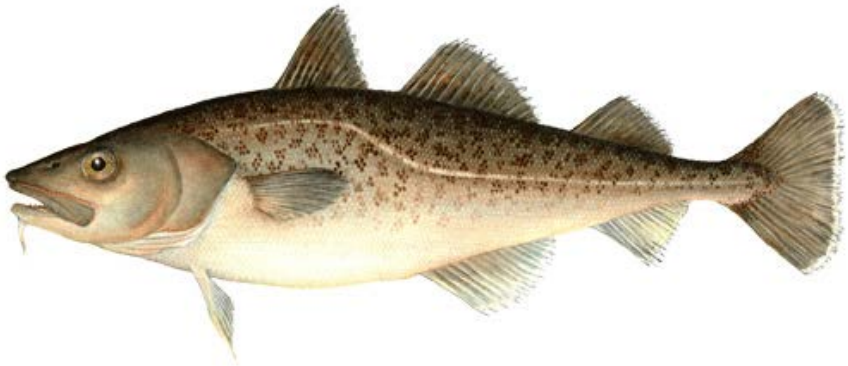
Monterey Bay Aquarium
Seafood Watch®

Pacific Cod

Gadus macrocephalus



Russian Federation

Bottom trawl, Boat seine net, Bottom longline

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Anne Hawkins, Consulting Researcher

About Seafood Watch®

The Monterey Bay Aquarium Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the North American marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. The program's mission is to engage and empower consumers and businesses to purchase environmentally responsible seafood fished or farmed in ways that minimize their impact on the environment or are in a credible improvement project with the same goal.

Each sustainability recommendation is supported by a seafood report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's sustainability criteria to arrive at a recommendation of "Best Choice," "Good Alternative," or "Avoid." In producing the seafood reports, Seafood Watch utilizes 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 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. Both the detailed evaluation methodology and the scientific reports, are available on seafoodwatch.org.

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 or visit online at seafoodwatch.org.

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Guiding Principles

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

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

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

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

1. Impacts on the species under assessment
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

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

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

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

Best Choice/Green: Are well managed and caught or farmed 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 or farmed.

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

Summary

This report provides analysis and recommendation for the Pacific cod (*Gadus macrocephalus)* fishery in the Russian Federation. The Pacific cod is a bottom-dwelling fish that is found across a large range from the Yellow Sea through the Japan Sea, the Okhotsk Sea, the northern part of the Bering Sea, and along the coast of North America to Santa Monica Bay, California. The fishery is believed to operate using bottom trawl, bottom longline, bottom gillnet, and bottom seine gear.

The amount of publicly available information about this fishery is extremely limited, and uncertainty over stock status, bycatch, and management transparency drive much of this analysis. Stock abundance is not thought to be critically low, and the species does have moderate inherent resilience to fishing pressure.

Retained and bycatch species analyzed in this assessment were selected based on criteria developed by Seafood Watch. These criteria predict species groups that may be caught by individual gear types. Overall, data are lacking on the composition and quantity of bycatch. In particular, major concerns exist over marine mammal bycatch in bottom gillnet and trawl gear and the effects of seine gear on corals and other biogenic habitats. These concerns, in conjunction with a complete lack of available information on bycatch specific to the Pacific cod fishery, led to a critical bycatch rating. There is also no information on discard rates in the fishery, or even on what specific gear configurations are used, that could enable conclusions to be drawn about the likelihood of bycatch or discards.

The Federal Fisheries Agency oversees management of the Pacific cod fishery. It has a relatively complex and well-developed management structure. Total allowable catch levels are set to control fishing mortality, and additional rules implement fishing seasons, allowable gear, and minimum size restrictions if necessary. Ecosystem data is collected, but the extent to which bycatch issues are included in management principles is not known. Both the institutional structure and the regulatory environment of fisheries management in Russia change frequently, and further changes in the law are under negotiation at the time of this report's production. Management principles generally have economic prosperity and development of the fishing industry as end goals. Despite the existence of a management system that allows for stakeholder input and multiple levels of review, the opacity of the rule-setting process and the unavailability of data continues to be a concern**.**

As with other aspects of this assessment, the actual impacts of the fishery on benthic habitats are largely unknown. Habitat impacts were therefore analyzed based on general gear types and known effects in similar fisheries. In particular, the effects of trawling on potentially sensitive substrate are of concern. It is unknown whether any mitigation of gear impacts is being practiced. Pacific cod should not be considered a species of exceptional ecosystem importance, and at least some ecosystem considerations are included in the management structure.

Table of Conservation Concerns and Overall Recommendations

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Pacific cod - Longline, Bottom	Yellow (3.05)	Critical (0.00)	Red (1.73)	Yellow (2.45)	**Avoid (0.000)**
Pacific cod - Seine Net, Boat	Yellow (3.05)	Critical (0.00)	Red (1.73)	Yellow (2.45)	**Avoid (0.000)**
Pacific cod - Trawl, Bottom	Yellow (3.05)	Critical (0.00)	Red (1.73)	Red (1.73)	**Avoid (0.000)**

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, **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, **and** does not meet the criteria for Best Choice (above)
- **Avoid/Red** = Final Score <=2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern,[2] **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).

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Introduction

Scope of the analysis and ensuing recommendation

This report focuses on Pacific cod caught by Russian fishing vessels. Pacific cod in Russia is commercially exploited using bottom gillnet, bottom trawl, bottom (Danish) seine, and bottom longline gear in the Bering Sea, the Sea of Okhotsk, and the Sea of Japan.

Overview of the species and management bodies

Management History and Status:

During the years 1995-2004, the Russian Fishery Committeewas the Russian Federation's federal fisheries management agency, which included regional bodies that wereresponsible for fisheries monitoring and oversight. In 2004 the State Fishery Committee was dismantled and management transferred to a new agency called the Federal Fishery Agency (FFA), which was incorporated within the Ministry of Agriculture.

Several institutes of marine science, organized under the Russian Federal Research Institute of Fishery and Oceanography (VNIRO), are distributed within the Russian Federation that serve advisory roles to the FFA. For Pacific cod, the most important institutes in Russia are the TINRO-Centre (TINRO) for the northwest Pacific and the Sea of Japan, the SakhalinNIRO (SakhNIRO) monitoring fisheries of the Kuril Island region, and the KamchatNIRO (KamNIRO) monitoring fisheries around the Kamchatka Peninsula. The institutes perform stock assessments for the fishery and develop catch advice. That advice is then reviewed by VNIRO and the Ministry of Natural Resources. If the review panel agrees to the Total Allowable Catch (TACs), they are set by an Order of the Ministry of Agriculture (SFP 2014).

In addition to having domestic research institutes, Russia is a member of the intergovernmental North Pacific Marine Science Organization (PICES), which promotes and coordinates marine research in the northern North Pacific and adjacent seas and facilitates the exchange of scientific information on issues related to the ocean environment, global weather and climate change, living resources and their ecosystems, and the impacts of human activities. The organization is purely scientific and does not recommend regulatory measures. There are also numerous technical universities in the Russian federation that focus exclusively on marine issues and/or offer graduate degree programs in fisheries science.

There is currently an executive-level initiative being considered to restructure the entire arena of fisheries management in Russia, which may lead to changes in the management process (World Fishing 2013; Government of the Russian Federation 2012). There are also other controversial initiatives taking place in the management of the fishery, including revisions to quota allocation methods.

Biology and Life History Characteristics:

The following is a brief summary of Pacific cod life history. A more thorough description can be found in Gustafson *et al.* (2007). Pacific cod have a large population range from the Yellow Sea through the Japan Sea, the Okhotsk Sea, the northern part of the Bering Sea, and along the coast of North America to Santa Monica Bay, California (Dulepova and Klyashtorin 2008). Adult Pacific cod are a member of the inner shelf-mesobenthal community, and are typically found at depths of 50 to 300 m (Allen and Smith 1988; Hart 1973; Love 1991). Spawning occurs at depths of from 40 to 265 m (Palsson 1990).

Eggs are demersal and are found sublittorally in areas associated with coarse sand and cobble bottoms (Phillips and Mason 1986; Palsson 1990). Larvae and small juveniles are pelagic; large juveniles and adults are parademersal (Dunn and Matarese 1987). Larvae are found in highest abundance between 15 and 30 m. Small juveniles usually settle into intertidal/subtidal habitats, commonly associated with sand and eel grass, and gradually move into deeper water with increasing age. Juveniles are found in polyhaline to euhaline waters, whereas adults are found in marine waters (Gustafson *et al.* 2000).

Pacific cod are oviparous and have external fertilization (Hart 1973). They are single-batch spawners. Pacific cod in northern areas spawn at lower temperatures (1-5^{o}C in the Bering Sea) than do fish in southern areas (7-9^{o}C around Japan; 6-9^{o}C in the Strait of Georgia). Eggs are demersal, weakly adhesive, and are found in polyhaline to euhaline waters between 1^{o}C and 10^{o}C (Gustafson *et al.* 2000). Because most winter concentration areas have bottom sediments consisting of coarse sand and cobble, it is inferred that Pacific cod preferentially spawn near these bottom types (Palsson 1990). In the eastern part of the Sea of Okhotsk, off western Kamchatka, Pacific cod are known to spawn from the end of February to the end of May in depths of 170 to 280 m (Rovnina et al. 1997), but most spawning sites have not been identified.

Although they have not traditionally been considered to be a migratory species (Gustafson *et al.* 2000), migration patterns in at least part of the population have been identified (see, e.g., Savin 2007). There also exist seasonal bathymetric movements from deep spawning areas of the outer shelf and upper slope in fall and winter to shallow middle-upper shelf feeding grounds in the spring and early summer (Gustafson *et al.* 2000; Savin 2007).

Production Statistics

Pacific cod have historically constituted the largest part of groundfish catches in the Russian Exclusive Economic Zone (EEZ). Catches began to increase substantially in the early 1980's, and peaked in the mid-1980's around 188,000 tons in 1985. The largest catches were on the shelves of western and eastern Kamchatka, and in the western Bering Sea (Dulepova and Klyashtorin 2008).

Catch data is recorded, though not always publicly reported, but some catch data are available through various reports. The following table summarizes Pacific cod catch in the Russian Federation from three different reports (Tribiloustova 2005; Radchenko 2006; Dulepova and Klyashtorin 2008). This data has been reported by the United Nations Food and Agriculture Organization (FAO) and Russian fishery

managers, but its original source is unclear. Also, there is evidence that Pacific cod is harvested as bycatch in other fisheries including the directed walleye pollock fishery (IASC 2010), and it is unknown whether any bycatch information is included in the catch data.

Importance to the US/North American market

The Russian Federation has recently enacted a policy to keep fisheries yield within the domestic market, including through the imposition of a 5% export tariff (Ramsden 2012). This policy is likely to reduce the amount of exports from Russia entering the North American market at least in the short term. Of the products that are exported, there has been a monumental shift since 1999 from the market being entirely dominated by fresh and chilled products to consisting almost exclusively of frozen exports (Tribiloustova 2005).

Pacific cod is considered a low price-category fish, and in 2012 3,526,936 kilograms of Pacific cod products were imported, with a value of $25,342,235 (Sumaila *et al.* 2007). Most of the Russian products are being retained domestically or entering into the East Asian markets. As a result, Russian Pacific cod products are expected to be of diminished importance to the North American market compared to the high catch levels in the U.S. Alaskan cod fishery.

There has been some speculation on the extent to which prices in global cod markets can affect each other. There is currently a large amount of uncertainty in the future of cod prices. While there have been massive recent restrictions on U.S. Atlantic cod catch limits, the Barents Sea Atlantic cod fishery is experiencing increases in quotas. It is likely that any large shift in market practices will take some time, as Asian market buyers have a great deal of product loyalty (Ramsden 2012).

Common and market names

The common name is Pacific cod and scientific name is *Gadus macrocephalus.* Market names include cod, Alaska cod, grey cod, true cod, and treska. The Russian name for the species is tikhookeanskaya treska.

Primary product forms

Pacific cod imported from the Russian Federation to the United States is frozen prior to transport, most commonly in fillet or minced form (NMFS 2013a).

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: Stock for which you want a recommendation

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

PACIFIC COD				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Russia Longline, Bottom	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	**Yellow (3.053)**
Russia Seine Net, Boat	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	**Yellow (3.053)**
Russia Trawl, Bottom	2.00:Medium	4.00:Low Concern	2.33:Moderate Concern	**Yellow (3.053)**

Criterion 1 Assessment

PACIFIC COD

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Medium

The FishBase vulnerability score is 50 out of 100, indicating medium vulnerability (Cheung et al. 2005). Pacific cod mature at a relatively young age of about 3-5 years, and have high fecundity, but exhibit some characteristics that may increase their vulnerability to fishing, such as spawning aggregations and limited distribution (Froese and Pauly 2011).

Factor 1.2 - Stock Status

Scoring Guidelines

- *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.*

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Low Concern

The most recent available stock assessment document shows that the abundance of Pacific cod varies across the region, but does provide estimates of abundance in relation to abundance conservation targets or reference points. In the Western Bering Sea, biomass is projected at 153.8 thousand tonnes by the end of 2015, compared to a target of biomass at maximum sustainable yield (Bmsy) = 113.9 thousand tonnes. In east Kamchatka, biomass for 2015 is projected to be 50.87 thousand tonnes compared to a Bmsy of 52.65 thousand tonnes and a limit reference point (Blim) of 29.5 thousand tonnes.
Because biomass is generally above the point where recruitment would be impaired (the limit reference point), but is below the target reference point in some areas, the abundance is considered a low concern (TINRO Center 2014).

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *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.*

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderate Concern

Data available through 2006 shows that, for all regions for which data is presented, catch in recent years has been below the Total Allowable Catch (TAC). TACs are calculated based on the fishing mortality that results in maximum sustainable yield (Fmsy), but because there are not buffers incorporated, the actual fishing mortality rate may fluctuate around Fmsy from year to year. In 2014, fishing mortality (F) was estimated as 0.284/year compared to a target of Fmsy = 0.245/year. In 2015, the TAC will be set at a level designed to achieve an F of 0.245/year (Fmsy). In Kamchatka, F was estimated at 0.301/year while Fmsy was estimated at 0.294/year. The TAC for 2015 will be set in accordance with the harvest control rule at a level designed to result in F = 0.274/year.
Because the fishing mortality fluctuates around Fmsy, it is considered a moderate concern (TINRO Center 2014).

Rationale:
*Performance in Achieving Catch Targets*The Pacific cod fishery TAC is reported to be underutilized by at least 33% through 2006 (Radchenko 2006). The Russian Federal Fishery Agency does not expect overfishing in this fishery, so effort limitation (days-at-sea) with remote monitoring of reported catch is likely to be applied. Restoration of depleted fisheries is not currently considered in TAC-setting but the Federal Fishery Agency is considering including it under the recommendations and supervision of fishery science, including gears, vessel types, and calculations of economical benefits (Radchenko 2006). At the 2012 Groundfish Forum in Berlin, Mr. Vitaly Orlov also presented information that suggests the Federal Fisheries Agency has official data indicating that Pacific cod catches from 2004-2012 have not exceeded the TACs that were set for the fishery. Recent data shows that TACs were not exceeded in recent years in at least several stock areas (Savin 2013).

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 Critical.

Criterion 2 Summary

Pacific cod: Russia , Longline, Bottom

Subscore:: 0.000 **Discard Rate: 0** **C2 Rate: 0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
SEABIRDS	High	2.00: High Concern	0.00: Critical	**0.000**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
CORALS AND OTHER BIOGENIC HABITATS	High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
PACIFIC COD	Medium	4.00: Low Concern	2.33: Moderate Concern	**3.053**

Pacific cod: Russia , Seine Net, Boat

Subscore:: 0.000 **Discard Rate: 1.00** **C2 Rate: 0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
CORALS AND OTHER BIOGENIC HABITATS	High	2.00: High Concern	0.00: Critical	**0.000**
FINFISH	Medium	3.00:	2.33:	**2.644**

		Moderate Concern	Moderate Concern	
PACIFIC COD	Medium	4.00: Low Concern	2.33: Moderate Concern	**3.053**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
FORAGE FISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: Russia , Trawl, Bottom

Subscore:: **0.000** **Discard Rate:** **1.00** **C2 Rate:** **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
CORALS AND OTHER BIOGENIC HABITATS	High	2.00: High Concern	0.00: Critical	**0.000**
SHARKS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
FORAGE FISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
PACIFIC COD	Medium	4.00: Low Concern	2.33: Moderate Concern	**3.053**

Information on the bycatch and retained species caught in the Russian Federation Pacific cod fishery is generally not publically accessible. Bycatch is scored according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type. More information is available in Appendix 3 of the Seafood Watch criteria. The taxa that are most likely to interact with the Pacific cod fisheries include: benthic invertebrates, finfish, forage fish, sharks, mammals, seabirds, and corals. For the trawl and seine fisheries, corals limit the score for Criterion 2 due to their high vulnerability and high potential for mortality from the fishery. For the gillnet fishery, marine mammals limit the score due to their high vulnerability, low stock status, and high

potential for mortality from the fishery. For the longline fishery, seabirds limit the score due to their high vulnerability, low stock status, and high potential for mortality from the fishery.

Criterion 2 Assessment

BENTHIC INVERTS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Seine Net, Boat

Medium

Seine gear is likely to interact with benthic invertebrates, but the species of benthic invertebrates affected by the Pacific cod fishery is unknown. Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Russia , Trawl, Bottom

Medium

Trawl gear is likely to interact with benthic invertebrates, but the species of benthic invertebrates affected by the Pacific cod fishery is unknown. Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderate Concern

The stock status of unknown species of benthic invertebrates is considered to be of moderate concern according to the Seafood Watch criteria.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Seine Net, Boat

Low Concern

The impact of seine fisheries on unknown species of benthic invertebrates is scored as a low concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Trawl, Bottom

Moderate Concern

The impact of trawl fisheries on unknown species of benthic invertebrates is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Factor 2.4 - Discard Rate

Russia , Seine Net, Boat

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 1.2% for small pelagic purse seine fisheries. This is the most similar gear with available estimates (Kelleher 2005).

Russia , Trawl, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 9.6% for demersal finfish trawl fisheries (Kelleher 2005).

CORALS AND OTHER BIOGENIC HABITATS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Longline, Bottom

High

Longline gear is likely to interact with corals and other biogenic habitats, but the species of corals affected by the Pacific cod fishery are unknown. Unknown species of corals and other biogenic habitats are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Russia , Seine Net, Boat

High

Seine net gear is likely to interact with corals and other biogenic habitats, but the species of corals affected by the Pacific cod fishery are unknown. Unknown species of corals and other biogenic habitats are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Russia , Trawl, Bottom

High

Trawl gear is likely to interact with corals and other biogenic habitats, but the species of corals affected by the Pacific cod fishery are unknown. Unknown species of corals and other biogenic habitats are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

High Concern

The stock status of unknown species of corals and other biogenic habitats is considered to be of high concern according to the Seafood Watch criteria.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Longline, Bottom

Low Concern

The impact of longline fisheries on unknown species of corals and other biogenic habitats is scored as a low concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Seine Net, Boat

Critical

The impact of seine fisheries on unknown species of corals and other biogenic habitats is scored as a critical concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type. There are no known management measures in place to address bycatch concerns for this species.

Russia , Trawl, Bottom

Critical

The impact of seine fisheries on unknown species of corals and other biogenic habitats is scored as a critical concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type. There are no known management measures in place to address bycatch concerns for this species.

Factor 2.4 - Discard Rate

Russia , Longline, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 7.5% for demersal longline fisheries (Kelleher 2005).

Russia , Seine Net, Boat

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 1.2% for small pelagic purse seine fisheries. This is the most similar gear with available estimates (Kelleher 2005).

Russia , Trawl, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 9.6% for demersal finfish trawl fisheries (Kelleher 2005).

FINFISH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Longline, Bottom

Medium

Longline gear is likely to interact with finfish, but the species of finfish affected by the Pacific cod fishery are unknown. Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Russia , Seine Net, Boat

Medium

Seine net gear is likely to interact with finfish, but the species of finfish affected by the Pacific cod fishery are unknown. Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Russia , Trawl, Bottom

Medium

Trawl gear is likely to interact with finfish, but the species of finfish affected by the Pacific cod fishery

are unknown. Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderate Concern

The stock status of unknown species of finfish is considered to be of moderate concern according to the Seafood Watch criteria.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Longline, Bottom

Moderate Concern

The impact of longline fisheries on unknown species of finfish is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Seine Net, Boat

Moderate Concern

The impact of seine net fisheries on unknown species of finfish is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Trawl, Bottom

Moderate Concern

The impact of trawl fisheries on unknown species of finfish is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Factor 2.4 - Discard Rate

Russia , Longline, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 7.5% for demersal longline fisheries (Kelleher 2005).

Russia , Seine Net, Boat

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 1.2% for small pelagic purse seine fisheries. This is the most similar gear with available estimates (Kelleher 2005).

Russia , Trawl, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 9.6% for demersal finfish trawl fisheries (Kelleher 2005).

FORAGE FISH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Seine Net, Boat

Medium

Seine gear is likely to interact with forage fish, but the species of forage fish affected by the Pacific cod fishery are unknown. Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Russia , Trawl, Bottom

Medium

Trawl gear is likely to interact with forage fish, but the species of forage fish affected by the Pacific cod fishery are unknown. Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderate Concern

The stock status of unknown species of forage fish is considered to be of moderate concern according to the Seafood Watch criteria.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Seine Net, Boat

Low Concern

The impact of seine net fisheries on unknown species of forage fish is scored as a low concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Trawl, Bottom

Moderate Concern

The impact of bottom trawl fisheries on unknown species of forage fish is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Factor 2.4 - Discard Rate

Russia , Seine Net, Boat

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 1.2% for small pelagic purse seine fisheries. This is the most similar gear with available estimates (Kelleher 2005).

Russia , Trawl, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 9.6% for demersal finfish trawl fisheries (Kelleher 2005).

SEABIRDS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Longline, Bottom

High

Longline gear is likely to interact with seabirds. Although somprehensive data on seabird bycatch in the Russian Pacific cod longline fishery are not available, reports from a study conducted in Kamchatka found numerous seabird species killed including Laysan albatross, fulmar and short-tailed shearwater (WWF 2006). Seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria due to their low reproductive rates.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Longline, Bottom

High Concern

The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria, because these species are of high vulnerability. In addition, the fishery is documented to interact with particular species of high concern, including Laysan albatross (listed by IUCN as "Near Threatened") (WWF 2006).

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Longline, Bottom

Critical

The impact of longline fisheries on unknown species of seabirds is scored as a critical concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type. Numerous species of seabirds including albatross are reported to experience mortality in the region's longline fisheries (WWF 2006), but complete information on seabird bycatch specific to the Russian Pacific cod fishery is not available. Although a portion of the fleet voluntary uses streamers that have been demonstrated to be effective at reducing seabird bycatch, these are not required nor used by the entire fleet. There are no known management measures in place to address bycatch concerns for these species.

SHARKS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Russia , Longline, Bottom

High

Longline gear is likely to interact with sharks, but the species of sharks affected by the Pacific cod fishery are unknown. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Russia , Trawl, Bottom

High

Trawl gear is likely to interact with sharks, but the species of sharks affected by the Pacific cod fishery are unknown. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Russia , Longline, Bottom

Russia , Trawl, Bottom

High Concern

The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Russia , Longline, Bottom

Low Concern

The impact of longline fisheries on unknown species of sharks is scored as a low concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Russia , Trawl, Bottom

Moderate Concern

The impact of trawl fisheries on unknown species of sharks is scored as a moderate concern according to the Seafood Watch unknown bycatch matrix, based on a synthesis of peer reviewed literature and expert opinion on the bycatch impacts of each gear type.

Factor 2.4 - Discard Rate

Russia , Longline, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 7.5% for demersal longline fisheries (Kelleher 2005).

Russia , Trawl, Bottom

< 20%

Because no discard information is available for this fishery, this estimate is based on the FAO's global weighted discard rate of 9.6% for demersal finfish trawl fisheries (Kelleher 2005).

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	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
Russia Longline, Bottom	3.000	1.000	Red(1.732)
Russia Seine Net, Boat	3.000	1.000	Red(1.732)
Russia Trawl, Bottom	3.000	1.000	Red(1.732)

Factor 3.1: Harvest Strategy

Scoring Guidelines

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**
Russia Longline, Bottom	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Moderately Effective
Russia Seine Net, Boat	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Moderately Effective
Russia Trawl, Bottom	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Moderately 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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

The Federal Fisheries Agency coordinates all fisheries management in the Russian Federation and has regional offices located throughout the country. The overarching law that affects the way fisheries are managed is the *Law on Fisheries*, which requires total allowable catch (TAC) levels to be set for fishery stocks, based on the level of catch that is "scientifically justified" in a particular fishing area. In addition to the *Law on Fisheries*, the FFA also adopts fishing rules that regulate fishing seasons, gear types, minimum size restrictions, and closed areas (RPCA 2012). The process for setting TACs in the fishery is described under Criterion 1 of this report ("Fishing Mortality").Both the institutional structure and the

regulatory environment of fisheries management in Russia change frequently, and further changes in the law are under negotiation at the time of this report's production. Recently, changes in the management structure are generally being developed with the goals of economic prosperity of the fishing industry and maximum utilization of resources (WFA 2013).There are several examples of partnerships in which Russian fishery managers have collaborated with those from other countries to jointly manage resources or to share data. This type of cooperation appears to be increasing, and has been considered successful in multiple instances (AFSC 2013; Hønneland 2012).Overall, this fishery is considered to have a moderately effective management strategy. Although the legal and institutional structure of management appears to be based on appropriate principles, the lack of information regarding implementation requires a precautionary approach to scoring. Also, the frequently changing regulatory environment creates the possibility that long-term goals are not being developed or assessed.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

N/A

It is unknown whether overfished, depleted, endangered, or threatened stocks have interactions with this fishery. Russian fishery managers have reported increases in abundance of Pacific cod across the region (AFSC 2013). However, since the stock status is unknown, this criteria is scored as not applicable.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

The Russian Federation employs both a Vessel Monitoring System (VMS) program and surveys to collect data for stock assessments. This means that both fishery-dependent and fishery-independent data is used in stock assessments and the setting of catch limits.

The VMS program in Russia applies to all fishing boats in the territorial sea, continental shelf, and the EEZ of the Russian Federation. A sectoral system for monitoring provides continuous collection, processing, and storage of data on the Pacific Ocean and eastern Arctic Sector at the Kamchatka Region center in Petropavlosk-Kamchatskiy. Vessel positions are monitored by satellite, and production activities are reported through the VMS (FAO 2013). In addition, an observer program is operating on commercial boats in the Russian EEZ, and visual methods and recovery coefficients are used to estimate wet-weight catches. Recovery coefficients are reevaluated every year (AFSC 2013).

The TINRO science center performs acoustic trawl and bottom trawl surveys across a wide range of the fishery. TINRO currently operates two research vessels, which operate commercially during the fishing season using set-aside quotas. Length-frequency data is collected, and the research vessels use electronic scales for accurate catch estimates The center is also embarking on cooperative research activities with the United States to share Bering Sea trawl data and reduce uncertainty in stock assessments (AFSC 2013).

Despite the generation of data through VMS, observer, and survey activities, there is a lack of publicly available information regarding the use of the data in assessments and the frequency of the assessments. There is also little information available that would enable a determination of whether both the surveys and the assessment process are scientifically independent. Data the are recorded by management are often not reported publicly and it is not clear how they are used. Due to this uncertainty, the research and monitoring system can be considered moderately effective.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Highly Effective

The management system does require that scientific advice is followed in the setting of TACs. Therefore, this criterion is rated as highly effective.

Rationale:
All available information indicates that TACs are not routinely being exceeded or set higher than scientific advice indicates. Furthermore, reports from TINRO show that the precautionary approach is routinely applied in setting catch limits (Shuntov and Radchenko 2003).

The following TACs were presented by fishing company owner Vitaly Orlov at the Groundfish Forum in Berlin in 2012 (Orlov 2012). He also presented data that shows that these aggregate TACs for each region were set according to match the scientific advice for each sub-region. However, it is not known how the TACs relate to MSY or a sustainable level of catch.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

A relatively well-developed enforcement system for fisheries regulations exists in the Russian Federation. The Federal Security Service (FSB) is the enforcement body and works with the Government Marine Inspection (GMI) to oversee compliance in territorial waters and waters of the EEZ and continental shelf. The GMI has standard enforcement tools such as aircraft, patrol vessels, and radar surveillance, and may access VMS and other databases as necessary to monitor the fishery. They also inspect landings and observe some operations at-sea (RPCA 2012). Factory trawler inspectors operate for enforcement purposes, and flow scales are being planned for use on board commercial fishing vessels although they are not yet operational (AFSC 2013).A few recent changes in Russian law have improved enforcement capabilities against illegal fishing. Amendments to the Law on Fisheries now require any catch occurring in the Russian Exclusive Economic Zone (EEZ) to be landed in Russian ports

(PortNews 2008). In addition, no quotas for fishing in the EEZ will be issued to vessels that do not have Russian flags. Data from fisheries monitoring is newly admissible in court as evidence against poaching, and payment schemes are levied against all species landed as bycatch (WWF 2013). These laws should significantly reduce the risk of catch underreporting and deter excessive bycatch.There is some uncertainty associated with the effectiveness of enforcement measures, since there is little independent scrutiny of these practices and actual compliance rates are not externally reported. Because of this, enforcement is precautionarily considered to be moderately effective.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

The track record of long-term maintenance of stock abundance and ecosystem integrity for this fishery is uncertain, and the most recent management measures have not been in place long enough to determine whether stock abundance will be maintained in the long term.

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.

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

While stakeholder consultation is included in the management process, the management process lacks full transparency, as assessments and management information are not available to the general public and to the international scientific community. Therefore, stakeholder inclusion is considered to be moderately effective.

Rationale:
Public participation is a cornerstone of the modern regime for fishery management in the Russian federation. The federal Law on Fisheries explicitly sets that all citizens, public organizations, and associations have the right to participate in decision making process (RPCA 2012). As written in the regulations, the public can provide input in many stages of the management process, including through the fishery management councils, advisory panels, ecological expert groups, and public hearings (AFSC 2013). Assessments are reviewed by special research plan teams and regional research advisory panels and fishery management councils before going out to public hearing. After public hearings, an ecological expert group has a final review of proposed TACs before they are finalized by the Federal Fishery Agency. The public, including NGOs, can participate in the TAC-setting process through representation in a Regional Fishery Management Council or by participating in the public hearings. (AFSC 2013). However, it is difficult for stakeholders that are not closely linked to the management process to access information.

Bycatch Strategy

Factor 3.2: Management of fishing impacts on bycatch species						
Region / Method	**All Kept**	**Critical**	**Strategy**	**Research**	**Advice**	**Enforce**
Russia Longline, Bottom	No	No	Ineffective	Moderately Effective	Moderately Effective	Moderately Effective
Russia Seine Net, Boat	No	No	Ineffective	Moderately Effective	Moderately Effective	Moderately Effective
Russia Trawl, Bottom	No	No	Ineffective	Moderately Effective	Moderately Effective	Moderately Effective

Subfactor 3.2.1 – Management Strategy and Implementation

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

Russia , Longline, Bottom

Ineffective

This fishery does employ management techniques such as gear restrictions and seasonal closures in order to reduce bycatch (RPCA 2012). There are also financial disincentives to catch non-target species including landing payments (WWF 2013). However, the details of these measures and their effectiveness are unknown. The fishery's impact on protected species and implementation of any measures to protect those species are unknown. Streamers have been demonstrated to be effective in the fishery (WWF 2006). Streamers are not required in the fishery, but are used by about 1/3 to ½ of the fleet based in Kamchatka (Konstantin Zgurovsky, pers comm). The proportion of the fleet based in other areas of Russia that voluntarily uses streamers is not known. Because the gear has a high probability of interaction with species of concern, particularly seabirds, and is not known to have any effective mitigation measures in place, the longline fishery is considered to have an ineffective bycatch management strategy.

Russia , Seine Net, Boat

Ineffective

This fishery does employ management techniques such as gear restrictions and seasonal closures in order to reduce bycatch (RPCA 2012). There are also financial disincentives to catch non-target species including landing payments (WWF 2013). However, the details of these measures and their effectiveness are unknown. The impact on vulnerable species and the effectiveness of measures to protect them is unknown. Because bottom seines have a high potential for bycatch of corals and other biogenic habitat-forming organisms when caught in those environments, and it is not known whether any effective mitigation measures are in place, the seine fishery is considered to have an ineffective bycatch management strategy.

Russia , Trawl, Bottom

Ineffective

This fishery does employ management techniques such as gear restrictions and seasonal closures in order to reduce bycatch (RPCA 2012). There are also financial disincentives to catch non-target species including landing payments (WWF 2013). However, the details of these measures and their effectiveness are unknown. The impact on vulnerable species and the effectiveness of measures to protect them is unknown. Because bottom trawls have a high potential for bycatch of corals and other biogenic habitat-forming organisms when caught in those environments, and it is not known whether any effective mitigation measures are in place, the bottom trawl fishery is considered to have an ineffective bycatch

management strategy.

Subfactor 3.2.2 – Scientific Research and Monitoring

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

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

Collection of observer data exists, as well as landings data (AFSC 2013; RPCA 2012). However, that data is not reported publicly and it is not known how it is used in management. The effectiveness of coverage and analysis of the data is unknown.

Subfactor 3.2.3 – Management Record of Following Scientific Advice

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

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

Scientific advice is overall likely well-utilized for this fishery based upon the management structure (see Fact 3.1). However, it is unknown whether assessments are conducted for all species that are caught as bycatch in the fishery, and to what extent those assessments factor into the setting of catch limits.

Subfactor 3.2.4 – Enforcement of Management Regulations

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

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderately Effective

Little is known about enforcement mechanisms for bycatch species, but it is likely that they are similar to those for the target species.

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	Overall Recomm.
Russia Longline, Bottom	2.00:Moderate Concern	0.00:Not Applicable	3.00:Moderate Concern	**Yellow (2.450)**
Russia Seine Net, Boat	2.00:Moderate Concern	0.00:Not Applicable	3.00:Moderate Concern	**Yellow (2.450)**
Russia Trawl, Bottom	1.00:High Concern	0.00:Not Applicable	3.00:Moderate Concern	**Red (1.732)**

The effects of different types of fishing gear on the habitats associated with different bottom types have been well studied in various regions within Area 67 (Breeze *et al*. 1997; High 1998; Freese *et al*. 1999; McConnaughey *et al*. 2000; Roberts *et al*. 2000; Witherell 2000; Enticknap 2002; Chuenpagdee *et al*. 2003; NMFS 2004; Stone 2006). However, in the western Pacific (Area 61), no similar studies are known. In particular, there are no fishery-specific data for the amount of fishing effort by gear type over specific bottom types, and no indication of seafloor mapping efforts or designation of high-concern critical habitat areas. There are also no statistics on rates of deployment for specific gear types by fishery and no information on spatial coverage according to gear type. Furthermore, no data exist regarding differences in community composition between areas where particular gear types have been deployed and areas that have received little or no fishing effort.

This lack of data limits any attempt to analyze the effects of individual gear types on unique combinations of physical features and their associated organisms within the area of the fishery. It may be possible, however, to infer the general effects of a particular gear type in one area from the known effects of that gear type in another area with a similar bottom type. A brief summary of the available

studies and their possible application to gear types used for Pacific cod in the western Pacific is included in the discussion below.

Justification of Ranking

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

Scoring Guidelines

- *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.

Russia , Longline, Bottom

Moderate Concern

The substrate types encountered by the fishery are unknown. However, because Pacific cod inhabit cobble bottom areas, the fishery is assumed to occur in these habitats. Bottom longline fisheries in rocky habitats are considered a moderate concern.

Rationale:
Demersal longlines are perhaps the least damaging of all the gear types used in the Russian Federation to catch Pacific cod. When properly deployed, demersal longlines have minimal impact on the physical and biological habitat (Chuenpagdee *et al.* 2003). Demersal longlines consist of a main groundline, smaller lines that connect hooks to the main groundline (gangions or snoods) and anchors to keep the main groundline on the bottom. The main groundline and hooks are deployed slowly from the stern of the vessel with minimal dragging of the anchors or mainline. After a period of soaking, the lines and hooks are retrieved in a similar manner. Although some dragging and snagging is inevitable, it is less

frequent and less damaging than with demersal trawls (Chuenpagdee *et al.* 2003) and presumably less than bottom seines. Also, because the ends of the lines are buoyed at the surface and only soak for relatively short periods of time, longlines are rarely lost, which also helps make them less damaging than bottom-set nets.

Russia , Seine Net, Boat

Moderate Concern

The substrate types encountered by the fishery are unknown. However, because Pacific cod inhabit cobble bottom areas, the fishery is assumed to occur in these habitats. Bottom seine fisheries in rocky habitats are considered a moderate concern.

Rationale:
Bottom seines (Danish seines) are used by Russian Federation vessels to catch many species, including Pacific cod and pollock. A bottom seine consists of a small to medium-sized net pulled by two tow-lines (warps). Different from bottom trawls, bottom seines have no braces to keep the net mouth open, no rock-hopping gear and no chains. When legally deployed, a bottom seine is pulled close to the sea bottom, but without ever actually contacting the floor or any organisms attached to it. Nevertheless, bottom seines are often improperly deployed, dragging directly on the sea floor or so close that contact with the bottom or its attached benthic communities is frequent (Vaisman 2001). Used in this incorrect manner, a bottom seine can cause damage similar to that caused by demersal trawls (TRAFFIC survey data, reported in Vaisman 2001). Such damage may include the destruction of sessile or attached benthic organisms, the re-arrangement of physical features leading to loss of habitat for invertebrates, epifauna and juvenile fish, and the re-suspension of sediments (Piskaln *et al.* 1998; Heifetz 2002; Chuenpagdee *et al.* 2003).

Russia , Trawl, Bottom

High Concern

The substrate types encountered by the fishery are unknown. However, because Pacific cod inhabit cobble bottom areas, the fishery is assumed to occur in these habitats. Bottom trawl fisheries in rocky habitats are considered a high concern.

Rationale:
Demersal trawls are used in the Russian Pacific cod fishery, and although there is no documentation of the specific effects of this gear type on the habitat where Pacific cod are caught in Russian waters, the general effects of demersal trawl fishing have been well described. Demersal trawls consist of a large net pulled by two tow-lines (warps) fitted with fixed braces (otterboards or doors) that hold the mouth

of the net open. There are often heavy rollers (rockhoppers) on the bottom edge of the net mouth to allow the trawl to move over rough bottoms without snagging. Demersal trawls may also contain heavy chains on the bottom edge of the mouth to stir up target species buried in the sediment. The braces, chains and rockhoppers of demersal trawls can inflict considerable physical damage to the habitat in several ways. Demersal trawls can reduce structural diversity by severely damaging or removing benthic organisms attached to the sea bottom such as corals, seaweeds and sponges (Auster and Langton, 1999; TRAFFIC survey data, reported in Vaisman 2001). These species might not have the opportunity to recover to pre-trawl conditions if their recovery time is longer than the interval between trawls (Watling and Norse, 1998). The physical features of the seafloor can also be damaged (e.g., smoothing of sedimentary bedforms and reduction of bottom roughness), to the extent that benthic invertebrate species and epifauna can no longer find adequate substrates for attachment and juvenile fish species are left vulnerable (NRC 2002; Chuenpagdee *et al.* 2003). In addition, sediments may be stirred up with adverse effects on a variety of species including as the particularly vulnerable cold-water corals (Piskaln *et al.* 1998). Because many of these organisms form the base of their local food chains, effects of these disturbances may be widespread and enduring (Heifetz 2002).

Factor 4.2 – Mitigation of Gear Impacts

Scoring Guidelines

- *+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.*

Russia , Longline, Bottom

Not Applicable

There are no known measures that mitigate impacts to the seafloor by protecting vulnerable or sensitive habitats or limiting the fishery's spatial footprint.

Russia , Seine Net, Boat

Not Applicable

There are no known measures that mitigate impacts to the seafloor by protecting vulnerable or sensitive habitats or limiting the fishery's spatial footprint.

Russia , Trawl, Bottom

Not Applicable

There are no known measures that mitigate impacts to the seafloor by protecting vulnerable or sensitive habitats or limiting the fishery's spatial footprint.

Factor 4.3 – Ecosystem-Based Fisheries Management

Scoring Guidelines

- *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.*

Russia , Longline, Bottom

Russia , Seine Net, Boat

Russia , Trawl, Bottom

Moderate Concern

While there are no current ecosystem-based management strategies in place, Pacific cod is not considered a species of exceptional importance to the ecosystem.

Rationale:

As with other aspects of the Pacific cod fishery in the Russian Federation, there is little information available on how the stock affects ecosystem structure in its range. Pacific cod constitutes roughly 19% of the main fish biomass in the Olutorsko-Navarinsky region and has among the highest trophic level of all nectobenthos in the region, comparable to halibut and sculpins (Gorbatenko *et al.* 2008).Adult Pacific cod have been described as euryphages because the main part of their diet is whatever prey species is most abundant (Kihara and Shimada 1988, Klovach et al. 1995). Klovach et al. (1995) found that 20-40 cm Pacific cod in the Bering Sea eat shrimp, mysids and amphipods; 40-50 cm Pacific cod eat crabs and amphipods; 50-70 cm Pacific cod prefer mainly sandlance; and 70+ cm Pacific cod consume almost exclusively walleye pollock when available. A study of gut contents of cod caught off the northern Kuril Islands and southern Kamchatka in 1996 showed that the fish constituted roughly 48% of the cod's diet, with an additional 19% from cephalopods, 17% from discarded fishery offal, and 12% from decapods, with a relatively low percentage of walleye pollock found in the guts due to the decline of the east-Kamchatka pollock stock (Poltev and Stominok 2008). A later study validated those findings based on 2004 data, showing that 43-81% of Pacific cod gut contents consisted of fish, depending on the size of the cod sampled. Small cod ate larger proportions of decapods, while larger cod had consumed more fish and cephalopods (Gorbatenko *et al.* 2008).Pacific cod is known to be a food source for several native species, and its removal is a potential concern when considering the ecosystem effects of the Russian Pacific cod fishery. Larval Pacific cod are eaten by pelagic fishes and sea birds. Juveniles are eaten by larger demersal fishes, including Pacific cod. Adults are preyed upon by large marine species including toothed whales, Pacific halibut, salmon shark, and larger Pacific cod (Hart 1973; Love 1991; Stepanenko 1995; Palsson 1990). It is unknown whether Pacific cod plays similar ecosystem functions within the Russian EEZ as it does in the Eastern Bering Sea, but similarities are likely.It has been speculated that the endangered Steller sea lion (*Eumetopias jubatus*) may be adversely affected by the removal of Pacific cod, since the species relies on the cod as a major prey source for at least part of the year (NMFS 2012). The issue has been studied extensively in U.S. waters, and the extent to which the removal of Pacific cod may be a source of dietary stress to the sea lions is inconclusive. It is also unknown whether Steller sea lions are likely to have similar dietary composition on each side of the Pacific. Steller sea lion populations have increase in Alaska waters, leading the National Marine Fisheries Service to propose removing the eastern population from the Endangered Species List (NMFS 2012). There is also evidence from TINRO that Steller sea lion populations are increasing within the Russian EEZ (Burkanov and Loughlin 2005; Smirnov 2012).Because of relatively high abundance, the presence of

other gadoid fish stocks, and opportunistic dietary habits, Pacific cod should not be considered a species of exceptional ecosystem importance.

While Russia does not manage fisheries using a stated ecosystem-based approach, the science centers including TINRO gather much ecosystem data and are considering ways to better incorporate ecosystem principles into management (see, e.g., Shuntov and Radchenko 2003). There is therefore much potential for improved management and availability of information in the future.

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