After the 'liver' fishery ended, dogfish became the target of a food fishery in the late 1970s (Galluci et al. 2011).

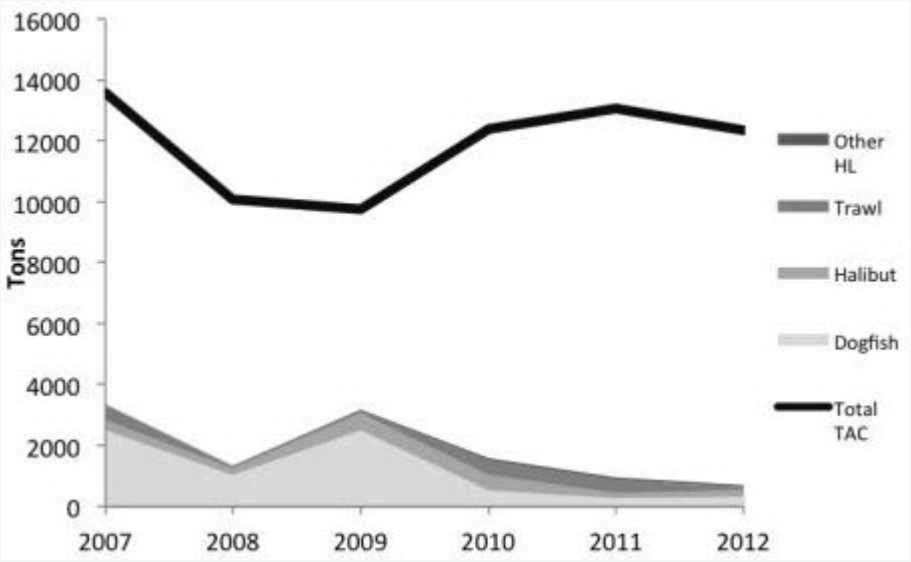


Estimated historical fishing mortality of inside (top) and outside (bottom) stocks of spiny dogfish. Figure from (Galluci et al. 2011).

In 2012, the total catches of inside and outside dogfish were approximately 200 and 699 t, respectively, while the total available TACs for inside and outside dogfish were 2,044 and 12,358 t, respectively (Appendix C). Catches of both dogfish stocks have declined since 2009 (Figures 50 and 51). In 2012, the directed dogfish hook and line fishery was responsible for 83.5% and 48.7% of the catch of inside and outside dogfish, respectively (Appendix C). The trawl fishery caught 16.1% and 11.4% of the inside and outside catches, respectively, and the halibut and outside rockfish fisheries accounted for 29.8% and 6.9% of outside dogfish catch, respectively (Appendix C).



Inside (Area 4B) dogfish TACs (black line) and catches by fishery (shaded areas), 2007-2012. Data from (DFO 2013b)(DFO 2013d).



Outside (Area 3C, 3D, 5A/B, 5C/D/E) dogfish TACs (black line) and catches by fishery (shaded areas), 2007-2012. Data from (DFO 2013b)(DFO 2013d).

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece

counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

Criterion 3: Management Effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. 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 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*

Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Criterion 3 Summary

Region / Method	Harvest Strategy	Bycatch Strategy	Score
British Columbia / Northeast Pacific / Bottom trawls / Canada / hard substrate	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Bottom trawls / Canada / soft substrate	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Midwater trawls / Canada	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Set longlines / Canada / Inside Rockfish	3.00	0.00	Yellow (3.00)
British Columbia / Northeast Pacific / Set longlines / Canada / Outside Rockfish	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Jig / Canada / Inside Rockfish	3.00	0.00	Yellow (3.00)
British Columbia / Northeast Pacific / Jig / Canada / Outside Rockfish	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Longline (shallow-set) / Canada	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Longline (deep-set) / Canada	3.00	3.00	Yellow (3.00)
British Columbia / Northeast Pacific / Trolling lines / Canada / Inside Rockfish	3.00	0.00	Yellow (3.00)
British Columbia / Northeast Pacific / Trolling lines / Canada / Outside Rockfish	3.00	3.00	Yellow (3.00)

The Seafood Watch criteria define effective management via a number of guidelines. To be scored "highly

effective" for any of the guidelines, a fishery must achieve all of that guideline's requirements. Due to the multi-species nature of these fisheries, achieving all of the requirements for the 'management strategy and implementation' guidelines is challenging. Certain aspects of these fisheries' management regime are very strong. This is especially true for the at-sea and dockside monitoring requirements that are in place. However, challenges noted in "management strategy and implementation" and "recovery of stocks of concern" preclude a higher score for Criterion 3.

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Harvest Strategy

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.*

Factor 3.1 Summary

FACTOR 3.1 - MANAGEMENT OF FISHING IMPACTS ON RETAINED SPECIES							
Region / Method	**Strategy**	**Recovery**	**Research**	**Advice**	**Enforce**	**Track**	**Inclusion**
British Columbia / Northeast Pacific / Bottom trawls / Canada / hard substrate	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Bottom trawls / Canada / soft substrate	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Midwater trawls / Canada	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Set longlines / Canada / Inside Rockfish	Highly Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective

British Columbia / Northeast Pacific / Set longlines / Canada / Outside Rockfish	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Jig / Canada / Inside Rockfish	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Jig / Canada / Outside Rockfish	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Longline (shallow-set) / Canada	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Longline (deep-set) / Canada	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Trolling lines / Canada / Inside Rockfish	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Trolling lines / Canada / Outside Rockfish	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective

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.

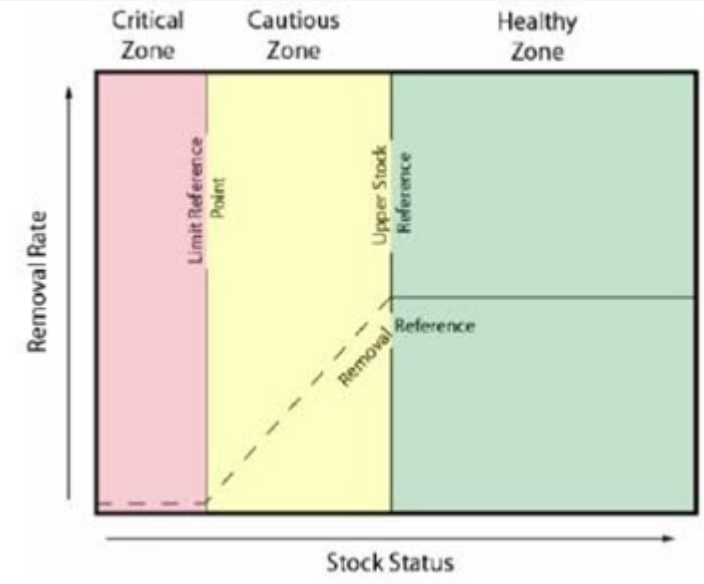
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

Three important factors that inform the score for "management strategy and implementation" are 1) the application of appropriate biomass reference points, 2) an associated harvest control rule, and 3) the degree to which uncertainty and risk are addressed in management decisions. While a framework for the integration of reference points and an harvest control rule exists, it has not been widely applied and many stocks are managed without reference points or a harvest control rule. The overall score for management strategy and implementation is "moderately effective"; the rationale is below.

Justification:

Reference Points
In "A Fishery Decision-making Framework Incorporating the Precautionary Approach" (hereafter referred to as "the Framework"), DFO outlines an approach to the management of harvest rates based on stock status relative to reference points (DFO 2009a). The approach uses two reference points, an Upper Stock Reference Point (USRP) and a Limit Reference Point (LRP), to define stock status into one of three zones: Healthy (B>USRP), Cautious (LRP<B<USRP), and Critical (B<LRP) (Figure 65). The maximum allowable removal rate is set at $\leq F_{MSY}$ while the stock is in the Healthy Zone, is reduced when the stock enters the Cautious Zone, continues to be reduced as the stock approaches the LRP, and becomes zero if the stock falls into the Critical Zone (Figure 65). Importantly, the USRP may not necessarily be a target reference point (DFO 2009a): the target may be set higher than the USRP, but it is the USRP that represents the stock status below which the removal rates is reduced.



DFO precautionary harvest strategy, showing reference points and removal reference. Figure from (DFO 2006).

The Framework specifies that ($0.8*B_{MSY}$) and ($0.4*B_{MSY}$) may be used as proxies for the USRP and LRP, respectively (Annex 1b in (DFO 2009c)). The Seafood Watch criteria suggest that target and limit reference points should generally not be lower than B_{MSY} and ($0.5*B_{MSY}$), respectively, and require strong scientific justification when lower reference points are used. In the section of the Framework that specifies the USRP and LRP proxy reference points, no reference is made to specific scientific research to support their selection (Annex 1b in (DFO 2009a)). One issue of concern, therefore, is the appropriateness of the proxy reference points for B.C. groundfish species, especially for those that are long-lived (e.g., rockfish). (For comparison, rockfish in the U.S. west coast fishery are managed with target and limit reference points of 40% and 25% of equilibrium unfished spawning biomass, respectively (PFMC 2011).

Risk aversion and buffering against uncertainty
One avenue through which uncertainty and/or risk are presented is through the use of decision tables, which are included in newer stock assessments. In a decision table, a range of potential outcomes, and the probability associated with each outcome, are given for each potential harvest strategy. This allows managers to weigh the risks and benefits of different strategies throughout time. The degree to which specific harvest decisions are informed by risk aversion and buffering against uncertainty is not made public, however.

Harvest control rule
See "Reference Points" above. An example of the harvest control rule in action is the reduced 2013 sablefish TAC, which resulted from a reduced biomass estimate (which itself was the result of a continued decline noted in sablefish survey CPUE) (DFO 2009a). Many stocks, however, are managed without reference points and the associated harvest control rule.

BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH

Highly Effective

Three important factors that inform the score for "management strategy and implementation" are the application of appropriate biomass reference points and an associated harvest control rule, and the degree to which uncertainty and risk are addressed in management decisions. Biomass reference points exist for lingcod, and these reference points inform projections for harvest decision tables (e.g., Table 2 in (DFO 2011c)). As there are no other main species caught in the lingcod fishery, the measures applied to the lingcod stock warrant a score of "highly effective" for the directed lingcod fishery.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

To date, DFO has lacked a consistent and proactive approach for the identification of stocks of concern in the groundfish fishery. Formal identification of stocks of concern has often fallen outside of DFO to COSEWIC, which has identified several groundfish stocks of concern (DFO 2013a). Longspine thornyhead, rougheye and blackspotted rockfish, and yelloweye rockfish have also been listed under SARA (DFO 2013a). In the case of longspine thornyhead, approximately one decade lapsed between the first indications of significant declines in CPUE (Figure 22) and the production of the SARA-mandated management plan (DFO 2012d). While catches during this time were relatively low due to declining economic viability of the fishery (Haigh et al. 2005a), the fact remains that there is still has been no formal assessment of the longspine thornyhead stock.

A policy framework that will allow DFO to effectively identify and set about rebuilding stocks of concern is now in place, as DFO's Precautionary Framework both sets out the criteria for identifying a stock in the 'Critical Zone' (see Figure 65 above), and requires that rebuilding plans be developed for stocks that fall in this zone. This approach, if implemented across managed stocks, would represent a significant improvement in the management of stocks of concern. However, this approach is data-intensive, and the relatively uneven provision of stock assessment information for B.C. groundfish species would seem to present a challenge to its implementation across all managed stocks.

The recovery of stocks of concern is scored "moderately effective" for all fisheries.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

The score for "scientific research and monitoring" is "moderately effective", due to the relatively uneven provision of stock assessments for target species.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

It is difficult to ascertain the degree to which scientific advice is followed by managers, as the decision-making processes that guide TAC development are not published and, increasingly, yield advice is being presented in the form of decision tables, with multiple possible choices and probable outcomes. While there is no evidence of scientific advice being routinely overruled, neither is there publicly available evidence of TACs being consistently set equal to or less than the levels recommended by science. Scientific advice is therefore scored "moderately effective".

Subfactor 3.1.5 – Enforcement of Management Regulations

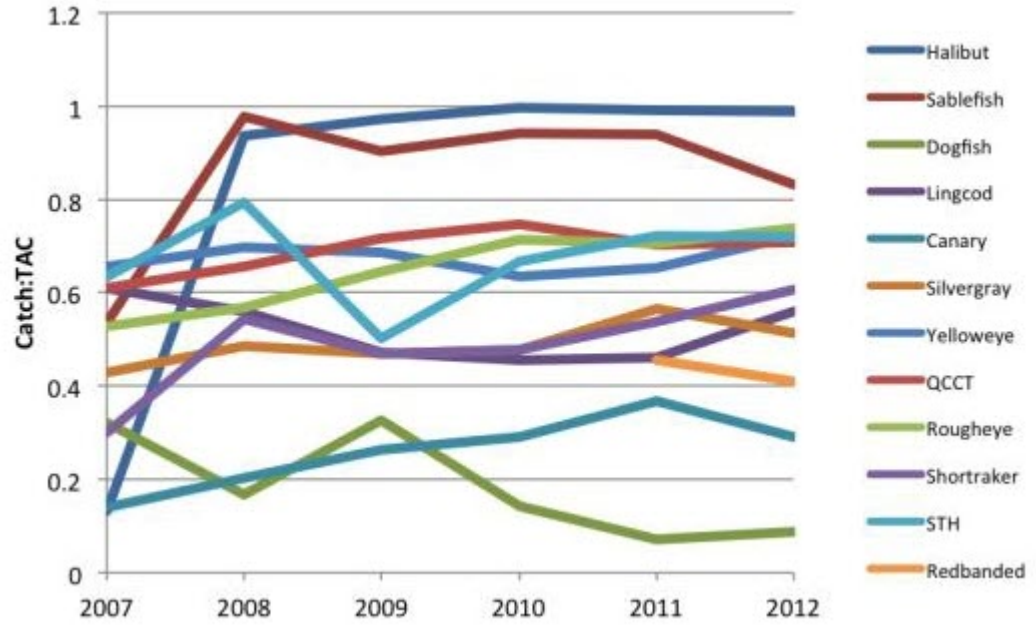
Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Highly Effective

Enforcement is provided by fisheries officers, who take part in vessel patrols and air surveillance of fishing operations. The management system is apparently effective in its ability to limit catches to the TACs that it sets, as shown in Figure 66. Enforcement is scored "highly effective".

Justification:



Comparison of catches to TACs, across all fisheries, for selected species. Data from Appendix C.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

Due to the uneven provision of stock assessments, the track record for this fishery's management regime is not known, and is scored "moderately effective."

Subfactor 3.1.7 – Stakeholder Inclusion

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

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Highly Effective

The management of the fisheries in question is informed by consultations with a number of advisory bodies. The advisory body with the greatest diversity of stakeholders is the Groundfish Integrated Advisory Board (GIAB), which includes representatives from commercial fisheries, processors, unions, various levels of government, First Nations, recreational fisheries, coastal communities, and environmental organizations. Stakeholder inclusion is scored “highly effective”.

Factor 3.2 - Bycatch Strategy

SCORING GUIDELINES

Four subfactors are evaluated: Management Strategy and Implementation, Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations. Each is rated as ‘ineffective,’ ‘moderately effective,’ or ‘highly effective.’ Unless reason exists to rate Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations differently, these rating are the same as in 3.1.

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

FACTOR 3.2 - BYCATCH STRATEGY						
Region / Method	**All Kept**	**Critical**	**Strategy**	**Research**	**Advice**	**Enforce**
British Columbia / Northeast Pacific / Bottom trawls / Canada / hard substrate	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Bottom trawls / Canada / soft substrate	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Midwater trawls / Canada	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Set longlines / Canada / Inside Rockfish	Yes	All Species Retained				
British Columbia / Northeast Pacific / Set longlines / Canada / Outside Rockfish	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Jig / Canada / Inside Rockfish	Yes	All Species Retained				
British Columbia / Northeast Pacific / Jig / Canada / Outside Rockfish	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Longline (shallow-set) / Canada	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Longline (deep-set) / Canada	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective
British Columbia / Northeast Pacific / Trolling lines / Canada / Inside Rockfish	Yes	All Species Retained				
British Columbia / Northeast Pacific / Trolling lines / Canada / Outside Rockfish	No	No	Moderately Effective	Highly Effective	Moderately Effective	Highly Effective

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.).

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

Two important factors behind the scores for "management strategy and implementation" are biomass reference points and an associated harvest control rule. To date, bocaccio is the only non-target "bycatch" species that has biomass reference points and an associated harvest control rule. Management strategy and implementation is scored "moderately effective" for the five fisheries scored under Factor 3.2.

Justification:

Reference points
The dogfish, halibut, outside rockfish, sablefish, and trawl fisheries each caught bycatch species that did not have estimates of biomass relative to reference points.

Harvest control rule
The dogfish, halibut, outside rockfish, sablefish, and trawl fisheries each caught bycatch species that do not have the reference points to allow for application of DFO's harvest strategy (Figure 65) (see "Reference points" above).

Risk aversion and buffering against uncertainty
The rationale is the same as presented for "risk aversion and buffering against uncertainty" for Factor 3.1.

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

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Highly Effective

All fisheries have 100% at-sea and 100% dockside monitoring, with 100% observer coverage for the trawl fleet and a combination of observer and electronic monitoring coverage in the remaining fisheries.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Moderately Effective

The score and rationale are the same as presented for "Scientific Advice" in Factor 3.1.

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.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Highly Effective

The score and rationale are the same as presented for "Enforcement" in Factor 3.1.

Criterion 4: Impacts on the habitat and ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.

The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management 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 cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
British Columbia / Northeast Pacific / Bottom trawls / Canada / hard substrate	1.00: High Concern	1.00: Strong Mitigation	4.00: Low Concern	Yellow (2.83)
British Columbia / Northeast Pacific / Bottom trawls / Canada / soft substrate	2.00: Moderate Concern	1.00: Strong Mitigation	4.00: Low Concern	Green (3.46)
British Columbia / Northeast Pacific / Midwater trawls / Canada	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Set longlines / Canada / Inside Rockfish	4.00: Very Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (4.12)
British Columbia / Northeast Pacific / Set longlines / Canada / Outside Rockfish	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Jig / Canada / Inside Rockfish	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Jig / Canada / Outside Rockfish	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Longline (shallow-set) / Canada	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Longline (deep-set) / Canada	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Trolling lines / Canada / Inside Rockfish	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)
British Columbia / Northeast Pacific / Trolling lines / Canada / Outside Rockfish	3.00: Low Concern	0.25: Minimal Mitigation	4.00: Low Concern	Green (3.61)

The groundfish fishing gears used in the British Columbia fisheries are expected to come into contact with the seafloor during their regular use. As such, the potential for disturbance and destruction of habitat is always present with these gears. The destructive potential of mobile gears is well known, and bottom longlines and pots may also cause damage. Many of the species that the groundfish fisheries pursue are known to associate with hard substrates, which are known to be more susceptible to gear disturbance and damage than soft substrates in high-energy areas. Spatial management measures such as the sponge reef trawl closures have helped to minimize the potential for damage to certain habitats, and recently, in 2012, a new suite of management measures for the trawl fishery was implemented in order to minimize and manage this fishery's bycatch of corals and sponges.

Criterion 4 Assessment

SCORING GUIDELINES

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

- *5 (None) - Fishing gear does not contact the bottom*
- *4 (Very Low) - Vertical line gear*
- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl) Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

Factor 4.2 - Mitigation of Gear Impacts

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

Factor 4.3 - Ecosystem-Based Fisheries Management

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators)*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and*

management is not place to mitigate these impacts

- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

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

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE

High Concern

The trawl fishery targets many species, some of which are known to associate with cobble, rock, boulder, or other hard habitats (Figure 15). Bycatch of corals and sponges has also long been a concern in this fishery (Ardron & Jamieson 2006). The Seafood Watch criteria require a score of "high" concern for a fishery that uses bottom trawl gear 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, via a "bottom trawl - soft substrate" designation, to all flatfish except rock sole and arrowtooth flounder, all skates, Pacific cod, spiny dogfish, thornyheads, and sablefish.

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

The trawl fishery targets many species, some of which are known to associate with cobble, rock, boulder, or other hard habitats (Figure 15). Bycatch of corals and sponges has also long been a concern in this fishery (Ardron & Jamieson 2006). The Seafood Watch criteria require a score of "high" concern for a fishery that uses bottom trawl gear 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, via a "bottom trawl - soft substrate" designation, to all flatfish except rock sole and arrowtooth flounder, all skates, Pacific cod, spiny dogfish, thornyheads, and sablefish.

BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

In recent years, trawl vessels equipped with midwater trawl gear have targeted a suite of rockfish species. The SFW criteria require a score of "low" concern for midwater trawl gear that contacts the bottom <25% of trawling time; while the percentage of time that the midwater gear is in contact with the bottom is not known for this fishery, the gear is not designed for bottom contact and thus it is assumed that such contact is only "occasional" (i.e., <25% of the time). The Factor 4.1 score for midwater trawl-caught rockfish is scored "low" concern.

BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH

Very Low Concern

Lingcod, which are the only major species caught in the directed lingcod fishery, are known to associate with mixed hard/rock substrates (Figure 15). The lingcod fishery is prosecuted with troll/jig gear; the use of bottom longline gear during directed lingcod trips is not permitted (DFO 2013a). In accordance with the Seafood Watch criteria, fishing with vertical lines is considered to have a "very low" impact on substrate.

BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Low Concern

The outside rockfish fishery catches redbanded rockfish, rougheye rockfish, quillback rockfish, and several other rockfish species, along with lingcod and spiny dogfish. Several of these species associate with cobble, rock, and/or boulder habitats (Figure 15). Both longline and jig gear are used this fishery. The Factor 4.1 score for this fishery is scored "low" concern.

BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH

Low Concern

The inside rockfish fishery uses jig and longline gear (DFO 2013a) and primarily catches quillback and lingcod, which are known to associate with rock and boulder substrates (Figure 15). The Factor 4.1 score for the inside rockfish fishery is "low" concern.

BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA

Low Concern

Spiny dogfish are known to associate with mixed soft substrates (Figure 15). However, this fishery, which is prosecuted with bottom longline gear, also catches a substantial amount of yelloweye rockfish. Yelloweye rockfish are known to associate with a variety of hard substrates (Figure 15). The dogfish fishery is therefore given a score of "low" concern for Factor 4.1.

BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA

Low Concern

The sablefish longline/trap fishery primarily catches sablefish, which associate with soft substrates. This fishery also catches redbanded, rougheye, shortraker, and yelloweye rockfish in substantial amounts; several of these species are known to associate with hard habitats (Figure 15). The Factor 4.1 score for the sablefish fishery is "low" concern.

Factor 4.2 - Mitigation of Gear Impacts

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Strong Mitigation

A suite of new management measures meant to manage and reduce the trawl fishery's impacts on coral and

sponge was put into place early in the 2012 fishing year. These measures froze the footprint of the fishery, reduced the area of the trawl footprint by 20% relative to historic levels, put into place fleet-wide and individual limits on coral and sponge catch, and implemented an encounter protocol that would prioritize the collection and dissemination of information regarding large (>20 kg) catches of coral and/or sponge. By the end of the first year of this program, the trawl fleet's total catch of coral and sponge was approximately 57% of the amount set as the maximum management objective. Taken together, these measures, and their apparent effectiveness, warrant a Factor 4.2 score of "strong mitigation".

Justification:

Rockfish Conservation Areas

There are 164 Rockfish Conservation Areas (RCAs) in place in British Columbia waters, the last of which were added in 2007 (DFO 2013a). No commercial or recreational groundfish fishing activities are permitted within RCAs, with the exception of midwater trawling (DFO 2013f).

Living Oceans Society, an environmental organization, analyzed the areal extent of the RCAs. This analysis found that RCAs cover approximately 3.5% of coastwide waters at fishable depths, and 5.6% of waters >200 m (LOS 2013). These coverage rates do not address the issue of habitat representation within the RCAs; it would be expected that rockfish habitat would be better represented within the RCAs than in non-protected areas. However, one GIS analysis found that a subset of RCAs did not consistently overlap with areas that had been identified as high-value habitats by a model and/or fishermen (Ardron & Wallace 2005). Furthermore, it has been suggested that the RCAs' coverage of deeper habitats may not be sufficient to protect the adults of some species, such as yellowmouth rockfish (COSEWIC 2010) or yelloweye rockfish (Ardron & Wallace 2005). Overall, following revisions to the RCAs in 2005, the RCA network's coverage of DFO-modeled rockfish habitat has been calculated to be between 12.8% - 20.0% of identified rockfish habitat, with habitats at depths >100 m being <13.0% represented (Table 2 in (Ardron & Wallace 2005)).

For the aforementioned reasons, this assessment considers RCAs to be providing strong protection to a small subset of vulnerable habitats in the coast's shallower waters.

Marine Protected Areas

In 2008, there were 161 areas that fit the "MPA" designation in British Columbia's waters (Robb et al. 2011). The governing bodies responsible for these MPAs included federal, provincial, and municipal governments (Robb et al. 2011). A recent analysis found that some degree of commercial fishing was allowed in 160 of the 161 MPAs, and that the total area that is fully off-limits to commercial fishing is approximately 3,575 km^2, which is approximately 0.8% of Canada's Pacific waters (Robb et al. 2011).

At the present time, DFO is responsible for two MPAs: Endeavour Hydrothermal Vents (EHV), and SGaan Kinghlas-Bowie Seamount MPA (SK-BS) (DFO 2013a). All commercial fisheries are currently allowed to operate in the EHV (DFO 2009d). A limited sablefish pot fishery occurs within a defined part of the Bowie Seamount MPA (DFO 2013a).

In addition to these two MPAs, a bottom trawl closure is in place around three glass sponge reefs (DFO 2013a), in recognition of their global significance and their susceptibility to damage by trawl gear.

Trawl Habitat Conservation Measures

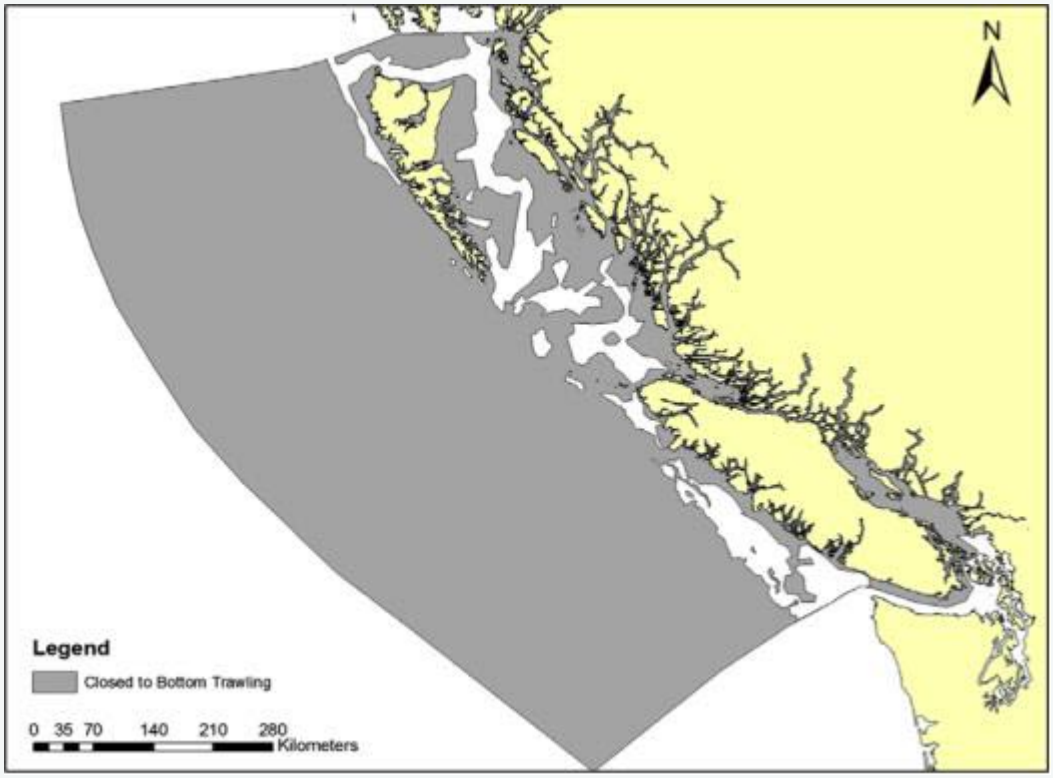
Disclosure: the author of this assessment was one of the primary designers of the trawl habitat conservation measures reviewed in this section.

On April 2, 2012, a suite of management measures meant to manage and reduce the bottom trawl fishery's impacts on habitat was implemented. These measures were developed in a collaborative effort between the

Canadian Groundfish Research and Conservation Society on behalf of the trawl fishery, and the Pacific Marine Conservation Caucus on behalf of environmental organizations. There three management measures that were developed in this effort are as follows.

1. Frozen trawl footprint

In order to ensure that the fishery does not disproportionately affect any particular habitat types, impact low energy/low productivity ecosystems in the deeper waters off of the west coast, or access previously un-trawled areas, a series of boundaries were developed for the fishery (DFO 2013a). Bottom trawling is prohibited from fishing outside the boundaries, effectively "freezing the footprint" of the fishery (Figure 67).



Map of areas open and closed to the bottom trawl fishery as of April, 2012. Figure from (DFO 2013a).

Habitat Bycatch Conservation Limit

The second management measure was the implementation of a fleet-wide Habitat Bycatch Conservation Limit (HBCL) of 4,500 kg (DFO 2013a). The HBCL acts as a fleet-wide cap on sponges and corals caught incidentally in the fishery. The fleet-wide HBCL is allocated to vessels, and all catch of coral and sponge counts against the vessel's individual HBCL. Any vessel that exceeds its individual HBCL is barred from trawling for the rest of that fishing year, unless sufficient HBCL can be acquired from another vessel (DFO 2013a).

Encounter protocol

The third and final management measure is an encounter protocol. This protocol establishes a procedure that is followed if and when a trawl vessel catches >20 kg of coral and/or sponge in a single tow. Essentially, the protocol ensures the prioritization of data collection and the timely transmission of relevant information regarding the incident (e.g., location, amount caught, etc.) to the rest of the trawl fleet (DFO 2013a). The vessels in the rest of the fleet, operating under the restrictive limits of their individual HBCL holdings, will presumably avoid trawling in the location of the catch.

Summary of effectiveness

These management measures were implemented on April 2, 2012 (DFO 2013a). For the remainder of the

fishing year (through February 20, 2013), a total of 0.50 t of combined corals/sponges were caught throughout the fleet (DFO 2013c). The stated management objective was to limit fleet-wide catch to ≤562 kg of coral and 322 kg of sponge (DFO 2013a), for a total of 0.884 t of coral and sponge combined. The 2012 catch was therefore approximately 57% of the management objective for maximum coral/sponge catch.

In the process of 'freezing' the footprint of the trawl fishery, parts of the trawl fishery's historic footprint were removed. As a result, the newly frozen footprint is approximately 20% smaller than the fishery's historical footprint (Bodtker et al. 2013). The reduction in the trawl footprint is especially pronounced in deeper waters, as approximately 65% of the >1,000 m waters that the trawl fishery was previously able to access were made off-limits by the frozen footprint (Bodtker et al. 2013). It is also likely that the spatial distribution of the fleet's fishing effort changed to avoid areas known to contain corals or sponges, but such an analysis has yet to be conducted.

The new trawl footprint includes <50% of the coastwide waters at depths of 0-199 m, 200-399 m, 800-999 m, and 1000-1199 m (Table 1 in (Bodtker et al. 2013)). The two depth strata that are >50% represented in the trawl footprint are 400-599 m (56% of coastwide depth is in the footprint), and 600-799 m (58%) (Table 1 in (Bodtker et al. 2013)).

BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Minimal Mitigation

There are few habitat-related spatial limits placed on the midwater trawl fishery. Midwater trawling is not subject to the suite of habitat management measures implemented for bottom trawling, as described previously. Furthermore, midwater trawling is allowed in Rockfish Conservation Areas (DFO 2013e).

BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Minimal Mitigation

Hook and line/trap fisheries: There are a number of closed areas scattered throughout British Columbia's waters. The closures that are most relevant for the groundfish hook and line and trap fisheries are the 164 Rockfish Conservation Areas, or RCAs, as fishing with hook and line or trap gear is prohibited in RCAs. Despite the high number of RCAs in place, available GIS information suggests that the areal extent of the RCAs is likely ≤20% of rockfish habitat; this number decreases for those rockfish (such as yelloweye) that are found in deeper waters as adults. Furthermore, there is little information regarding the representation of different habitat types in the RCAs. This uncertainty precludes an assumption that the RCAs are protecting sufficient amounts of representative habitat types. For the reasons mentioned above, RCAs are interpreted in this assessment as "strong protection" for particularly vulnerable habitats, and the hook and line and trap fisheries are scored "minimal mitigation" for Factor 4.2.

Justification:

Rockfish Conservation Areas

There are 164 Rockfish Conservation Areas (RCAs) in place in British Columbia waters, the last of which were added in 2007 (DFO 2013a). No commercial or recreational groundfish fishing activities are permitted within RCAs, with the exception of midwater trawling (DFO 2013f).

Living Oceans Society, an environmental organization, analyzed the areal extent of the RCAs. This analysis found that RCAs cover approximately 3.5% of coastwide waters at fishable depths, and 5.6% of waters <200 m (LOS 2013). These coverage rates do not address the issue of habitat representation within the RCAs; it would be expected that rockfish habitat would be better represented within the RCAs than in non-protected areas. However, one GIS analysis found that a subset of RCAs did not consistently overlap with areas that had been identified as high-value habitats by a model and/or fishermen (Ardron & Wallace 2005). Furthermore, it has been suggested that the RCAs' coverage of deeper habitats may not be sufficient to protect the adults of some species, such as yellowmouth rockfish (COSEWIC 2010) or yelloweye rockfish (Ardron & Wallace 2005). Overall, following revisions to the RCAs in 2005, the RCA network's coverage of DFO-modeled rockfish habitat has been calculated to be between 12.8% - 20.0% of identified rockfish habitat, with habitats at depths >100 m being <13.0% represented (Table 2 in (Ardron & Wallace 2005)).

For the aforementioned reasons, this assessment considers RCAs to be providing strong protection to a small subset of vulnerable habitats in the coast's shallower waters.

Marine Protected Areas
In 2008, there were 161 areas that fit the "MPA" designation in British Columbia's waters (Robb et al. 2011). The governing bodies responsible for these MPAs included federal, provincial, and municipal governments (Robb et al. 2011). A recent analysis found that some degree of commercial fishing was allowed in 160 of the 161 MPAs, and that the total area that is fully off-limits to commercial fishing is approximately 3,575 km^2, which is approximately 0.8% of Canada's Pacific waters (Robb et al. 2011).

At the present time, DFO is responsible for two MPAs: Endeavour Hydrothermal Vents (EHV), and SGaan Kinghlas-Bowie Seamount MPA (SK-BS) (DFO 2013a). All commercial fisheries are currently allowed to operate in the EHV (DFO 2009d). A limited sablefish pot fishery occurs within a defined part of the Bowie Seamount MPA (DFO 2013a).

Factor 4.3 - Ecosystem-Based Fisheries Management

BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA / NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, INSIDE ROCKFISH
BRITISH COLUMBIA / NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Low Concern

There is no evidence to suggest that any of the main species caught in the seven groundfish fisheries play an outsized (aka "keystone") role, relative to their abundance, in ecosystem functioning or food web structure and function. While groundfish as a whole are of significant importance to food webs as predators, competitors, and prey, the diversity found in groundfish diets (e.g., (Pearsall & Fargo 2007)) and in the

relevant food webs themselves (DFO 2007) suggests that highly specialized relationships are not expected for any particular species. As a result, the trophic webs are thought to be more stable and resilient than those that have “wasp-waist” characteristics (DFO 2007).

Currently, there are no programs or management measures in place that are meant specifically to manage the groundfish fisheries’ ecosystem impacts. The development of tools for ecosystem-based management is an ongoing effort in other branches of DFO, as demonstrated in the recently completed research initiative in the Strait of Georgia (DFO 2013g). The management of ecosystem impacts is scored "low" concern, as there are no species of exceptional ecological importance caught in these fisheries, and ecosystem-based management tools are not yet in place but are being developed by other branches of DFO.

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

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Appendix A: Extra By Catch Species

STELLER SEA LION

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Seafood Watch criteria assign an inherent vulnerability score of "high" to all marine mammals.

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

Steller sea lions in British Columbia were once subject to culls, but have been protected since 1970 (DFO 2008). Since 1970s, the abundance of Steller sea lions in British Columbia is estimated to have tripled, and pup production is estimated to have quadrupled (DFO 2008). The species' current abundance in British Columbia is now estimated to be "well past" known historical levels (DFO 2010). The species was assessed as "Special Concern" by COSEWIC and is listed as "Special Concern" under SARA (Appendix E). While the stock's status is high relative to historical levels, its stock status score for this report is "low" concern, instead of "very low", due to the stock's SARA listing.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Low Concern

In the recent Steller sea lion management plan, incidental mortality from fisheries and aquaculture was determined to have "low" population-level impacts and to be a "low" concern (Table 1 in (DFO 2010)). While this management plan does not offer any estimates of sustainable annual removals, it does state that the continued growth of the population in British Columbia suggests that the totality of current impacts is within sustainable limits, with the caveat that any apparently minor increase in anthropogenic mortality would have the potential to have substantial impacts (DFO 2010). The primary source of Steller sea lion bycatch in the groundfish fisheries is in the trawl fishery, which caught approximately 3.2 t of Steller sea lions in 2012 (Appendix E). The mortality of Steller sea lions in the trawl fishery is scored "low" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SIXGILL SHARK

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for bluntnose sixgill shark is 84. The species' inherent vulnerability is therefore scored "high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

High Concern

The current abundance, and trend in abundance, is not known for bluntnose sixgill shark (DFO 2012c). The species was assessed as "Special Concern" by COSEWIC and is listed as "Special Concern" under SARA, and is listed as "Near Threatened" by the IUCN (Appendix E). In accordance with the Seafood Watch criteria, the stock status of bluntnose sixgill shark is scored "high" concern, due to its COSEWIC, SARA, and IUCN statuses.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

Low Concern

In 2012, the catch of bluntnose sixgill sharks in the trawl and hook and line fisheries was less than a level that is considered to be "unlikely" to have significant impacts on the population. Fishing mortality of bluntnose sixgill shark is scored "low" concern for the trawl, halibut, sablefish, rockfish outside, and spiny dogfish fisheries.

Justification:

In the SARA management plan for bluntnose sixgill shark, bycatch mortality in fishing activities is identified as the primary threat to bluntnose sixgill shark (DFO 2012c). In this plan, it is reported that the average annual bycatch of bluntnose sixgill shark bycatch in the groundfish trawl fishery was 0.7 t/year during the period 2001 and 2009 (DFO 2012c). More recently, the bycatch of this shark in the 2012 trawl fishery (0.296 t; Appendix E) was less than the 2001-2009 average, and was comparable to the smallest annual catches in this fishery during the period 1996-2009 (Table 2 in (DFO 2012c)).
In addition to the trawl fishery's bycatch, there were 216 instances in which bluntnose sixgill sharks were caught and released in hook and line fisheries in 2012 (Appendix E). These releases occurred in the halibut fishery (26 releases), joint halibut/sablefish trips (32 releases), sablefish longline (93 releases), rockfish outside fishery (5 releases), and spiny dogfish fishery (60 releases) (DFO Pacific Region 2013). The mortality associated with these catch and release levels is not known, but the species' management plan states that annual catches of approximately 377 sharks (with unknown associated mortality) is considered to be "unlikely" to have a significant impact on the bluntnose sixgilll shark population (DFO 2012c).

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (SHALLOW-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, LONGLINE (DEEP-SET), CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA
BRITISH COLUMBIA/NORTHEAST PACIFIC, JIG, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH
BRITISH COLUMBIA/NORTHEAST PACIFIC, TROLLING LINES, CANADA, OUTSIDE ROCKFISH

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for

the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SHARPCHIN ROCKFISH

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for sharpchin rockfish is 64, and the species' productivity rating in Cope et al. 2011 is 1.36 (Table 1 in (Cope et al. 2011)). Sharpchin rockfish inherent vulnerability is therefore scored "high".

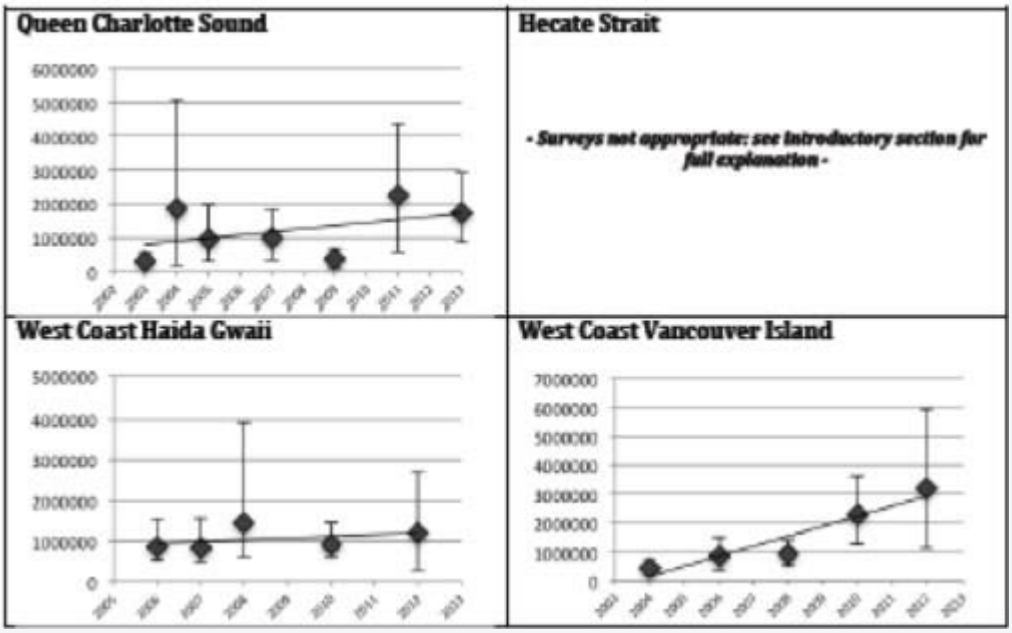
Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

To date, the sharpchin rockfish stock in British Columbia has not been assessed. Trawl survey biomass indices suggest a gradual increase in the three relevant survey areas (Figure 62). While the species' "high" inherent vulnerability (see Factor 2.1) and the lack of a stock assessment suggest a Factor 2.2 score of "high" concern, the trends noted in the survey biomass indices mitigate concern. Sharpchin rockfish stock status is therefore scored "moderate" concern.

Justification:



Trawl survey biomass indices for sharpchin rockfish. Data from (DFO 2013b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In 2012, approximately 300 t of sharpchin rockfish were caught in the trawl fishery (DFO Pacific Region 2013). Of this total, 121.25 t were discarded (DFO Pacific Region 2013). There is no TAC for sharpchin rockfish, and no estimate of sustainable fishing mortality. Therefore, the Factor 2.3 score is "moderate" concern for this stock.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SPLITNOSE ROCKFISH

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for splitnose rockfish is 66, and the species' productivity rating in Cope et al. 2011 is 1.28 (Table 1 in (Cope et al. 2011)). Splitnose rockfish vulnerability is scored "high".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

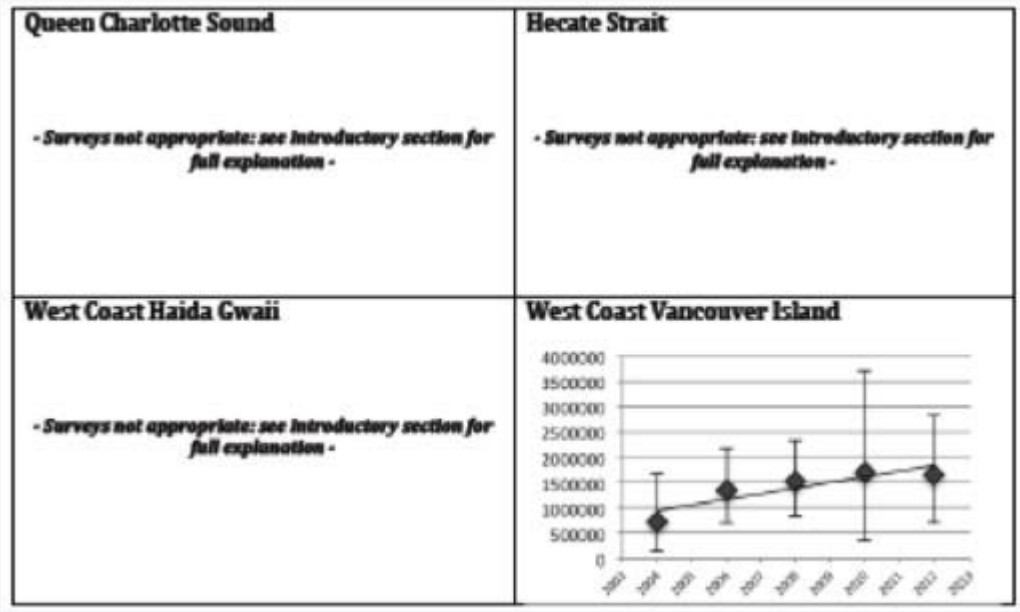
Moderate Concern

There is no stock assessment for splitnose rockfish. The WCVI trawl survey biomass index for splitnose rockfish shows an increasing trend (Figure 63). While the Seafood Watch criteria suggest a Factor 2.2 score of "high" concern for a species with unknown stock status and "high" inherent vulnerability (see Factor 2.1), the

Factor 2.2 score for splitnose rockfish is moderated by the trend in the WCVI survey biomass index, and splitnose rockfish stock status is therefore scored "moderate" concern.

Justification:

Of the four trawl surveys for which data exist, only the WCVI survey yields splitnose rockfish biomass indices that are appropriate for analysis; the QCS indices are characterized by high relative error (mean relative error = 0.68), and WCHG and HS surveys have yielded relatively small biomass estimates for this species (DFO 2013b). The WCVI survey index shows an increased trend from 2004 through 2012 (Figure 63).



Trawl survey biomass indices for splitnose rockfish. Data from (DFO 2013b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

There is no TAC for splitnose rockfish. In 2012, the trawl fishery caught approximately 181.5 t of splitnose rockfish, and retained approximately 48% (DFO Pacific Region 2013). The impact of this level of fishing mortality on the stock is not known. The Factor 2.3 score for splitnose rockfish caught in the trawl fishery is therefore scored “moderate" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece

counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

SPOTTED RATFISH

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

High

The Fishbase vulnerability score for spotted ratfish is 50. The species' productivity rating in Cope et al. 2011 is 1.63 (Table 1 in (Cope et al. 2011)). Spotted ratfish inherent vulnerability is therefore scored "high".

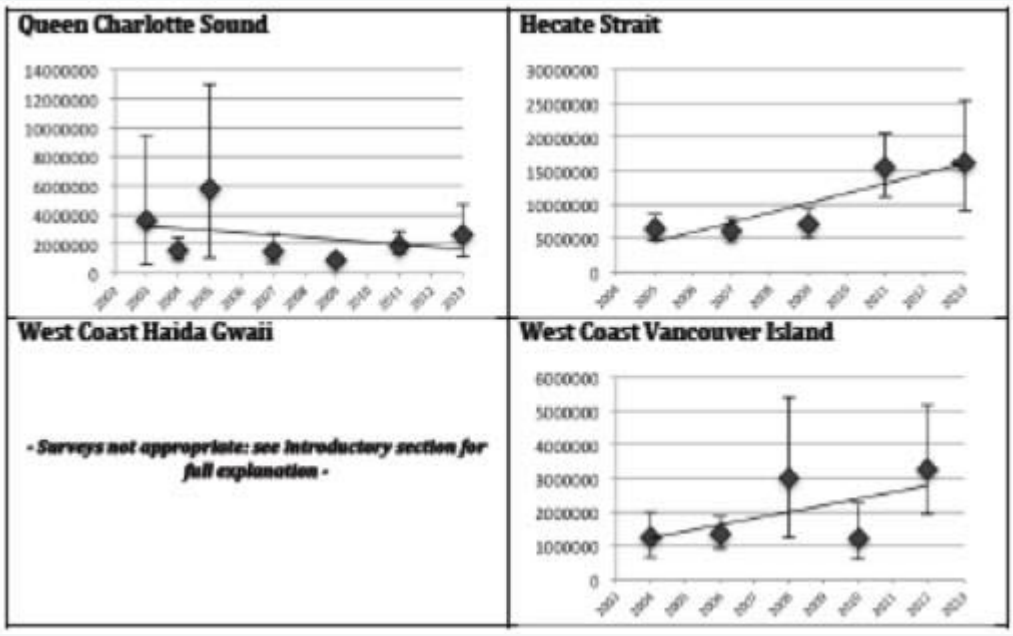
Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

There is no stock assessment for spotted ratfish. Trends in trawl survey biomass indices vary between the three relevant survey areas, with increases in HS (where trawl survey biomass estimates are highest) and WCVI, and a slight decline in QCS (Figure 64). Sinclair and colleagues (2007) also noted a substantial increase in the HS spotted ratfish biomass index between 1984-2002 (Sinclair et al. 2007). The lack of a stock assessment and the species' "high" inherent vulnerability would usually compel a Factor 2.2 score of "high" concern, but the sustained increase in the HS survey index moderates this score. Spotted ratfish are scored "moderate" concern for Factor 2.2.

Justification:



Trawl survey biomass indices for spotted ratfish. Data from (DFO 2013b).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

Moderate Concern

In 2012, the trawl fishery caught 574.75 t of spotted ratfish (DFO Pacific Region 2013). Approximately 96% of this catch was discarded at sea (DFO Pacific Region 2013). As there is no estimate of sustainable mortality for spotted ratfish and no TAC, the Factor 2.3 score is "moderate" concern for the trawl fishery.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, HARD SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE
BRITISH COLUMBIA/NORTHEAST PACIFIC, MIDWATER TRAWLS, CANADA

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

FLATHEAD SOLE

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Medium

The Fishbase vulnerability score for flathead sole is 36, and the species' productivity rating in Cope et al. 2011 is 2.30 (Table 1 in (Cope et al. 2011)). Flathead sole vulnerability is scored "medium".

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

There is no stock assessment for flathead sole. Flathead sole trawl survey biomass indices show increasing trends in HS and WCVI, and a slight decline in QCS. Sinclair and colleagues (2007) also noted a substantial increase in the HS flathead sole biomass index between 1984-2002 (Sinclair et al. 2007). While there is no stock assessment for this species, the increasing trends in the biomass indices and the species' "medium"

inherent vulnerability mitigate concern. The stock status of flathead sole is scored “moderate” concern.

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

Moderate Concern

There is no quota for flathead sole. In 2012, the trawl fishery caught approximately 66.4 t of flathead sole, and retained 42% of this catch (DFO Pacific Region 2013). The effect of this level of fishing mortality on the stock is not known, and the Factor 2.3 score for flathead sole is therefore scored "moderate" concern.

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, BOTTOM TRAWLS, CANADA, SOFT SUBSTRATE

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

PACIFIC HALIBUT

Factor 2.1 - Inherent Vulnerability

BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

High

The Fishbase vulnerability score for Pacific halibut is 86. Pacific halibut are therefore scored “high” for inherent vulnerability.

Factor 2.2 - Abundance

BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Low Concern

The median estimate for Pacific halibut SB_{2015} is 43% of unfished equilibrium biomass, and there is low probability that SB_{2015} is below the $SB_{30\%}$ upper reference point used by the International Pacific Halibut Commission. After more than a decade of declining biomass, driven by decreasing size-at-age and reduced recruitment, Pacific halibut spawning biomass is estimated to have stabilized and then increased in recent years. For these reasons, the stock status of Pacific halibut is scored “low” concern.

Justification:

At the end of 2012, a review of the model used to assess the Pacific halibut stock was undertaken. The changes that were made to the model as a result of the review yielded projections that show a much stronger

decline in biomass over recent years, and an estimate of exploitable biomass that was 28.3% lower in 2013 than it was in 2011 (Stewart et al. 2012).

At the time of the writing of this report, an executive summary for the 2015 stock assessment was available. In this summary, the recent trend in halibut biomass shows a substantial decline from the late 1990s through approximately 2010, a leveling-out from 2010 through approximately 2012, and a slight increase in the years thereafter (Figure 4 in Stewart et al. 2015). The median estimate for SB_{2015} is 43% of equilibrium unfished biomass (Stewart et al. 2015}. This is above the $SB_{30\%}$ upper reference point that the International Pacific Halibut Commission (IPHC) uses to demarcate the stock status at which reduced harvest rates are initiated. While the authors of that executive summary note that the distribution of probabilities shows a "very wide plausible interval" for SB_{2015}, the probability that $SB_{2015} \leq SB_{30\%}$ is only approximately 3% (Stewart et al. 2015).

Factor 2.3 - Fishing Mortality

BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

Moderate Concern

In 2014, the British Columbia halibut longline fishery accounted for approximately 94% of both commercial halibut TAC and catch. British Columbia's Pacific halibut catch limits are determined by the IPHC. For 2014, the IPHC selected a coastwide harvest alternative that was less conservative than the option derived from their standard harvest policy. While the harvest alternative adopted for 2014 was associated with low probabilities of either sub-$SB_{30\%}$ or sub- $SB_{20\%}$ stock status in 2015, it was associated with a high probability of exceeding the IPHC's coastwide target harvest rate and an increased probability (relative to the standard harvest policy option) of $SB_{2015} < SB_{2014}$. The mortality of Pacific halibut in the directed fishery is scored "moderate" concern.

Justification:

The IPHC determines the amount of Pacific halibut available for all fisheries in British Columbia by applying an area-specific harvest rate (21.5% for Area 2B when SB>SB30%) to the amount of exploitable biomass that has been apportioned to Area 2B (Stewart et al. N.D.). Catch limit recommendations may be lower than the resulting value, however, due to a "slow-up" policy that restricts the maximum increase in allowable catch from one year to the next (IPHC N.D.).

For 2014, the fishery catch limit for Area 2B was 3,107 t (IPHC 2014). This catch limit corresponded to a harvest alternative that was less conservative than the "blue line" option derived from application of the IPHC's harvest strategy (IPHC 2014). The harvest alternative selected for 2014 was associated with relatively low probabilities of the coastwide SB2015 being less than SB30% (5 times out of 100) or SB20% (1 time out of 100) (IPHC 2014). However, it was associated with a high probability that the coastwide 2014 harvest rate would exceed the IPHC's target harvest rate (89 times out of 100), and increased the probability that SB2015<SB2014 by 11 times out of 100 (from 56 times to 67 times out of 100) (IPHC 2014).

In British Columbia, halibut are caught in the directed halibut longline fishery, as bycatch in other commercial fisheries, and in recreational fisheries. In 2014, the estimated total mortality of Pacific halibut in all British Columbia fisheries (3,034 t) was approximately 97.6% of the total catch limit (3,107 t), with commercial landings (2,619 t) accounting for approximately 86.3% of total estimated mortality (Appendix I, Table 1 in (IPHC 2015)). For the 2014 season, 100% of the commercial halibut TAC (2,627 t) was allocated to the hook and line fisheries (the trawl fishery has a 454 t halibut bycatch mortality cap) (DFO 2014a). During the 2014 season, the halibut longline fishery accounted for approximately 93.6% of both commercial TAC and catch (DFO 2015b).

Factor 2.4 - Discard Rate

BRITISH COLUMBIA/NORTHEAST PACIFIC, SET LONGLINES, CANADA, OUTSIDE ROCKFISH

20-40%

The discard: landings ratio for the bottom trawl fishery was 20.9% in 2012 (DFO Pacific Region 2013).

Discard rates (i.e., the ratio of at-sea discards to landings) are challenging to determine for the hook and line groundfish fisheries. This is because some of the available logbook data record certain releases as piece counts, rather than by weight. Furthermore, the Seafood Watch criteria require that the bait used in fishing operations be added to the weight of the discards, so that the final ratio is (bait+ discards)/landings. There is no information regarding the quantities of bait used in the groundfish hook and line fisheries. Therefore, for the hook and line fisheries, a proxy (bait+ discards)/landings ratio of 0.20-0.40 is used.

Appendix B: COSEWIC, SARA, and IUCN statuses of rockfish species

Table A.1. COSEWIC, SARA, and IUCN statuses of rockfish species of concern, and spiny dogfish (COSEWIC/SARA statuses: (SARA Registry 2014); IUCN statuses: (IUCN 2014)).

Species	COSEWIC	SARA	IUCN
Bocaccio	Endangered		Critically Endangered
Canary rockfish	Threatened		
Darkblotched rockfish	Special Concern		
Longspine thornyhead	Special Concern	Special Concern	
Quillback rockfish	Threatened		
Rougheye rockfish Types I and II	Special Concern	Special Concern	
Spiny dogfish (North Pacific)	Special Concern		Vulnerable
Yelloweye rockfish Inside and Outside Populations	Special Concern	Special Concern	
Yellowmouth rockfish	Threatened		

Appendix C: Bycatch of seabirds, marine mammals, large sharks, salmon, and green sturgeon

Table B.1. Bycatch of seabirds, marine mammals, large sharks, salmon, and green sturgeon in British Columbia groundfish fisheries, 2012
(Catch Data: (DFO Pacific Region 2013); COSEWIC/SARA statuses: (SARA Registry 2014); IUCN statuses: (IUCN 2014)).

Species	Trawl Catch (t)	Hook and Line Catch (count)	COSEWIC Status	SARA Status	IUCN Status
Seabirds					
Albatrosses	-	24	NA	NA	NA
Black-footed albatross	-	1 (Outside ZN)	Special Concern	Special Concern	Near threatened
Laysan albatross	-	1 (Outside ZN)	NA	NA	Near threatened
Marine mammals					
California sea lion	0.590	-	Not At Risk	NA	Least Concern
Eared seals/walruses	0.312	-	NA	NA	Data Deficient (walrus)
Steller sea lion	3.232	1 (Halibut)	Special Concern	Special Concern	Least Concern (*E.j.*
					monteriensis)
Sharks					
Blue shark	-	637	Data deficient1	NA	Near Threatened
Bluntnose sixgill shark	0.296	216	Special Concern	Special Concern	Near Threatened
Pacific sleeper shark	6.589	291	NA	NA	Data Deficient
Salmon shark	-	30	NA	NA	Least Concern
Tope (soupfin) shark	0.546	217	Special Concern	Special Concern	Vulnerable
Salmon					
Chinook salmon	10.450	199	NA	NA	NA
Chum salmon	0.474	-	NA	NA	NA
Coho salmon	0.510	43	NA	NA	NA
Pink salmon	0.016	-	NA	NA	NA

Sockeye salmon	0.038	-	NA	NA	Least Concern
Other					
Green sturgeon	0.503	-	Special concern	Special concern	Near threatened

1. (COSEWIC 2014b)

The bycatch of the albatrosses, Steller sea lions, bluntnose sixgill shark, tope (soupfin) shark, and green sturgeon are addressed due to these species' SARA and/or IUCN statuses.

Appendix D: Summary of changes made in 2016 update report

The 2016 update to the B.C. groundfish report consisted of the incorporation of information from new stock assessments for arrowtooth flounder, Pacific cod (Hecate Strait and Queen Charlotte Sound), Pacific halibut, and yellowtail rockfish. As a result of this new information, the Criterion 1 scores for these stocks changed as shown in Table C.1.

Table C.1. Summary of changes to relevant stock status and fishing mortality scores as a result of 2016 update.

Stock	Stock status (2014)	Stock status (2016)	Fishing Mortality (2014)	Fishing Mortality (2016)	Criterion 1 Ranking (2014)	Criterion 1 Ranking (2016)
Arrowtooth flounder	Moderate Concern	Very Low Concern	Moderate Concern	Very Low Concern	2.64	5.00
Pacific cod	Moderate Concern	High Concern	Moderate Concern	Very Low Concern	2.64	3.16
Yellowtail rockfish	High Concern	Very Low Concern	Moderate Concern	Very Low Concern	2.16	5.00
Pacific halibut (C2)	Low Concern	Low Concern	Low Concern	Moderate Concern	3.83	3.05

An additional gear type, midwater trawl, was also incorporated into the Criterion 4 section of the 2016 update report. At the time of the 2016 update, midwater trawl gear was being used to target a suite of rockfish, but catch composition data for this gear was lacking. As a result, the "midwater trawl" fishery that was introduced in the 2016 report was assigned the same species as the "bottom trawl, hard substrate" fishery. The two fisheries differed in their Criterion 4 scores as show in Table C.2.

Table C.2. Summary of differences in Criterion 4 scores for midwater and bottom trawl (hard substrate) fisheries in 2016 update report.

Fishery	Factor 4.1 (Impacts on substrate)	Factor 4.2 (Mitigation)	Factor 4.3 (EBFM)	Criterion 4 Score
Bottom trawl (hard substrate)	1.00 High Concern	1.00 Strong Mitigation	4.00 Low Concern	2.828
Midwater trawl	3.00 Low Concern	0.25 Minimal Mitigation	4.00 Low Concern	3.606

As a result of the incorporation of the new stock status and Criterion 4 information, the overall recommendation changed for only one stock: yellowtail rockfish, which changed from an overall "avoid" (numeric score of 2.227) to an overall "good alternative" (numeric scores 2.746 for bottom trawl and 2.919 for (midwater trawl).