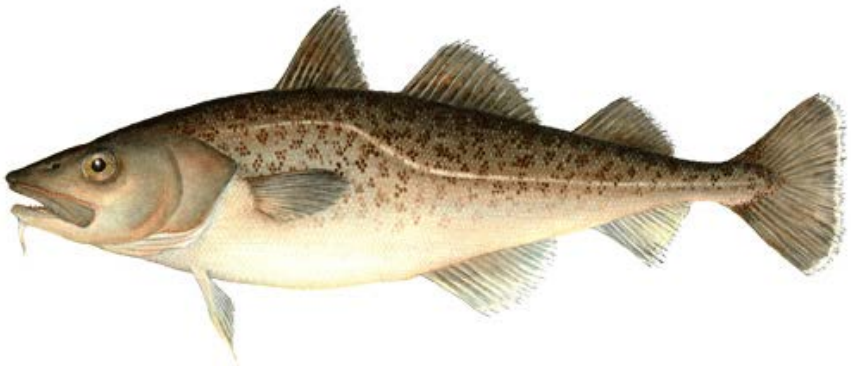
Monterey Bay Aquarium
Seafood Watch®

Pacific Cod

Gadus macrocephalus



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Japan

Bottom trawl, Boat seine net, Bottom longline, Bottom gillnet, Trap net

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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.

Seafood Watch and seafood reports are made possible through a grant from the David and Lucile Packard Foundation.

Guiding Principles

Seafood Watch® defines sustainable seafood as originating from sources, whether fished[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 Pacific cod *(Gadus macrocephalus)* commercially fished in Japan. Pacific cod is a large-bodied demersal finfish found in the North Pacific in a geographic arc from southern California north to the Bering Sea and back south to Japan. In Japan, Pacific cod have been separated into three separate management regions: the Sea of Japan, Hokkaido, and the North Pacific off of Honshu, with the majority catch supported by vessels in South Hokkaido and the North Pacific off of Honshu. Capture is achieved mostly by Danish seines, bottom trawls, bottom longlines, gillnets, and trap nets.

Throughout its range, Pacific cod is moderately resilient to fishing pressure. Annual stock assessments conducted by the incorporated Fisheries Research Agency (FRA) show that Pacific cod have been overfished for years throughout all regions in Japan, and overfishing is currently occurring or probable in all regions. But annual catch numbers and efforts have not shown any substantial long-term declines, so management reference points are possibly too conservative. The North Pacific stock assessment is robust, but stock assessments for the Sea of Japan and Hokkaido fisheries are based completely on fishery-dependent data, which could result in poorly characterized management goals.

Bycatch data is poor and not collected by any research or regulatory agency. It is highly plausible that bycatch forms a considerable portion of the fishery because the gear used is susceptible to incidental take, and there have been no known efforts to reduce bycatch. Commercial fishers are allowed to retain bycatch, so discard rates might be low. Danish seines are known to affect benthic organisms such as corals and other biogenic organisms; gillnets affect marine mammals; longlines affect seabirds; and trawl nets affect seabirds and sharks in fisheries throughout the world. Because these vulnerable species are susceptible to catch by the major gear types used in the Pacific cod fishery and there are no regulations to reduce bycatch, it is a high concern for all these gear types. Trap nets generally have low unintended catch rates and minimal seafloor impact, so their effect on species is believed to be a low concern.

Pacific cod is managed by the Fisheries Agency (FA) of the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF). The FA has not implemented any ACL (annual catch limits) to prevent further overfishing of the species. Bottom trawling and Danish seining have been banned in all coastal areas of Japan to protect benthic habitats. The moratorium for bottom trawling extends the entire length of Japan's Exclusive Economic Zone (EEZ) in much of Northern Honshu. Seasonal prohibitions also exist for gillnets at several Pacific cod nursing grounds in the North Pacific. The effectiveness of these moratoriums is unclear, and the lack of general fisheries management is especially alarming because the species is likely over-exploited.

The effects of this fishery on the substrate remain unclear, though the fishing moratoriums afford a great deal of protection for deep-sea habitats against bottom trawling and for nearshore habitats against bottom trawling and Danish seines. Data on substrate compositions are sparse, and the only known deep-sea coral habitats are found off of west Hokkaido, where they are partially shielded from

bottom trawling and Danish seines. Kelp beds are protected from trawling and seining as a result of the moratoriums, and gillnetting likely occurs in water too deep for kelp beds.

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: North Pacific Japan: Tohoku region North Pacific - Trawl, Bottom	Green (3.41)	Red (2.16)	Red (1.00)	Yellow (2.74)	**Avoid (2.120)**
Pacific cod: North Pacific Japan: Tohoku region North Pacific - Seine Net, Boat	Green (3.41)	Yellow (2.64)	Red (1.00)	Yellow (3.12)	**Avoid (2.304)**
Pacific cod: North Pacific Japan: Tohoku region North Pacific - Longline, Bottom	Green (3.41)	Critical (0.00)	Red (1.00)	Yellow (3.00)	**Avoid (0.000)**
Pacific cod: North Pacific Japan: Tohoku region North Pacific - Gillnet, Bottom	Green (3.41)	Critical (0.00)	Red (1.00)	Yellow (3.12)	**Avoid (0.000)**
Pacific cod: West Hokkaido Hokkaido Mgmt. region Sea of Japan - Seine Net, Boat	Red (1.73)	Red (1.41)	Red (1.00)	Yellow (2.60)	**Avoid (1.588)**
Pacific cod: West Hokkaido Hokkaido Mgmt. region Sea of Japan - Gillnet, Bottom	Red (1.73)	Critical (0.00)	Red (1.00)	Yellow (2.45)	**Avoid (0.000)**
Pacific cod: West Hokkaido Hokkaido Mgmt. region Sea of Japan - Longline, Bottom	Red (1.73)	Red (2.16)	Red (1.00)	Yellow (2.45)	**Avoid (1.740)**
Pacific cod: South Hokkaido Hokkaido Mgmt. region North Pacific - Seine Net, Boat	Red (1.73)	Yellow (2.64)	Red (1.00)	Yellow (3.12)	**Avoid (1.945)**
Pacific cod: South Hokkaido Hokkaido Mgmt. region North Pacific - Longline, Bottom	Red (1.73)	Critical (0.00)	Red (1.00)	Yellow (3.00)	**Avoid (0.000)**
Pacific cod: South Hokkaido Hokkaido Mgmt. region North Pacific - Gillnet, Bottom	Red (1.73)	Critical (0.00)	Red (1.00)	Yellow (3.12)	**Avoid (0.000)**
Pacific cod: Sea of Okhotsk Hokkaido Mgmt. region Sea of Okhotsk - Trawl, Bottom	Red (2.00)	Red (2.16)	Red (1.00)	Yellow (2.60)	**Avoid (1.830)**
Pacific cod: Sea of Okhotsk Hokkaido Mgmt. region Sea of Okhotsk - Longline, Bottom	Red (2.00)	Critical (0.00)	Red (1.00)	Yellow (3.00)	**Avoid (0.000)**

Pacific cod: Sea of Okhotsk Hokkaido Mgmt. region Sea of Okhotsk - Gillnet, Bottom	Red (2.00)	Critical (0.00)	Red (1.00)	Yellow (3.00)	**Avoid (0.000)**
Pacific cod: North Pacific Japan: Tohoku region North Pacific - Trap net	Green (3.41)	Green (3.32)	Red (1.00)	Yellow (3.12)	**Avoid (2.439)**
Pacific cod: Sea of Japan Sea of Japan Mgmt. region Sea of Japan - Seine Net, Boat	Red (1.73)	Yellow (2.64)	Red (1.00)	Yellow (3.12)	**Avoid (1.945)**
Pacific cod: Sea of Japan Sea of Japan Mgmt. region Sea of Japan - Gillnet, Bottom	Red (1.73)	Critical (0.00)	Red (1.00)	Yellow (3.00)	**Avoid (0.000)**
Pacific cod: Sea of Japan Sea of Japan Mgmt. region Sea of Japan - Trap net	Red (1.73)	Green (3.32)	Red (1.00)	Yellow (3.00)	**Avoid (2.038)**

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).

Table of Contents

Introduction

Scope of the analysis and ensuing recommendation

This report evaluates Pacific cod *(Gadus macrocephalus)* fisheries in Japan. The species is commercially fished by way of bottom trawls, Danish seines, gillnets, longlines, and trap nets in the North Pacific, the Sea of Japan, and the Sea of Okhotsk.

Overview of the species and management bodies

Pacific cod is a demersal finfish that can be found in continental shelves and in upper continental slopes throughout the North Pacific Ocean, with a limited range of approximately 34–63°N latitude (NOAA 2003). In the Northwest Pacific, Pacific cod are found in the Bering Sea and as far south as the northern Yellow Sea off Port Arthur, China (NOAA 2000). Pacific cod have been found as deep as 875 meters (m), though most adults are found between 50 and 300 m (NOAA 1988). Because Pacific cod are aggregate spawners (Garrison and Miller 1982), they are an easy fisheries target. Larvae and small juveniles are pelagic and can be found in the upper 45-meter water column with a concentrated abundance within the 15 to 30 m column (Takatsu et al. 2002). As a non-migratory species, Pacific cod are known for moving marginal distances within an area, possibly resulting in the occurrence of a number of local populations (Narimatsu 2006). Their primary diet consists of mostly decapod crustaceans and walleye pollock (Yamamura et al. 2003). In turn, they are an important prey for Steller sea lions (Sinclair and Zeppelin 2002). As a fairly long-lived species with a high fecundity rate, Pacific cod are moderately resilient to fishing pressure.

In Japan, Pacific cod populations have been identified in all waters surrounding Hokkaido and northern Honshu. The primary management body in the Japanese EEZ (Exclusive Economic Zone) is the Fisheries Agency of Japan (FA), which is a branch under the Ministry of Agriculture, Forestry and Fisheries (MAFF). The Fisheries Agency of Japan contracts out scientific research and stock assessment analysis of fisheries to the Fisheries Research Agency (FRA), which is an incorporated administrative agency specializing in the research and development of fisheries activities. The FA does not set any catch or size limits for Pacific cod, but marine protected areas have been established throughout Japan in an effort to protect benthic habitats.

Little is known about the historical significance of the Pacific cod fishery in Japan. The fishery may have begun 100 years ago (Narimatsu 2013), and the annual commercial catches during the early 1900s were likely larger than the present catches (Hoshino 2013). But the food culture dates to the first century B.C.E. the year 3 B.C.E. in Hokkaido. Fishhooks fashioned from Pacific cod bones have been found in indigenous settlements in Hokkaido, so it is likely that the fish were a significant food source for the aborigines. Starting as early as the 1400s, Hokkaido's native Ainu people paid homage to imperial rulers (such as the shogun) with Pacific cod dishes. Because Pacific cod was mainly caught during the cold winters in Hokkaido, the fish could be transported south to Tokyo and Kyoto without risk of spoilage (Hoshino 2013).

Production Statistics

Pacific cod are commercially fished in the Northeast Pacific (Area 61) and the Northwest Pacific (Area 67), which accounts for the majority of the total global catch. Historically, the Japanese fisheries composed the largest share of the total global catch until over-exploitation occurred in the mid-1970s. While the Japanese fisheries have been slow to recover, Russian and Alaskan fisheries have expanded due to exceptionally strong year classes from 1977–1978 and 1982–1985 (FAO 2011). In Area 67, annual catches increased from less than 1,000 tons in 1979 to nearly 91,000 tons in 1985. In the most recent assessment in 2011, the United States led global catches of Pacific cod, accounting for more than 301,000 tons of the total global catch of just over 437,000 tons (NOAA 2011a) (FAO 2011). On the other hand, Japanese fisheries accounted for just over 47,000 tons, which is comparable to annual catches from the late 1980s (FAO 2011).

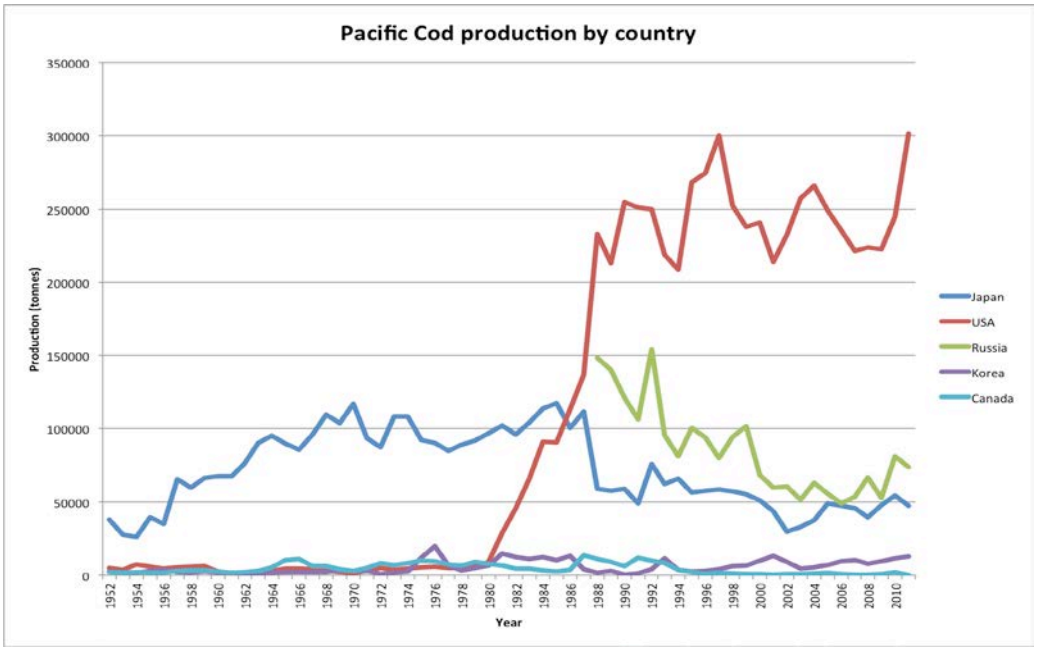


Figure 1: Annual Pacific cod production by country. The FAO has no record of Russia's catches before 1988. (FAO 2013)

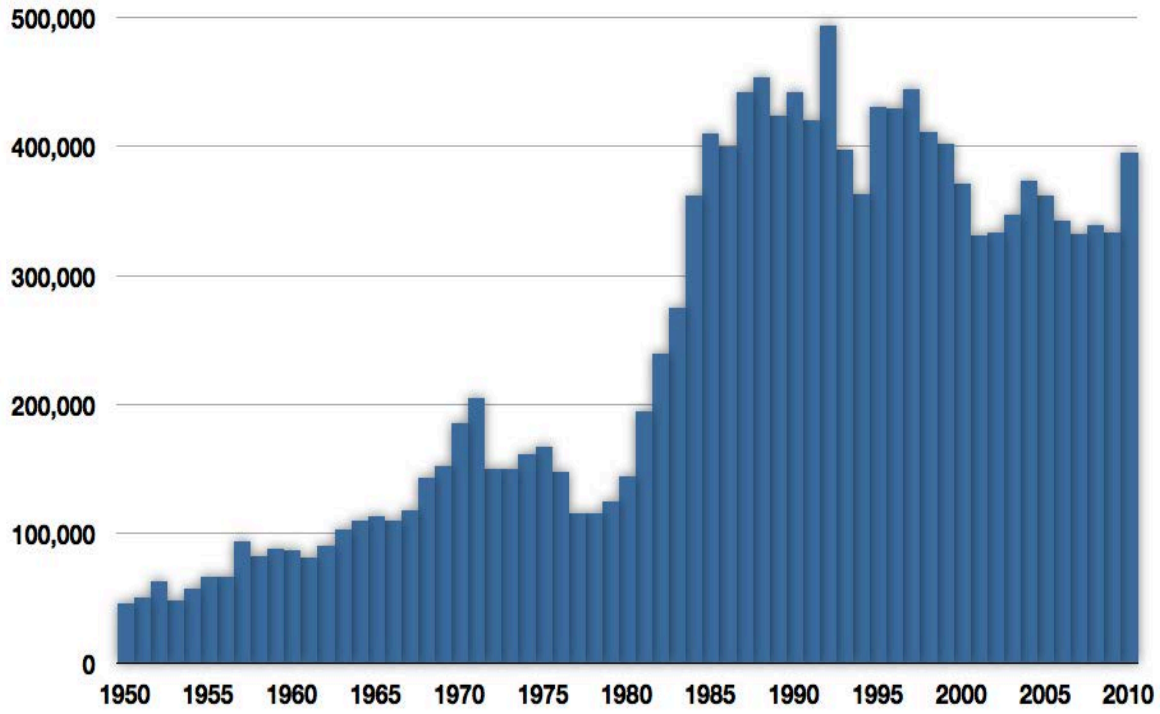


Figure 2: Annual global catches have remained relatively stable since the mid-1980s, hovering around 400,000 tons.

The FRA has categorized Pacific cod in Japan into three management regions: the North Pacific, Sea of Japan, and Hokkaido. The Hokkaido region comprises three sub-regions: South Hokkaido, West Hokkaido, and the Sea of Okhotsk. In the North Pacific management region, Pacific cod are caught primarily with bottom trawls and Danish seines, which combine for 75% of the total catch, followed by bottom longlines (18%), bottom gillnets (6%), and trap nets (<1%). In the Sea of Japan management region, Pacific cod are caught with Danish seines (52%), bottom gillnets (38%), and trap nets (10%). In South Hokkaido, Danish seines (55%) are the dominant gear type, followed by bottom longlines and bottom gillnets, which combine for 45% of the total catch. In West Hokkaido, bottom longlines and bottom gillnets combine for 80% of the total catch, followed by Danish seines (20%). And in the Sea of Okhotsk, bottom trawls (90%) are the dominant gear type, with bottom longlines and bottom gillnets composing 10% of the total catch.

Importance to the U.S./North American market

The National Marine Fisheries Service (NMFS) Office of Science and Technology database consolidates all foreign trade data for cod under a single category. It is therefore difficult to precisely distinguish between Pacific and Atlantic cod species from trade statistics. NOAA reports that 109,211,889 kilograms (kg) of “groundfish cod” were exported in 2012 from the U.S. Customs Pacific Districts (NOAA 2013a), a figure that likely approximates Pacific cod, because Atlantic cod would presumably be exported from

New England Districts. Nearly half the cod was exported to China (46.5%), followed by Japan (16.1%) and Portugal (8.7%).

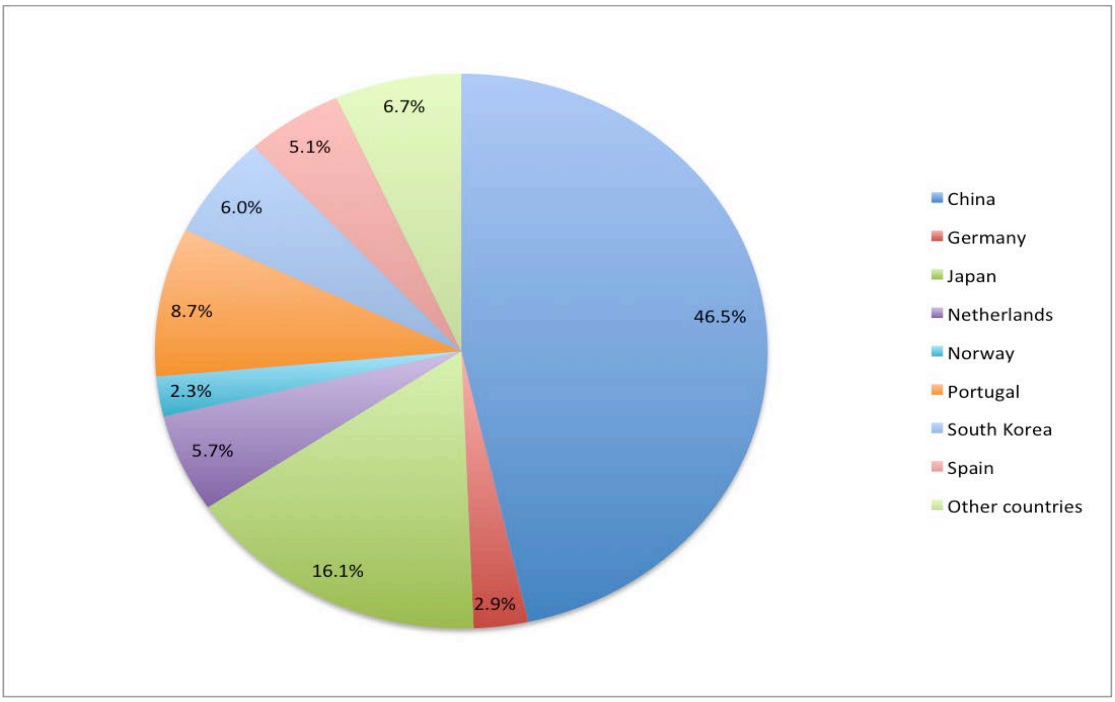


Figure 3: 2012 exports of groundfish cod from U.S. Customs Pacific Districts (NOAA 2013a)

In general, U.S. import statistics of Pacific cod are of limited value because imported packages are only required to disclose the origin of the product's "final sale" (Theisen 2009). Under this system, Pacific cod exported from Alaska to China for processing and then sent back to the United States would be categorized as an import from China. NMFS does keep records of cod imports from Japan, though there is substantial uncertainty in these numbers because pollock and hake are occasionally included. In any case, Japanese imports are negligible. Since 2006, cod imports from Japan have averaged 2,330 kg annually (NOAA 2013b), which hardly figures into the annual U.S. consumption of over 70 million kg (NOAA 2012a).

Japan exhibits one of the highest annual per capita seafood consumption rates in the world at 55.9 kg (NOAA 2011c). Because of substantial demand and the implementation of EEZs, seafood imports have far exceeded exports (De Silva and Yama 2007). Japan's Ministry of Finance consolidates most fisheries trade statistics, thus making it difficult to precisely distinguish between species including Pacific cod (JETRO 2011). Over the past few years, Japan has imported over 2.6 million tons of seafood products while exporting around half a million tons. It is therefore likely that the majority of Pacific cod captured in Japan is consumed domestically.

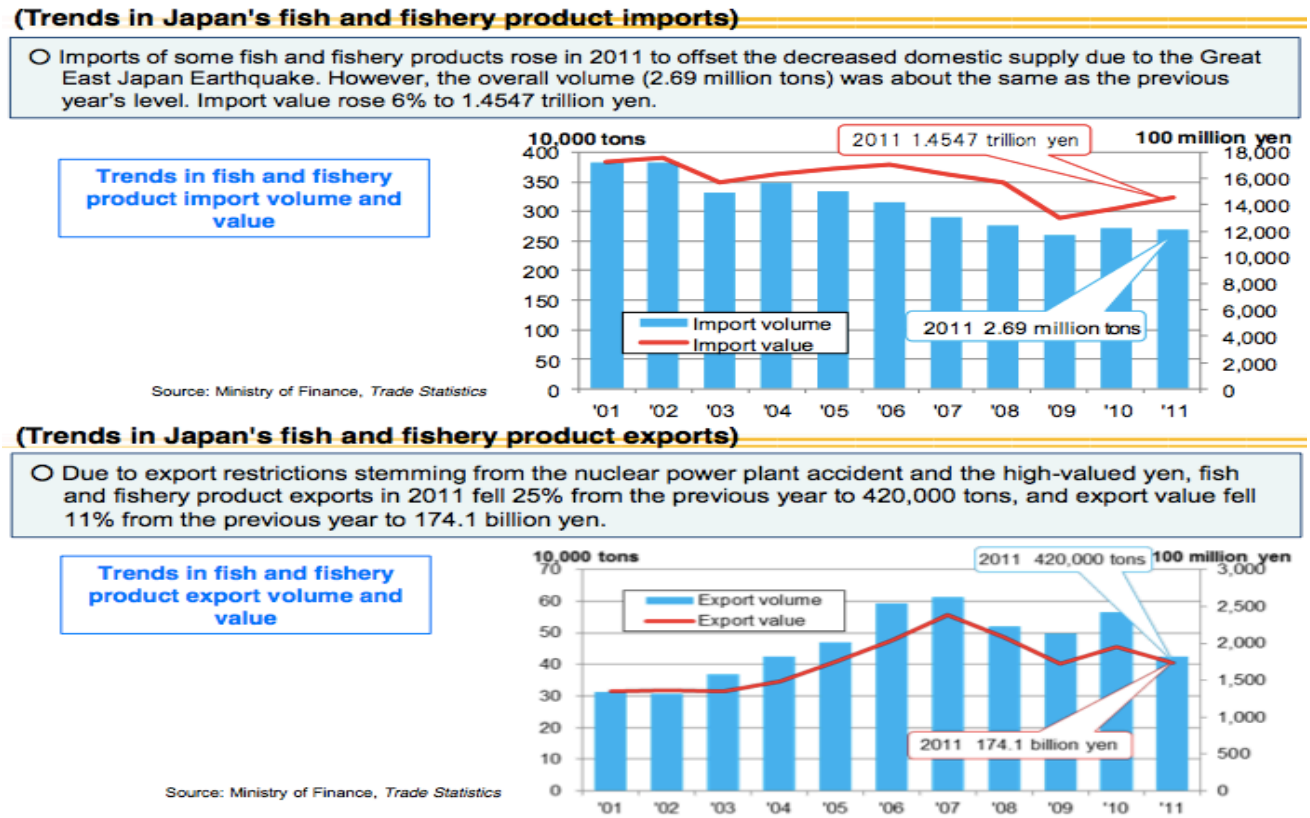


Figure 4: Taken from JFA 2011.

Common and market names

In the United States, Pacific cod is commonly marketed as “cod” and “Alaska cod.” Vernacular names include grey cod, true cod, and treska (FDA 2012). In Japan, the common and market name is *Madara*.

Primary product forms

In the U.S., Pacific cod is available as fresh or frozen fillets. Unique product forms include cod cheeks and collars (NOAA 2011b).

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: NORTH PACIFIC				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Japan: Tohoku region North Pacific Gillnet, Bottom	2.00:Medium	5.00:Very Low Concern	2.33:Moderate Concern	**Green (3.413)**
Japan: Tohoku region North Pacific Longline, Bottom	2.00:Medium	5.00:Very Low Concern	2.33:Moderate Concern	**Green (3.413)**
Japan: Tohoku region North Pacific Seine Net, Boat	2.00:Medium	5.00:Very Low Concern	2.33:Moderate Concern	**Green (3.413)**
Japan: Tohoku region North Pacific Trap net	2.00:Medium	5.00:Very Low Concern	2.33:Moderate Concern	**Green (3.413)**
Japan: Tohoku region North Pacific Trawl, Bottom	2.00:Medium	5.00:Very Low Concern	2.33:Moderate Concern	**Green (3.413)**

PACIFIC COD: SEA OF JAPAN				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Sea of Japan Mgmt. region Sea of Japan Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Sea of Japan Mgmt. region Sea of Japan Seine Net, Boat	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Sea of Japan Mgmt. region Sea of	2.00:Medium	3.00:Moderate	1.00:High	**Red (1.732)**

Japan Trap net		Concern	Concern	

PACIFIC COD: SEA OF OKHOTSK				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Hokkaido Mgmt. region Sea of Okhotsk Gillnet, Bottom	2.00:Medium	4.00:Low Concern	1.00:High Concern	**Red (2.000)**
Hokkaido Mgmt. region Sea of Okhotsk Longline, Bottom	2.00:Medium	4.00:Low Concern	1.00:High Concern	**Red (2.000)**
Hokkaido Mgmt. region Sea of Okhotsk Trawl, Bottom	2.00:Medium	4.00:Low Concern	1.00:High Concern	**Red (2.000)**

PACIFIC COD: SOUTH HOKKAIDO				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Hokkaido Mgmt. region North Pacific Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Hokkaido Mgmt. region North Pacific Longline, Bottom	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Hokkaido Mgmt. region North Pacific Seine Net, Boat	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**

PACIFIC COD: WEST HOKKAIDO				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Hokkaido Mgmt. region Sea of Japan Gillnet, Bottom	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Hokkaido Mgmt. region Sea of Japan Longline, Bottom	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**
Hokkaido Mgmt. region Sea of Japan Seine Net, Boat	2.00:Medium	3.00:Moderate Concern	1.00:High Concern	**Red (1.732)**

The Fisheries Research Agency of Japan (FRA) has categorized Pacific cod into three regions: the North Pacific (Tohoku), Sea of Japan, and Hokkaido. The Hokkaido region comprises three sub-regions: South Hokkaido, West Hokkaido, and the Sea of Okhotsk. Recent stock assessments using both scientific

monitoring surveys and commercial fishery statistics show that the Tohoku stock has rebounded to record highs after years of overfishing. The Sea of Japan and Hokkaido stocks appear to be increasing, but assessments are quantified mostly from commercial fishery statistics and catch per unit effort data. Based on present and historical management reference points, both regions have been experiencing overfishing for years. The lack of management and sound fisheries data is alarming, and it is likely that this fishery's impact on the stock is of a high concern.

Criterion 1 Assessment

PACIFIC COD: NORTH PACIFIC

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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Medium

FishBase score is 50 (Cheung et al. 2005).

Rationale:
In Japan, Pacific cod can be found in waters off northern Honshu and in all waters surrounding Hokkaido. Most of the Japanese Pacific cod commercial fishery is supported by the Hokkaido and Tohoku regions, which may house subpopulations of the same stock (Kanno et al. 2001). In the western Pacific, Pacific cod is considered to be a moderately short-lived species with a maximum age of 25 years (Munk 2001) and a maximum recorded total length of 122 cm (Theisen 2009). Because food supply, water temperature, and predation vary significantly between the regions, Pacific cod exhibit variable life spans and growth rates relative to their respective habitats. In all areas except south Hokkaido, Pacific cod have a maximum average lifespan of 8 years and a maximum average length of 81–90 cm (Narimatsu et al. 2012). Populations off southern Hokkaido live for a maximum average of 6 years and with an average maximum length of 76 cm (Chimura and Funamoto 2012).

Pacific cod are aggregate spawners, typically spawning at depths between 40 and 290 meters (m) (Shimada and Kimura 1994). In Japan, several aggregate spawning areas have been identified: Mutsu Bay off Aomori Prefecture, the northeast coast of Honshu, and all of Hokkaido's coastal areas. The spawning season takes place annually from December through March, peaking in late December through January (Hattori et al. 1992). Females are demersal egg layers with a high fecundity rate that averages 2.1 to 2.4 million eggs per adult (Poltev 2008). On average, 43% of females reach sexual maturity at age 3, and 88% reach it at age 4 (Narimatsu et al. 2010). Recruitment-per-spawner (RPS) rates vary between years, but have been in the range of 0.20–0.26 per 10,000 eggs since 2005 (Narimatsu et al. 2012).

Pacific cod in Japan are considered a non-migratory species, likely because their primary food sources are locally available year-round (Poltev 2007). Spawning areas are limited to water temperatures between 0°C and 13°C (Alderdice and Forrester 1971). Due to aggregate spawning, temperature-limiting spawning habitats, and a lack of extensive migratory dispersal, Pacific cod are an easy target species for commercial fisheries.

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.*

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

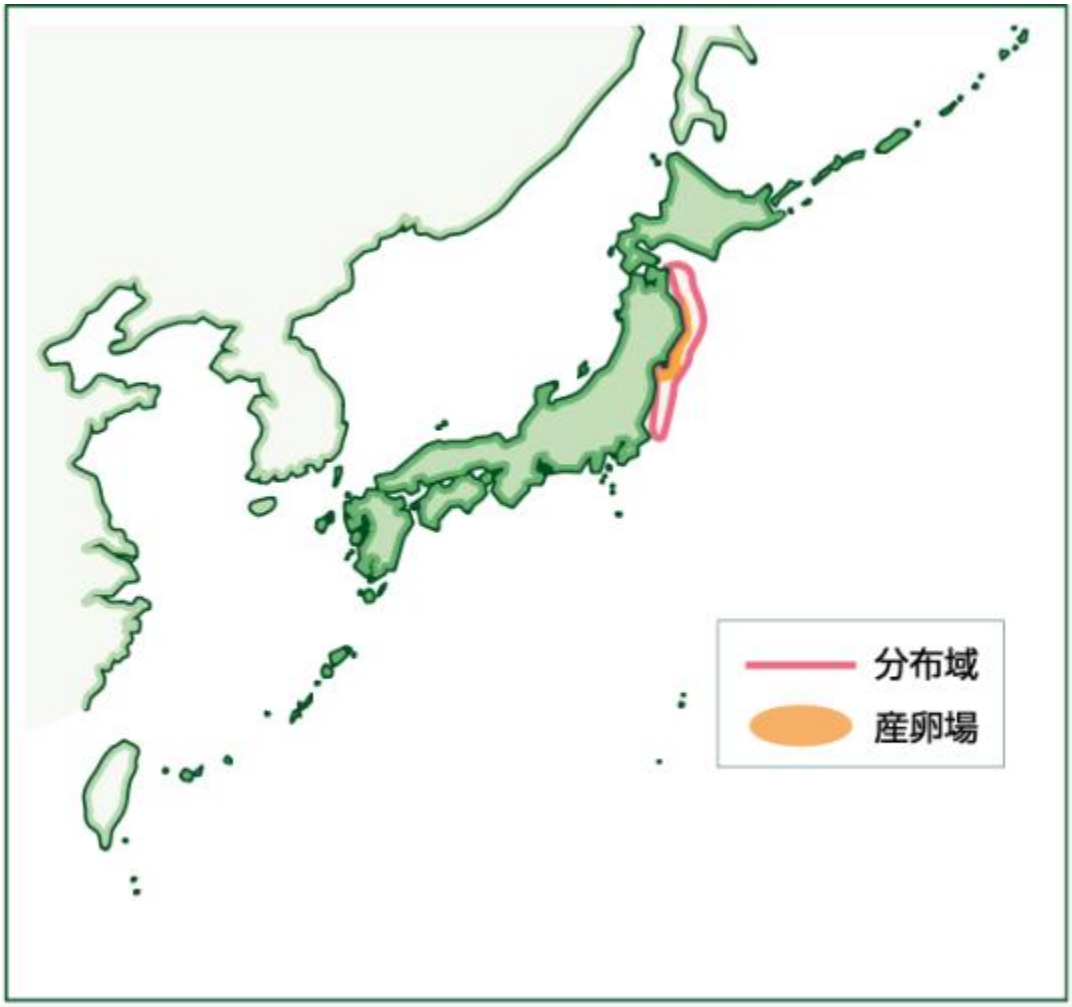
Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Very Low Concern

Out of the three regions, the Tohoku stock assessment is the only one derived from scientific research data. The FRA (Fisheries Research Agency of Japan) uses a reference point based on SPR (spawning potential ratio) of $20\%_{SPR}$ for Pacific cod. The percentage SPR is the ratio of the total biomass of fish that exist because of the fishery to the total biomass that would exist without a fishery (Wallace and Fletcher 2001). Since 1975, data on catch per unit effort (CPUE) have been collected for Danish seines and bottom trawls, which account for 70%–85% of the fishery. Since 1996, 75%–100% of the catch has been between 1 and 3 years old, suggesting that the fishery is targeting mostly immature fish. The CPUE has remained low from 1975 through 1997, but with dramatic increases during the past decade. Although CPUE statistics have not shown any long-term declines, the stock assessment from 2011 estimated SPR at 14.3%, which is well below the limit reference point of 20% (Narimatsu et al. 2012). The management reference point has been derived from annual survey data since 1995 by trawling at dozens of research sampling points down the coastline at depths of 150–900 m in October and November, thus making it a better indicator of the stock status than CPUE. The total fish biomass, which was estimated to be only 63,942 tons (t) in 2011 (Narimatsu et al. 2012), has now rebounded to a historic high of 278,945 t (Narimastsu et al. 2014). This could be the result of decreased fishing pressure caused by the Great East Japan Earthquake (2011), which crippled this region's fishing fleets. Nonetheless, the stock abundance is at an all-time high, and is therefore a very low concern.

Rationale:
The Tohoku region is off the northeast coast of Honshu and completely within the Northwest Pacific Ocean. The FRA has grouped all Pacific cod living from the tip of Cape Shiriyazaki of Aomori Prefecture down to Ibaraki Prefecture near Tokyo Narita International Airport under the Tohoku region. The northern portion shares a border with the south Hokkaido Pacific cod stock. Recruitment rates are calculated annually and have remained stable since 2005. The FRA uses a length-based yield per recruitment model to estimate sexual maturity and egg production.



The area outlined in red is where Pacific cod are found. The orange area is the known spawning habitat.

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.*

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The FRA has calculated acceptable biological catch (ABC) limits and ABC targets for the past 11 years. Although ABC reference points are calculated similarly to the ABC implemented by fisheries management in the United States, an ABC is not a binding catch limit in the Japanese fishery—just a recommendation. Despite recent stock assessments that show that overfishing is not currently occurring, no policies are in place to curb future overfishing. The future of the Tohoku region Pacific cod could be at risk if pre-earthquake fishing pressure recovers; thus it warrants a moderate concern.

The FA is mandated by law to establish ABC reference points for this fishery. These reference points may be used as recommendations for future fisheries management practices, but are not binding catch limits. In every year except 2003, 2004, and 2008, annual catches surpassed the recommended ABC limit. The most severe year was 2005, when the catch exceeded the ABC limit by 170%. In 2009 and 2010, respective total catches exceeded the ABC limit by 99% and 111% and accounted for an estimated 63% and 59% mortality rate of the entire population (Narimatsu et al. 2012). 2011 fishing mortality returned to within management thresholds, but this could be due to the Great East Japan Earthquake of 2011 that severely crippled the Fukushima and Miyagi Prefectures' fishing fleets (JFA 2011), not the implementation of effective fishing regulations. In 2012, fishing mortality fell below the ABC target limit (Narimastsu et al. 2014).

- *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.

PACIFIC COD: SEA OF JAPAN

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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Medium

FishBase score is 50 (Cheung et al. 2005).

Rationale:
In Japan, Pacific cod can be found in waters off northern Honshu and in all waters surrounding Hokkaido. Most of the Japanese Pacific cod commercial fishery is supported by the Hokkaido and Tohoku regions, which may house subpopulations of the same stock (Kanno et al. 2001). In the western Pacific, Pacific cod is considered to be a moderately short-lived species with a maximum age of 25 years (Munk 2001) and a maximum recorded total length of 122 cm (Theisen 2009). Because food supply, water temperature, and predation vary significantly between the regions, Pacific cod exhibit variable life spans and growth rates relative to their habitats. In all areas except south Hokkaido, Pacific cod have a maximum average lifespan of 8 years and a maximum average length of 81–90 cm (Narimatsu et al. 2012). Populations off southern Hokkaido live for a maximum average of 6 years and with an average maximum length of 76 cm (Chimura and Funamoto 2012).

Pacific cod are aggregate spawners, typically spawning at depths between 40 and 290 m (Shimada and Kimura 1994). In Japan, several aggregate spawning areas have been identified: Mutsu Bay off Aomori Prefecture, the northeast coast of Honshu, and all of Hokkaido's coastal areas. The spawning season takes place annually from December through March, peaking in late December through January (Hattori et al. 1992). Females are demersal egg layers with a high fecundity rate that averages 2.1 to 2.4 million eggs per adult (Poltev 2008). On average, 43% of females reach sexual maturity at age 3, and 88% reach it at age 4 (Narimatsu et al. 2010). Recruitment-per-spawner (RPS) rates vary between years, but have been in the range of 0.20–0.26 per 10,000 eggs since 2005 (Narimatsu et al. 2012).

Pacific cod in Japan are considered a non-migratory species, likely because their primary food sources are locally available year-round (Poltev 2007). Spawning areas are limited to water temperatures between 0°C and 13°C (Alderdice and Forrester 1971). Due to aggregate spawning, temperature-limiting spawning habitats, and a lack of extensive migratory dispersal, Pacific cod are an easy target species for commercial fisheries.

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.*

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderate Concern

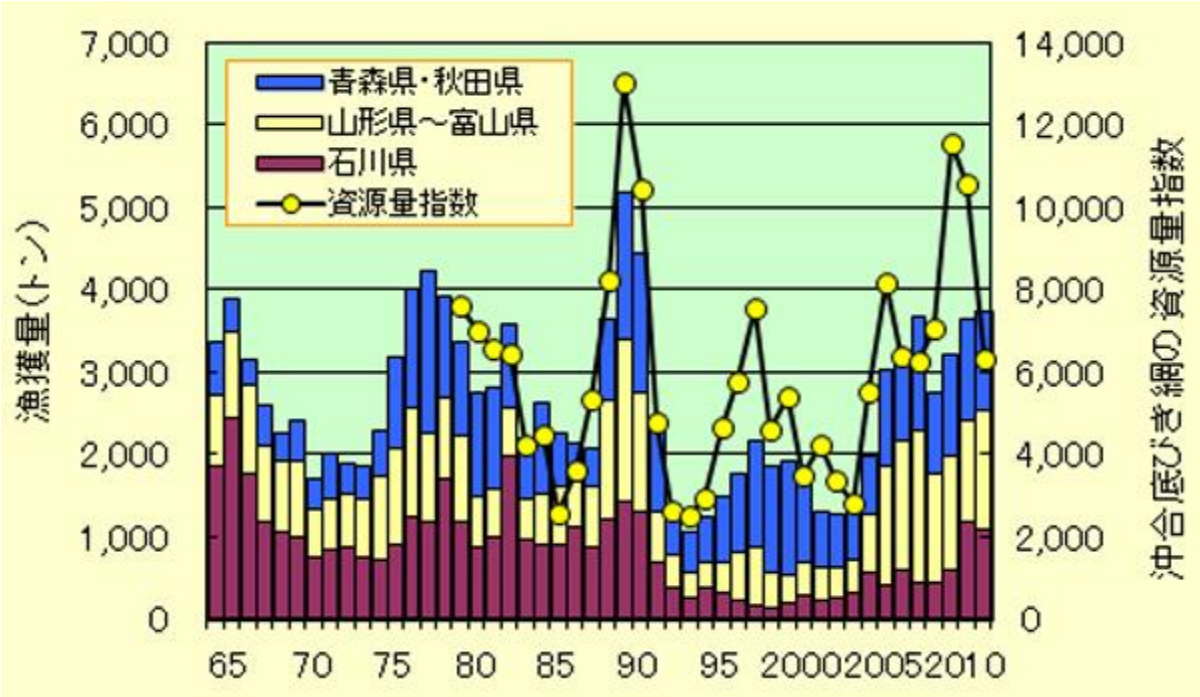
Formal population assessments are not conducted for Pacific Cod in this region. Instead, scientists use data on catch per unit effort (CPUE) from the commercial fishery to determine abundance. The FRA has given a flat but stable outlook for the Sea of Japan Pacific cod stock, signifying that abundance is stable without a noticeable trend. Based on the absence of long-term declines in CPUE levels, the Pacific cod population appears to be healthy. But only about 35% of the fishery is accounted for with CPUE data (Goto and Fujiwara 2012), so the stock status is far from complete and cannot be deemed as a "low concern."

Rationale:
The Sea of Japan Pacific cod stock extends from the northwestern coastline of Aomori Prefecture down to the Oki Islands off the coast of Tottori Prefecture, which is considered the southern boundary of the Pacific cod's range. The northern area is bordered by both the south and west Hokkaido sub-regions. Because there is no known critical spawning area for Pacific cod in the Sea of Japan region, the fishery is thought to be supplied by both the south and west Hokkaido sub-region stocks. Although it contains by far the smallest Pacific cod fishery among the three regions, the Sea of Japan has the oldest record of catch data, dating to 1964.

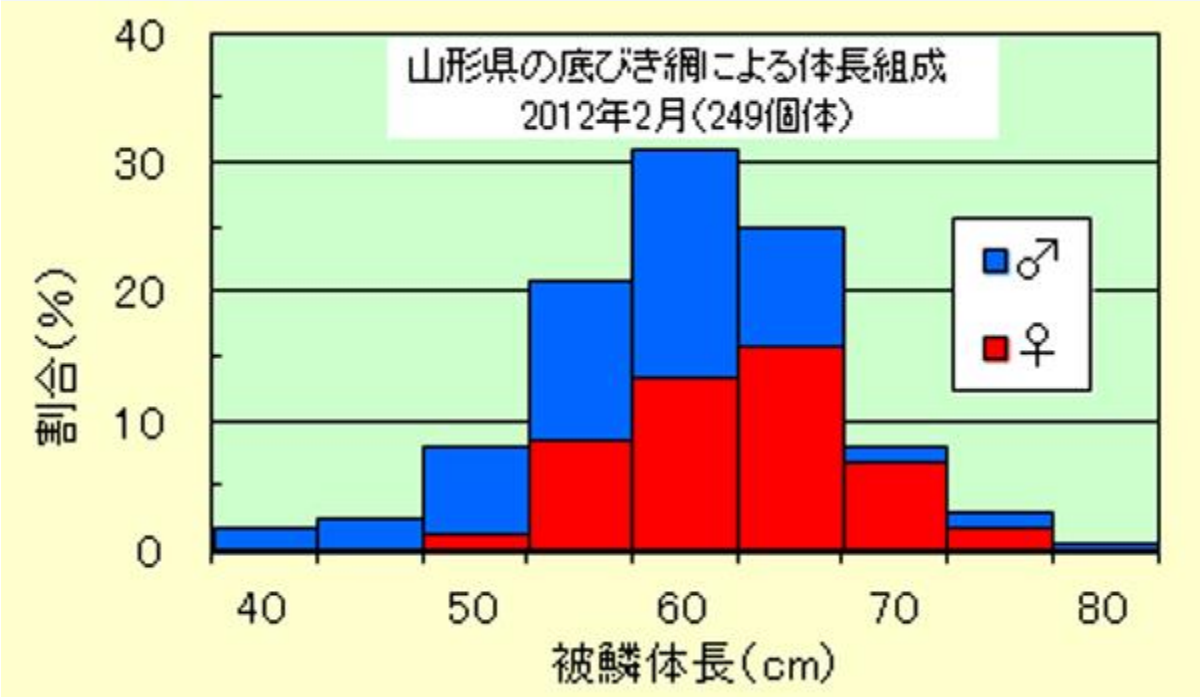
CPUE has been collected since 1979 for Danish seines reporting to the FA throughout the entire region. There have been no long-term reductions in CPUE numbers since inception, and CPUE has remained steadily proportional to total catches. But Danish seines reporting to the FA only account for about 20% of the total fishery, and the FRA has not determined if there is any hyperstability. Starting in 1997, the FRA began collecting more comprehensive annual CPUE data for Danish seines reporting to Yamagata Prefecture, which has accounted for about 15% of the total fishery. CPUE numbers for Yamagata Prefecture have not undergone any long-term decreases and has been rising over the past few years. To

determine the presence of hyperstability, the FRA has analyzed an annual subsample of a couple of hundred fish during the peak commercial Pacific cod fishing season in January. The analyses have shown no gender biases, and nearly all the fish have fallen within the 55–75 cm length range.

The area outlined in red is where Pacific cod are found. There is no known spawning habitat in this region.



The bars are the annual total catches in tons in the Sea of Japan (left vertical axis). Blue bars are catches reported from Aomori and Akita Prefectures. Yellow bars are catches reported from Yamagata to Toyama Prefectures. Magenta bars are catches reported from Ishikawa Prefecture. Yellow circles are Danish seine annual catch efforts in number of nets set (right vertical axis).



General catch composition of Danish seines reporting to Yamagata Prefecture. Blue bars are male fish and red bars are female fish. Horizontal axis represents fish length in centimeters and vertical axis represents percent of the total

subsample of 249 fish from February 2012.

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.*

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

High Concern

The FRA has calculated acceptable biological catch (ABC) limits and ABC targets for the past 11 years. Although ABC reference points are calculated similarly to the ABC implemented by fisheries management in the United States, an ABC is not a binding catch limit in the Japanese fishery—just a recommendation. In every of these years except 2012, fishing mortality has exceeded the ABC limit. The FRA has recommended decreasing fishing mortality to prevent overfishing, but no regulatory measures have been implemented. Although the most recent stock assessment in 2012 showed that total catch finally fell below the ABC target (Goto and Fujiwara 2014), the lack of effective management results in a

high concern for Pacific cod caught in the Sea of Japan region.

PACIFIC COD: SEA OF OKHOTSK

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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Medium

FishBase score is 50 (Cheung et al. 2005).

Rationale:
In Japan, Pacific cod can be found in waters off northern Honshu and in all waters surrounding Hokkaido. Most of the Japanese Pacific cod commercial fishery is supported by the Hokkaido and Tohoku regions, which may house subpopulations of the same stock (Kanno et al. 2001). In the western Pacific, Pacific cod is considered to be a moderately short-lived species with a maximum age of 25 years (Munk 2001) and a maximum recorded total length of 122 cm (Theisen 2009). Because food supply, water temperature, and predation vary significantly between the regions, Pacific cod exhibit variable life

spans and growth rates relative to their habitats. In all areas except south Hokkaido, Pacific cod have a maximum average lifespan of 8 years and a maximum average length of 81–90 cm (Narimatsu et al. 2012). Populations off southern Hokkaido live for a maximum average of 6 years and with an average maximum length of 76 cm (Chimura and Funamoto 2012).

Pacific cod are aggregate spawners, typically spawning at depths between 40 and 290 m (Shimada and Kimura 1994). In Japan, several aggregate spawning areas have been identified: Mutsu Bay off Aomori Prefecture, the northeast coast of Honshu, and all of Hokkaido's coastal areas. The spawning season takes place annually from December through March, peaking in late December through January (Hattori et al. 1992). Females are demersal egg layers with a high fecundity rate that averages 2.1 to 2.4 million eggs per adult (Poltev 2008). On average, 43% of females reach sexual maturity at age 3, and 88% reach it at age 4 (Narimatsu et al. 2010). Recruitment-per-spawner (RPS) rates vary between years, but have been in the range of 0.20–0.26 per 10,000 eggs since 2005 (Narimatsu et al. 2012).

Pacific cod in Japan are considered a non-migratory species, likely because their primary food sources are locally available year-round (Poltev 2007). Spawning areas are limited to water temperatures between 0°C and 13°C (Alderdice and Forrester 1971). Due to aggregate spawning, temperature-limiting spawning habitats, and a lack of extensive migratory dispersal, Pacific cod are an easy target species for commercial fisheries.

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.*

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Low Concern

The Sea of Okhotsk sub-region Pacific cod appears to be healthy and abundant (estimated by the FRA exclusively with CPUE statistics), and the FRA has projected future increases in fish numbers. Although 90% of the fishery has been accounted for by CPUE, the Sea of Okhotsk Pacific cod fishery lacks a full quantitative stock assessment. As a result, the population can be deemed only as a “low concern.”

Rationale:

The Sea of Okhotsk sub-region is located off northeast Hokkaido and extends from the eastern seaboard of Wakkanai City down to the Shiretoko Peninsula. The FRA has identified a Pacific cod critical spawning habitat within the sub-region that runs from east Wakkanai down to Monbetsu City. Of the Pacific cod commercial fishing, 90% is done by way of bottom trawling, and the FRA has recorded CPUE data since 1985. There have been no long-term declines in CPUE numbers, which have remained proportional to catch numbers. Abashiri, which is the largest coastal city in the sub-region, began collecting annual age statistics for catches in 2006. Since data collection began, 65%–85% of the catch has consistently comprised 2- to 3-year-old fish (Chimura and Funamoto 2012), suggesting that immature fish make up a significant portion of the total catch.

The area outlined in red is where Pacific cod are found. The orange areas are known spawning habitats.

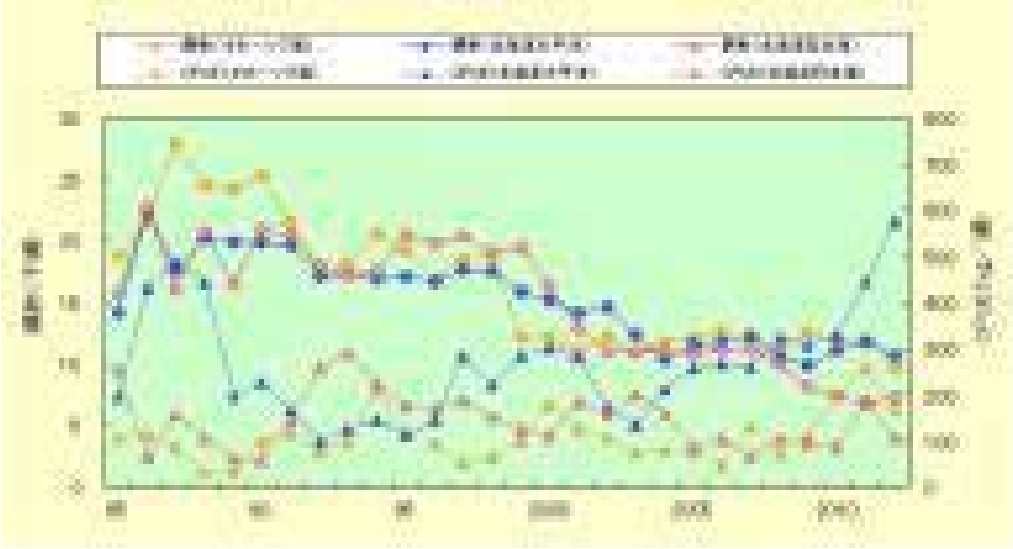


Chart depicting the total catch (colored circles) and CPUE (colored triangles) per sub-region in Hokkaido. The Sea of Okhotsk sub-region is in orange, South sub-region in blue, and West sub-region in red.

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.*

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

High Concern

The FRA has consolidated the three Hokkaido sub-regions to establish one ABC (acceptable biological catch) reference point for the entire Hokkaido prefecture. The ABC reference points have been established annually since 2003. Although ABC reference points are calculated similarly to the ABC implemented by fisheries management in the United States, an ABC is not a binding catch limit in the Japanese fishery—just a recommendation. The ABC limits were exceeded every year except 2003 and 2004. But 2003 and 2004 fishing mortality still surpassed the ABC targets by about 17% and 8.5%, respectively. The most severe year was 2005, when fishing mortality exceeded the ABC limit by 23%. Because no management initiatives have been implemented to bring fishing mortality down to the ABC reference points, fishing mortality is deemed to be a high concern.

Rationale:
The FRA acknowledged that there is a degree of uncertainty in their ABC limits and targets because they are based on stock assessments from the previous 3 years, rather than fishery-independent data (Narimatsu 2013) as in the North Pacific region. CPUE statistics appear to be sound, so there is a chance that ABC limits may be set too low.

PACIFIC COD: SOUTH HOKKAIDO

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Medium

FishBase score is 50 (Cheung et al. 2005).

Rationale:
In Japan, Pacific cod can be found in waters off northern Honshu and in all waters surrounding Hokkaido. Most of the Japanese Pacific cod commercial fishery is supported by the Hokkaido and Tohoku regions, which may house subpopulations of the same stock (Kanno et al. 2001). In the western Pacific, Pacific cod is considered to be a moderately short-lived species with a maximum age of 25 years (Munk 2001) and a maximum recorded total length of 122 cm (Theisen 2009). Because food supply, water temperature, and predation vary significantly between the regions, Pacific cod exhibit variable life spans and growth rates relative to their habitats. In all areas except south Hokkaido, Pacific cod have a maximum average lifespan of 8 years and a maximum average length of 81–90 cm (Narimatsu et al. 2012). Populations off southern Hokkaido live for a maximum average of 6 years and with an average maximum length of 76 cm (Chimura and Funamoto 2012).

Pacific cod are aggregate spawners, typically spawning at depths between 40 and 290 m (Shimada and Kimura 1994). In Japan, several aggregate spawning areas have been identified: Mutsu Bay off Aomori Prefecture, the northeast coast of Honshu, and all of Hokkaido's coastal areas. The spawning season takes place annually from December through March, peaking in late December through January (Hattori et al. 1992). Females are demersal egg layers with a high fecundity rate that averages 2.1 to 2.4 million eggs per adult (Poltev 2008). On average, 43% of females reach sexual maturity at age 3, and 88% reach it at age 4 (Narimatsu et al. 2010). Recruitment-per-spawner (RPS) rates vary between years, but have been in the range of 0.20–0.26 per 10,000 eggs since 2005 (Narimatsu et al. 2012).

Pacific cod in Japan are considered a non-migratory species, likely because their primary food sources are locally available year-round (Poltev 2007). Spawning areas are limited to water temperatures between 0°C and 13°C (Alderdice and Forrester 1971). Due to aggregate spawning, temperature-limiting spawning habitats, and a lack of extensive migratory dispersal, Pacific cod are an easy target species for commercial fisheries.

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.*

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Moderate Concern

Although the FRA has not established management reference points for this stock, a scientific stock assessment was performed covering data from 1994 to 2000 for a portion of the stock region, and found that the average %SPR was well below the critical limit of 20% (Ueda and Matsuishi 2005). But biomass has increased since 2000, and CPUE data, which covers the Danish seine portion of the fishery (about 50%–60%), suggests that the stock is healthy and abundant. Although the population appears to be currently increasing, the status of the population is essentially unknown because of conflicting information between the latest stock assessment and CPUE data; the lack of a reliable, up-to-date, quantitative stock assessment; and because significant portions of this fishery are not accounted for by CPUE data. This results in a rank of moderate concern for this fishery.

Rationale:
The south Hokkaido sub-region spans the eastern seaboard of Matsumae Peninsula east to the Nemuro Peninsula. Mutsu Bay and the Tsugaru Straits (the sole body of water between the northern tip of Honshu and the southern tip Hokkaido) are considered part of the south Hokkaido sub-region. A stock assessment was performed on annual catch data from 1994 to 2000 (Ueda and Matsuishi 2005). The stock assessment covered only a small portion of the entire sub-region: between the northern tip of Honshu and south Hokkaido (Ueda et al. 2004) rather than the entire south Hokkaido sub-region defined by the FRA. The study found that the annual %SPR fell between 5.1% and 19.7%, with an average of 11.7%, which is well below the critical limit of 20%. But biomass from 1994 to 2000 increased, which the authors attributed to recruitment increases.

Regardless, the authors believe that both yield and spawning biomass would have increased if the weight at first capture had been heavier. Biomass between 1994 and 2000 has only been calculated through virtual population analysis, and the most recent tally in 2000 estimated biomass at 7,908 tons (t) (Ueda et al. 2004). The sub-region contains by far the largest Pacific cod commercial fishery in Hokkaido, with catches that surpass the Sea of Okhotsk and west Hokkaido combined. The FRA has identified a wealth of critical spawning habitats in Mutsu Bay, the Tsugaru Straits, Uchiura Bay, and the entire coastal section off southeast Hokkaido.

About 50%–60% of the Pacific cod commercial fishery is caught with Danish seines, and the other 40%–50% by demersal longlines and bottom gillnets. Since 1985, the FRA has collected total catch numbers for all fishing gears, and CPUE data for Danish seines. There have been no long-term declines in CPUE numbers, which have remained proportional to catch numbers. The city of Kushiro, which is a major fishing port in the sub-region, has collected annual age statistics for catches since 1995. The majority of the catch has always comprised 1 to 3-year-old fish (Chimura and Funamoto 2012), suggesting that immature fish make up a significant portion of the total catch. Based on annual Danish seine CPUE statistics since 1985, the Pacific cod population in the Sea of Okhotsk sub-region appears to be healthy and abundant. The FRA has given a positive outlook for the population while projecting increases in Pacific cod numbers. But only 50%–60% of the fishery is accounted for by CPUE, so a significant portion of the stock status remains unaccounted for. Furthermore, previous stock assessment data has shown that overfishing occurred between 1994 and 2000 (Ueda and Matsuishi 2005).

The area outlined in red is where Pacific cod are found. The orange areas are known spawning habitats.

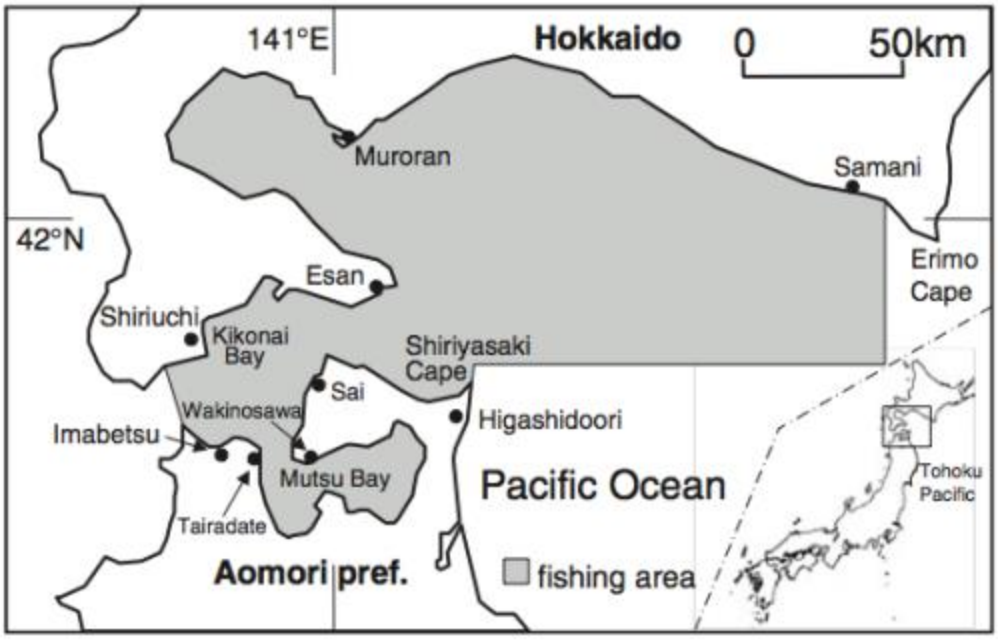


Fig. 1 Fishing area southern Hokkaido Aomori, Japan.

The south Hokkaido fishing region that was utilized by Ueda et al. 2004 for the stock assessment between 1994 and 2000. Note that this area only covers a small portion of the entire South Hokkaido sub-region defined by the FRA.

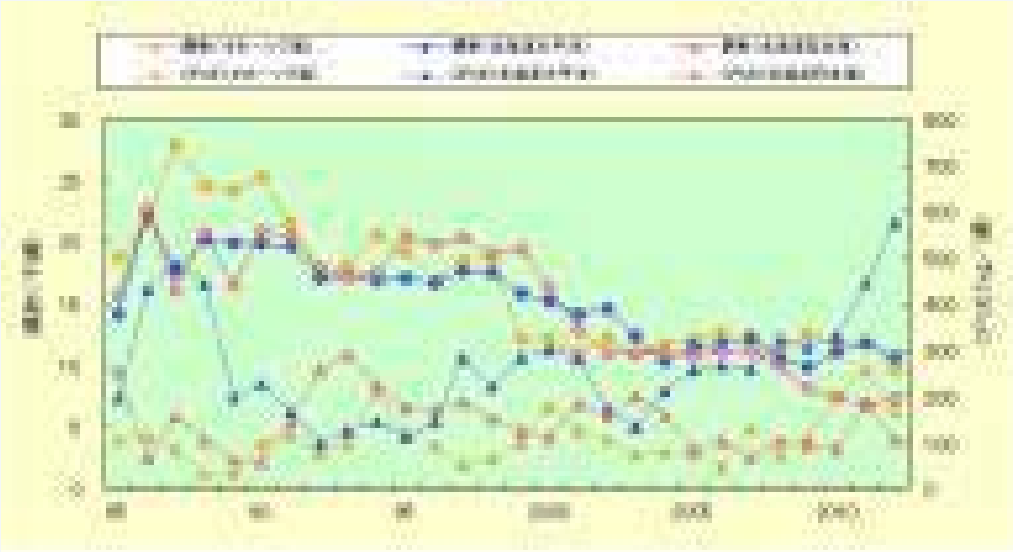


Chart depicting the total catch (colored circles) and CPUE (colored triangles) per sub-region in Hokkaido. The Sea of Okhotsk sub-region is in orange, South sub-region in blue, and West sub-region in red.

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.*

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

High Concern

The FRA has consolidated the three Hokkaido sub-regions to establish one ABC (acceptable biological catch) reference point for the entire Hokkaido prefecture. The ABC reference points have been established annually since 2003. Although ABC reference points are calculated similarly to the ABC implemented by fisheries management in the United States, an ABC is not a binding catch limit in the Japanese fishery—just a recommendation. The ABC limits were exceeded every year except 2003 and 2004. But 2003 and 2004 fishing mortality still surpassed the ABC targets by about 17% and 8.5%, respectively. The most severe year was 2005, when fishing mortality exceeded the ABC limit by 23%. Because no management initiatives have been implemented to bring fishing mortality down to the ABC reference points, fishing mortality is deemed to be a high concern.

Rationale:
The FRA acknowledged that there is a degree of uncertainty in their ABC limits and targets because they are based on stock assessments from the previous 3 years, rather than fishery-independent data

(Narimatsu 2013) as in the North Pacific region. CPUE statistics appear to be sound, so there is a chance that ABC limits may be set too low.

PACIFIC COD: WEST HOKKAIDO

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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Medium

FishBase score is 50 (Cheung et al. 2005).

Rationale:
In Japan, Pacific cod can be found in waters off northern Honshu and in all waters surrounding Hokkaido. Most of the Japanese Pacific cod commercial fishery is supported by the Hokkaido and Tohoku regions, which may house subpopulations of the same stock (Kanno et al. 2001). In the western Pacific, Pacific cod is considered to be a moderately short-lived species with a maximum age of 25 years (Munk 2001) and a maximum recorded total length of 122 cm (Theisen 2009). Because food supply,

water temperature, and predation vary significantly between the regions, Pacific cod exhibit variable life spans and growth rates relative to their respective habitats. In all areas except south Hokkaido, Pacific cod have a maximum average lifespan of 8 years and a maximum average length of 81–90 cm (Narimatsu et al. 2012). Populations off southern Hokkaido live for a maximum average of 6 years and with an average maximum length of 76 cm (Chimura and Funamoto 2012).

Pacific cod are aggregate spawners, typically spawning at depths between 40 and 290 m (Shimada and Kimura 1994). In Japan, several aggregate spawning areas have been identified: Mutsu Bay off Aomori Prefecture, the northeast coast of Honshu, and all of Hokkaido's coastal areas. The spawning season takes place annually from December through March, peaking in late December through January (Hattori et al. 1992). Females are demersal egg layers with a high fecundity rate that averages 2.1 to 2.4 million eggs per adult (Poltev 2008). On average, 43% of females reach sexual maturity at age 3, and 88% reach it at age 4 (Narimatsu et al. 2010). Recruitment-per-spawner (RPS) rates vary between years, but have been in the range of 0.20–0.26 per 10,000 eggs since 2005 (Narimatsu et al. 2012).

Pacific cod in Japan are considered a non-migratory species, likely because their primary food sources are locally available year-round (Poltev 2007). Spawning areas are limited to water temperatures of between 0°C and 13°C (Alderdice and Forrester 1971). Due to aggregate spawning, temperature-limiting spawning habitats, and a lack of extensive migratory dispersal, Pacific cod are an easy target species for commercial fisheries.

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.*

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Moderate Concern

Without conducting quantitative stock assessments, the FRA utilizes CPUE numbers to determine the stock status. CPUE is only calculated for Danish seines, which comprise 15%–25% of this fishery. Based on Danish seine CPUE statistics, the 15%–25% portion of the west Hokkaido Pacific cod stock is healthy and abundant. The FRA has given a positive outlook for the population while projecting increases in Pacific cod numbers. But CPUE covers only a small portion of this fishery, so the majority of the stock remains unaccounted for. Thus, the Pacific cod fishery in west Hokkaido is deemed as a "moderate concern."

Rationale:

The west Hokkaido sub-region runs from the western seaboard of Matsumae Peninsula up to the city of Wakkanai, which is the northern-most city in Hokkaido. The FRA has identified a large Pacific cod critical spawning habitat off the western coast of Wakkanai. About 15%–25% of the fishery use Danish seines, and 75%–85% use demersal longlines and bottom gillnets. Since 1985, the FRA has collected total catch numbers for all gear types and CPUE data for Danish seines. There have been no long-term declines in CPUE numbers, which have remained proportional to catch numbers. The cities of Wakkanai and Otaru, which are by far the largest fishing ports in the sub-region, began collecting annual age statistics for catches in 2002 and 1998, respectively. In Otaru, 80%–90% of the catch has nearly always consisted of 3 to 6-year-old fish. On the other hand, 80%–90% of Wakkanai's catches have always consisted of 2 to 3-year-old fish (Chimura and Funamoto 2012).

The area outlined in red is where Pacific cod are found. The orange areas are known spawning habitats.

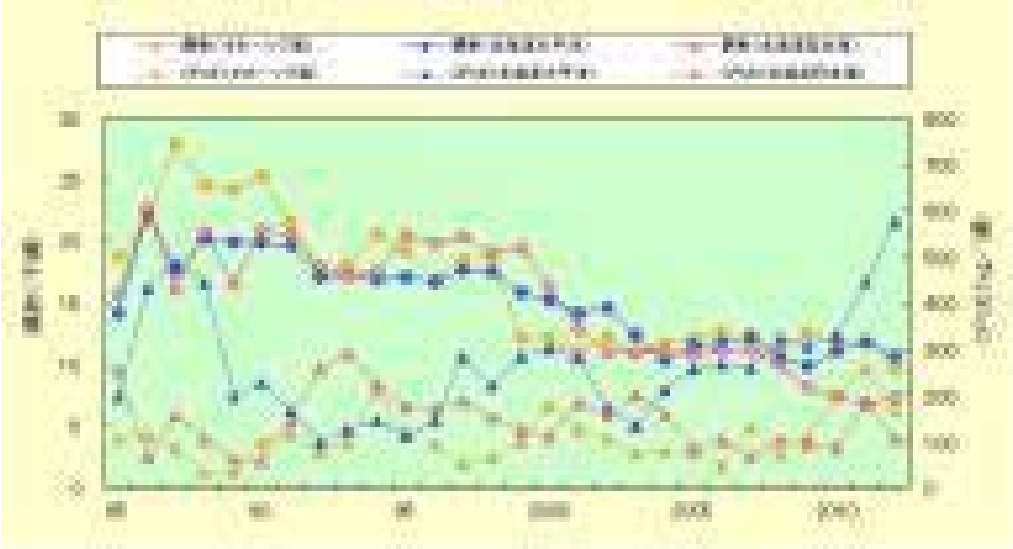


Chart depicting the total catch (colored circles) and CPUE (colored triangles) per sub-region in Hokkaido. The Sea of Okhotsk sub-region is in orange, South sub-region in blue, and West sub-region in red.

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.*

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

The FRA has consolidated the three Hokkaido sub-regions to establish one ABC (acceptable biological catch) reference point for the entire Hokkaido prefecture. The ABC reference points have been established annually since 2003. Although ABC reference points are calculated similarly to the ABC implemented by fisheries management in the United States, an ABC is not a binding catch limit in the Japanese fishery—just a recommendation. The ABC limits were exceeded for every year except 2003 and 2004. But 2003 and 2004 fishing mortality still surpassed the ABC targets by about 17% and 8.5%, respectively. The most severe year was 2005, when fishing mortality exceeded the ABC limit by 23%. Because no management initiatives have been implemented to bring fishing mortality down to the ABC reference points, fishing mortality is deemed to be a high concern.

Rationale:
The FRA acknowledged that there is a degree of uncertainty in their ABC limits and targets because they are based on stock assessments from the previous 3 years, rather than fishery-independent data (Narimatsu 2013) as in the North Pacific region. CPUE statistics appear to be sound, so there is a chance that ABC limits may be set too low.

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

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 B.

Pacific cod: North Pacific: Japan: Tohoku region North Pacific, Gillnet, Bottom

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

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
MAMMALS	High	2.00: High Concern	0.00: Critical	**0.000**
SEABIRDS	High	2.00: High Concern	1.00: High Concern	**1.414**
SHARKS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
PACIFIC COD: NORTH PACIFIC	Medium	5.00: Very Low Concern	2.33: Moderate	**3.413**

			Concern	

Pacific cod: North Pacific: Japan: Tohoku region North Pacific, Longline, Bottom

Subscore: 0.000 **Discard Rate: 1.00** **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**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
PACIFIC COD: NORTH PACIFIC	Medium	5.00: Very Low Concern	2.33: Moderate Concern	**3.413**

Pacific cod: North Pacific: Japan: Tohoku region North Pacific, Seine Net, Boat

Subscore: 2.644 **Discard Rate: 1.00** **C2 Rate: 2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
MAMMALS	High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
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: NORTH PACIFIC	Medium	5.00: Very Low Concern	2.33: Moderate Concern	**3.413**

Pacific cod: North Pacific: Japan: Tohoku region North Pacific, Trap net

Subscore: **3.318** **Discard Rate:** **1.00** **C2 Rate:** **3.318**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
FINFISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
PACIFIC COD: NORTH PACIFIC	Medium	5.00: Very Low Concern	2.33: Moderate Concern	**3.413**

Pacific cod: North Pacific: Japan: Tohoku region North Pacific, Trawl, Bottom

Subscore: **2.159** **Discard Rate:** **1.00** **C2 Rate:** **2.159**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
SEABIRDS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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	3.67: Low Concern	**3.318**
PACIFIC COD: NORTH PACIFIC	Medium	5.00: Very Low Concern	2.33: Moderate Concern	**3.413**

Pacific cod: Sea of Japan: Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

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

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
MAMMALS	High	2.00: High	0.00: Critical	**0.000**

		Concern		
PACIFIC COD: SEA OF JAPAN	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
SEABIRDS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
SHARKS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: Sea of Japan: Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Subscore: **2.644** **Discard Rate:** **1.00** **C2 Rate:** **2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
PACIFIC COD: SEA OF JAPAN	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
MAMMALS	High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
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: Sea of Japan: Sea of Japan Mgmt. region Sea of Japan, Trap net

Subscore: **3.318** **Discard Rate:** **1.00** **C2 Rate:** **3.318**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
PACIFIC COD: SEA OF JAPAN	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
FINFISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: Sea of Okhotsk: Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Subscore:: **0.000** **Discard Rate:** **0.00** **C2 Rate:** **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
MAMMALS	High	2.00: High Concern	0.00: Critical	**0.000**
SEABIRDS	High	2.00: High Concern	1.00: High Concern	**1.414**
PACIFIC COD: SEA OF OKHOTSK	Medium	4.00: Low Concern	1.00: High Concern	**2.000**
SHARKS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: Sea of Okhotsk: Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Subscore: **0.000** **Discard Rate:** **0.00** **C2 Rate:** **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
SEABIRDS	High	2.00: High	0.00: Critical	**0.000**

		Concern		
PACIFIC COD: SEA OF OKHOTSK	Medium	4.00: Low Concern	1.00: High Concern	**2.000**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**

Pacific cod: Sea of Okhotsk: Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Subscore: **2.159** **Discard Rate:** **1.00** **C2 Rate:** **2.159**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
PACIFIC COD: SEA OF OKHOTSK	Medium	4.00: Low Concern	1.00: High Concern	**2.000**
SEABIRDS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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	3.67: Low Concern	**3.318**

Pacific cod: South Hokkaido: Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

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

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
MAMMALS	High	2.00: High Concern	0.00: Critical	**0.000**
SEABIRDS	High	2.00: High Concern	1.00: High Concern	**1.414**
PACIFIC COD: SOUTH HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
SHARKS	High	2.00: High	2.33:	**2.159**

		Concern	Moderate Concern	
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**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: South Hokkaido: Hokkaido Mgmt. region North Pacific, Longline, Bottom

Subscore: **0.000** **Discard Rate:** **0.00** **C2 Rate:** **0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
SEABIRDS	High	2.00: High Concern	0.00: Critical	**0.000**
PACIFIC COD: SOUTH HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**

Pacific cod: South Hokkaido: Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Subscore: **2.644** **Discard Rate:** **1.00** **C2 Rate:** **2.644**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
PACIFIC COD: SOUTH HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
MAMMALS	High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
BENTHIC INVERTS	Medium	3.00: Moderate	3.67: Low Concern	**3.318**

		Concern		
FORAGE FISH	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: West Hokkaido: Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Subscore: 0.000 **Discard Rate: 0.00** **C2 Rate: 0.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
MAMMALS	High	2.00: High Concern	0.00: Critical	**0.000**
PACIFIC COD: WEST HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
CORALS AND OTHER BIOGENIC HABITATS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
SEABIRDS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
SHARKS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**
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**
BENTHIC INVERTS	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Pacific cod: West Hokkaido: Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Subscore: 2.159 **Discard Rate: 1.00** **C2 Rate: 2.159**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
PACIFIC COD: WEST HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
SEABIRDS	High	2.00: High Concern	2.33: Moderate Concern	**2.159**

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: West Hokkaido: Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Subscore: 1.414 **Discard Rate: 1.00** **C2 Rate: 1.414**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
CORALS AND OTHER BIOGENIC HABITATS	High	2.00: High Concern	1.00: High Concern	**1.414**
PACIFIC COD: WEST HOKKAIDO	Medium	3.00: Moderate Concern	1.00: High Concern	**1.732**
FINFISH	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
MAMMALS	High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	High	2.00: High Concern	3.67: Low Concern	**2.709**
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**

The bycatch and retained species caught in the Pacific cod fishery in Japan are generally unknown. 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. (Where noted, these scores have been modified based on information specific to the fishery.)

For the gillnet fisheries, marine mammals limit the score for Criterion 2 due to their high vulnerability, unknown stock status, and high potential to interact with gillnets. The trap net fisheries are likely to interact with benthic invertebrates and finfish, but the gear type's effect may be mild. For the bottom longline fisheries, seabirds limit the score for Criterion 2 due to their high vulnerability, unknown stock status, and high potential to interact with longlines. For the trawl net fisheries, seabirds and sharks limit

the score for Criterion 2 due to their high vulnerability, data-deficient stock status, and moderate potential to interact with trawl nets. For Danish seines, biogenic habitat-forming organisms (e.g., deep-water corals) limit the score for Criterion 2 due to their high vulnerability, inconclusive stock status, and high potential to interact with bottom seine nets. Within the Pacific cod fisheries regions in Japan, deep-water corals are only known to be found off West Hokkaido (Matsumoto 2005), so only the West Hokkaido sub-region fishery may interact with deep-water corals. There is no bottom trawling in the West Hokkaido sub-region. Kelp forests are found around Hokkaido and northern Honshu. But kelp are generally found no deeper than 30 meters (Minami et al. 2010), so this fishery is unlikely to affect kelp beds because most adult Pacific cod are found at depths between 50 and 300 meters (m) (NOAA 1988).

Criterion 2 Assessment

BENTHIC INVERTS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include tanner crabs and red king crabs (Weber 1967) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include tanner crabs and red king crabs (Weber 1967) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with benthic invertebrates, but the species of benthic invertebrates affected by the Pacific cod fishery is unknown. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Medium

Gillnet gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include tanner crabs and red king crabs (Weber 1967) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from

Alaska's Pacific cod trawling fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include tanner crabs and red king crabs (Weber 1967) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trap net

Medium

The trap gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod trap fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and tanner crabs (Hayashi 1943) (Sano 2010) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod trawling fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include tanner crabs and red king crabs (Weber 1967) (Yosho 2000). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include sea stars, octopus, and spider crabs (Sano 2010) (Tanase 1967) (Hayashi 1943). Unknown species of benthic invertebrates are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Medium

The trap gear type is likely to interact with benthic invertebrates, but it is unknown which species of benthic invertebrates are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod trap fisheries (NOAA 2011d), species found in this region that may interact with this fishery

include sea stars, octopus, and tanner crabs (Hayashi 1943) (Sano 2010) (Yosho 2000). 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderate Concern

The abundance 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Low Concern

The impact of gillnet 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.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Low Concern

The impact of seine net 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Low Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of seine net 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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Low Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Low Concern

The impact of gillnet 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.

Japan: Tohoku region North Pacific, Seine Net, Boat

Low Concern

The impact of seine net 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.

Japan: Tohoku region North Pacific, Trap net

Low Concern

The impact of trap net 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.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Low Concern

The impact of gillnet 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.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of seine net 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.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Low Concern

The impact of trap net 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.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

CORALS AND OTHER BIOGENIC HABITATS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High

Deepwater corals are found off the coast of western Hokkaido in the Sea of Japan (Matsumoto 2005). Kelp forests are generally found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), so this fishery may not come into contact with kelp beds. Although it is unclear if this fishery interacts with the deepwater corals, unknown species of corals 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)

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

The distribution and structure of deepwater coral communities was recently observed in the Sea of Japan off Hokkaido (Matsumoto 2005). But the health of the populations is inconclusive, and continuous assessment is required to determine the status of these communities. Due to the coral's high inherent vulnerability and this fishery's possible interaction with the species, the stock status is deemed as a high concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of bottom gillnet fisheries on unknown species of corals 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.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Low Concern

The impact of bottom longline fisheries on unknown species of corals 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

There have been some mitigation efforts to reduce mortality, because the deepwater corals are partly protected from bottom seines as a result of established moratoriums. Therefore, the impact of bottom seine net fisheries on unknown species of corals is scored as a high 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

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

FINFISH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include pollock, halibut, and flounder (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Medium

The longline gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include pollock, halibut, flounder, flathead sole, yellowfin sole, and large sculpins (Craig 1984) (Eschmeyer 1983) (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, Pacific halibut, flathead sole, yellowfin sole, and other flatfish (Eschmeyer 1983) (Craig 1984) (Wada et al. 2012). Bycatch might include walleye, pollock, and arabesque greenling, but that information is not transparent (Hoshino 2013). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include pollock, halibut, and flounder (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Medium

The longline gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include pollock, halibut, flounder, flathead sole, yellowfin sole, and large sculpins (Craig 1984) (Eschmeyer 1983) (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA

2011d), species found in this region that may interact with this fishery include large sculpins, Pacific halibut, flathead sole, yellowfin sole, and other flatfish (Eschmeyer 1983) (Craig 1984) (Wada et al. 2012). Bycatch may also include walleye, pollock, and arabesque greenling, but that information is not transparent (Hoshino 2013). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include pollock, halibut, and flounder (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Medium

The longline gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include pollock, halibut, flounder, flathead sole, yellowfin sole, and large sculpins (Craig 1984) (Eschmeyer 1983) (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, yellowfin sole, and Atka mackerel (Eschmeyer 1983) (Craig 1984) (Balanov 2009). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include pollock, halibut, and flounder (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Longline, Bottom

Medium

The longline gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include pollock, halibut, flounder, flathead sole, yellowfin sole, and large sculpins (Craig 1984) (Eschmeyer 1983) (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, Pacific halibut, flathead sole, yellowfin sole, and other flatfish (Eschmeyer 1983) (Craig 1984) (Wada et al. 2012). Bycatch may also include walleye, pollock, and arabesque greenling, but that information is not transparent (Hoshino 2013). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trap net

Medium

The trap gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA

2011d), species found in this region that may interact with this fishery include large sculpins, yellowfin sole, and Atka mackerel (Eschmeyer 1983) (Craig 1984) (Balanov 2009). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, yellowfin sole, and Atka mackerel (Eschmeyer 1983) (Craig 1984) (Balanov 2009). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

The gillnet gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on historical bycatch numbers from Alaska's Pacific cod gillnet fisheries (ADFG 1992), species found in this region that may interact with this fishery include pollock, halibut, and flounder (Kooka 1998) (Wada et al. 2012). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, Pacific halibut, flathead sole, yellowfin sole, and other flatfish (Eschmeyer 1983) (Craig 1984) (Wada et al. 2012). Bycatch may also include walleye, pollock, and arabesque greenling, but that information is not transparent (Hoshino 2013). Unknown species of finfish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Medium

The trap gear type is likely to interact with finfish, but it is unknown which species of finfish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include large sculpins, yellowfin sole, and Atka mackerel (Eschmeyer 1983) (Craig 1984) (Balanov 2009). 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region North Pacific, 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.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Moderate Concern

The impact of Danish seine 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Japan, 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Moderate Concern

The impact of Danish seine 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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Okhotsk, 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.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Japan: Tohoku region North Pacific, 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.

Japan: Tohoku region North Pacific, Seine Net, Boat

Moderate Concern

The impact of Danish seine 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.

Japan: Tohoku region North Pacific, Trap net

Low Concern

The impact of trap net fisheries on unknown species of finfish 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.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Moderate Concern

The impact of Danish seine 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.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Low Concern

The impact of trap net fisheries on unknown species of finfish 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.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

FORAGE FISH

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Medium

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

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). Unknown species of forage fish are considered to be of medium inherent vulnerability

according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

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

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Medium

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

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Medium

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

Japan: Tohoku region North Pacific, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

Medium

The bottom trawling gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). Unknown species of forage fish are considered to be of medium inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Medium

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

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Medium

The Danish seine gear type is likely to interact with forage fish, but it is unknown which species of forage fish are affected by the Pacific cod fishery. Based on bycatch numbers from Alaska's Pacific cod fisheries (NOAA 2011d), species found in this region that may interact with this fishery include Pacific herring (Nagasawa 2001). 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine 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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Low Concern

The impact of trawling 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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Japan: Tohoku region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine 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.

Japan: Tohoku region North Pacific, Trawl, Bottom

Low Concern

The impact of trawling 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine 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.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

MAMMALS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with mammals, but it is unknown which species of mammals are

affected by the gillnet fishery. Species found in this region that could potentially interact with gillnets include Steller sea lions (Hamanaka et al. 1982). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

High

The Danish seine gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the Danish seine fishery. Species found in this region that could potentially interact with gillnets include Steller sea lions (Hamanaka et al. 1982). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the gillnet fishery. Species found in this region that could potentially interact with gillnets include Steller sea lions (Hamanaka et al. 1982). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High

The Danish seine gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the Danish seine fishery. Species found in this region that could potentially interact with gillnets include Steller sea lions (Hamanaka et al. 1982). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High

The gillnet gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the gillnet fishery. Species found in this region that could potentially interact with gillnets include Steller sea lions (Hamanaka et al. 1982). Unknown species of mammals are considered to be of

high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the gillnet fishery. Species found in this region that could potentially interact with gillnets include harbor porpoises and Dall's porpoises, which have been reported as incidental catch in the salmon set net fisheries (Jefferson and Curry 1994). Though outside of their normal distribution range, finless porpoises have been found in Matsushima Bay off Miyagi Prefecture (Jefferson et al. 1993) (Yoshida et al. 2001). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Seine Net, Boat

High

The Danish seine gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the Danish seine fishery. Species found in this region that could potentially interact with gillnets include harbor porpoises and Dall's porpoises, which have been reported as incidental catch in the salmon set net fisheries (Jefferson and Curry 1994). Though outside of their normal distribution range, finless porpoises have been found in Matsushima Bay off Miyagi Prefecture (Jefferson et al. 1993) (Yoshida et al. 2001). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the gillnet fishery. Species found in this region that could potentially interact with gillnets include harbor porpoises and Dall's porpoises, which have been reported as incidental catch in the salmon set net fisheries (Jefferson and Curry 1994). Unknown species of mammals are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

High

The Danish seine gear type is likely to interact with mammals, but it is unknown which species of mammals are affected by the Danish seine fishery. Species found in this region that could potentially interact with gillnets include harbor porpoises and Dall's porpoises, which have been reported as incidental catch in the salmon set net fisheries (Jefferson and Curry 1994). Unknown species of mammals 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High Concern

There are no stock assessments or global scale data papers focusing on the marine mammals in this area. However, Steller sea lions are listed as "Near Threatened" (IUCN 2013b) by the IUCN. The stock status of unknown species of mammals is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

High Concern

There are no stock assessments or global scale data papers focusing on the marine mammals in this area. Harbor porpoises and Dall's porpoises are both listed as species of least concern by the IUCN (IUCN 2008) (IUCN 2012e). However, finless porpoises are listed as "Near Threatened" (IUCN 2013b). The stock status of unknown species of mammals is considered to be of high concern according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

There are no stock assessments or global scale data papers focusing on the marine mammals in this area. Harbor porpoises and Dall's porpoises are both listed as species of least concern by the IUCN (IUCN 2008)(IUCN 2012e). The stock status of unknown species of mammals 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Critical

There are no known mitigation efforts to reduce mortality, therefore the impact of gillnet fisheries on unknown species of mammals 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.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine net fisheries on unknown species of mammals 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Critical

There are no known mitigation efforts to reduce mortality, therefore the impact of gillnet fisheries on unknown species of mammals 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine net fisheries on unknown species of mammals 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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Critical

There are no known mitigation efforts to reduce mortality, therefore the impact of gillnet fisheries on unknown species of mammals 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.

Japan: Tohoku region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine net fisheries on unknown species of mammals 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Critical

There are no known mitigation efforts to reduce mortality, therefore the impact of gillnet fisheries on unknown species of mammals 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.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine net fisheries on unknown species of mammals 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.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

SEABIRDS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the gillnet fishery. Historical assessments from Japan's land-based gillnet salmon fishery showed that short-tailed shearwaters, puffins, auklets, and common murres were captured as bycatch (DeGange et al. 1993). Japan's driftnet fishery for bluefin tuna resulted in bycatch of black-footed albatross, Laysan albatross, northern fulmar, and sooty shearwater (DeGange et al. 1993). Although these species are found in this area, these pelagic fishery techniques and equipment substantially differ from demersal fisheries, so it is unclear which species interact with the Pacific cod gillnet fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the

Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

High

The longline gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the longline fishery. Based on bycatch numbers from Alaska's Pacific cod longline fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, gulls, shearwater, black-footed albatross, and Laysan albatross. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the gillnet fishery. Historical assessments from Japan's land-based gillnet salmon fishery showed that short-tailed shearwaters, puffins, auklets, and common murres were captured as bycatch, and Japanese murrelets were an unknown portion of the incidental catch (DeGange et al. 1993). Although this area is outside of albatross range (Birdlife International 2011), it is a known wintering ground for Saunders's gulls (Cao et al. 2008). Though these species are found in this area, the gillnet salmon fishery's pelagic techniques and equipment differ substantially from demersal fisheries, so it is unclear which species interact with the Pacific cod gillnet fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

High

The longline gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the longline fishery. Based on bycatch numbers from Alaska's Pacific cod longline fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, gulls, shearwater, Japanese murrelets, and Saunders's gulls. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High

The gillnet gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the gillnet fishery. Historical assessments from Japan's land-based gillnet salmon fishery showed that short-tailed shearwaters, puffins, auklets, and common murres were captured as bycatch (DeGange et al. 1993). Japan's driftnet fishery for bluefin tuna resulted in bycatch of black-footed albatross, Laysan albatross, northern fulmar, and sooty shearwater (DeGange et al. 1993). Although these species are found in this area, these pelagic fishery techniques and equipment differ substantially from demersal fisheries, so is it unclear which species interact with the Pacific cod gillnet fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

High

The longline gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the longline fishery. Based on bycatch numbers from Alaska's Pacific cod longline fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, gulls, shearwater, black-footed albatross, and Laysan albatross. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

High

The bottom trawl gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the trawling fishery. Based on bycatch numbers from Alaska's Pacific cod trawling fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, shearwater, and gulls. Albatross, which are within range of Alaska's Pacific cod trawling fisheries, were not captured in Alaska, so it is possible that albatross may also not interact with the Japanese fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the gillnet fishery. Historical assessments from Japan's land-based gillnet salmon fishery showed that short-tailed shearwaters, puffins, auklets, and common murres were captured as bycatch (DeGange et al. 1993). Japan's driftnet fishery for bluefin tuna resulted in bycatch of black-footed albatross, Laysan albatross, northern fulmar, and sooty shearwater (DeGange et al. 1993). Although these species are found in this area, these pelagic fishery techniques and equipment differ substantially from demersal fisheries, so is it unclear which species interact with the Pacific cod gillnet fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Longline, Bottom

High

The longline gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the longline fishery. Based on bycatch numbers from Alaska's Pacific cod longline fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, gulls, shearwater, black-footed albatross, and Laysan albatross. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

High

The bottom trawl gear type is likely to interact with seabirds, but it is unknown which species of seabirds are affected by the trawling fishery. Based on bycatch numbers from Alaska's Pacific cod trawling fisheries (NOAA 2011d), species found in this area that may interact with this fishery include northern fulmar, shearwater, and gulls. Albatross, which are within range of Alaska's Pacific cod trawling fisheries, were not captured in Alaska, so it is possible that albatross may also not interact with the Japanese fishery. Unknown species of seabirds are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with seabirds, but the species of seabirds affected by the gillnet fishery is unknown. Historical assessments from Japan's land-based gillnet salmon fishery showed that short-tailed shearwaters, puffins, auklets, and common murres were captured as bycatch, and Japanese

murrelets were an unknown portion of the incidental catch (DeGange et al. 1993). Although this area is outside of albatross range (Birdlife International 2011), it is a known wintering ground for Saunders's gulls (Cao et al. 2008). Though these species are found in this area, the gillnet salmon fishery's pelagic techniques and equipment differ substantially from demersal fisheries, so is it unclear which species interact with the Pacific cod gillnet fishery. Unknown species of seabirds 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, though not a substantial factor in Alaskan longline fisheries, are found in this area and are listed as "Vulnerable" by the IUCN (IUCN 2012a) (IUCN 2012b). On the other hand, Laysan albatross, a near-threatened species (IUCN 2012c), falls within this region and is occasionally caught in Alaskan fisheries (NOAA 2011d). The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

High Concern

Japanese murrelets and Saunders's gulls, which may be seabirds incidentally caught with this fishery, are both listed as "Vulnerable" species, with projected declines in future population numbers (Cao et al. 2008) (IUCN 2012d).

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, which are found in this area, are listed as "Vulnerable" by the IUCN (IUCN 2012a) (IUCN 2012b). Laysan albatross, a near-threatened species (IUCN 2012c), also falls within this

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

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, though not a substantial factor in Alaskan longline fisheries, are found in this area and are listed as “Vulnerable” by the IUCN (IUCN 2012a) (IUCN 2012b). On the other hand, Laysan albatross, a near-threatened species (IUCN 2012c), falls within this region and is occasionally caught in Alaskan fisheries (NOAA 2011d). The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, which are found in this area, are listed as “Vulnerable” by the IUCN (IUCN 2012a) (IUCN 2012b). Laysan albatross, a near-threatened species (IUCN 2012c), also falls within this region. The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Longline, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, though not a substantial factor in Alaskan longline fisheries, are found in this area and are listed as “Vulnerable” by the IUCN (IUCN 2012a) (IUCN 2012b). On the other hand, Laysan albatross, a near-threatened species (IUCN 2012c), falls within this region and is occasionally caught in Alaskan fisheries (NOAA 2011d). The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

High Concern

There are no assessments or global-scale data papers focusing on these species in this area. Short-tail and black-footed albatross, which are found in this area, are listed as “Vulnerable” by the IUCN (IUCN 2012a) (IUCN 2012b). Laysan albatross, a near-threatened species (IUCN 2012c), also falls within this region. The stock status of unknown species of seabirds is considered to be of high concern according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

High Concern

Japanese murrelets and Saunders’s gulls, which may be incidentally caught with this fishery, are listed as “Vulnerable” species, with projected declines in future population numbers (Cao et al. 2008) (IUCN 2012d).

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

High Concern

The impact of gillnet fisheries on unknown species of seabirds is scored as a high 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. Although there are no known efforts to mitigate bycatch, it is unclear if albatross are caught in this fishery, so a critical score would not be appropriate.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Critical

Because there are no known efforts to mitigate bycatch and albatross are likely caught along with this fishery, 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Moderate Concern

It is unknown which species of seabirds interact with this fishery. Although this fishery is outside of albatross range, threatened species such as Japanese murrelets and Saunders's gulls are within range and could possibly be affected. Due to the possibility of incidental capture of threatened species, fishing mortality is a moderate concern for this fishery.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High Concern

The impact of gillnet fisheries on unknown species of seabirds is scored as a high 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. Although there are no known efforts to mitigate bycatch, it is unclear if albatross are caught in this fishery, so a critical score would not be appropriate.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Critical

Because there are no known efforts to mitigate bycatch and albatross are likely caught along with this fishery, 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.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderate Concern

The impact of trawling fisheries on unknown species of seabirds 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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

High Concern

The impact of gillnet fisheries on unknown species of seabirds is scored as a high 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. Although there are no known efforts to mitigate bycatch, it is unclear if albatross are caught in this fishery, so a critical score would not be appropriate.

Japan: Tohoku region North Pacific, Longline, Bottom

Critical

Because there are no known efforts to mitigate bycatch and albatross are likely caught along with this fishery, 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.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The impact of trawling fisheries on unknown species of seabirds 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

It is unknown which species of seabirds interact with this fishery. Although this fishery is outside of albatross range, threatened species such as Japanese murrelets and Saunders's gulls are within range and could possibly be affected. Due to the possibility of incidental capture of threatened species, fishing mortality is a moderate concern for this fishery.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

SHARKS

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the gillnet fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Although blue sharks and salmon sharks are pelagic species, they have been observed, respectively, at depths to 600 meters and 668 m (Carey et al. 1990) (Hulbert et al. 2005), which is within the range of this fishery. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

High

The longline gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the longline fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod longline fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery

include Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

High

The Danish seine gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the Danish seine net fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the gillnet fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that shortfin mako sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Although the short fin mako is a pelagic species, it has been found at depths to 556 m (Loefer et al. 2005), which is within the range of this fishery. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

High

The longline gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the longline fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod longline fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery include Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High

The Danish seine gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the Danish seine net fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks and shortfin mako sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High

The gillnet gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the gillnet fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

High

The longline gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the longline fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod longline fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery include Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

High

The bottom trawling gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the bottom trawling fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod trawling fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery include salmon sharks and Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

High

The gillnet gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the gillnet fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Although blue sharks and salmon sharks are pelagic species, they have been observed, respectively, at depths to 600 m and 668 m (Carey et al. 1990)(Hulbert et al. 2005), which is within the range of this fishery. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Longline, Bottom

High

The longline gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the longline fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod longline fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery include Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Seine Net, Boat

High

The Danish seine gear type is likely to interact with sharks, but it is unknown which species of sharks are

affected by the Danish seine net fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

High

The bottom trawling gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the bottom trawling fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that blue sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Based on Alaska's Pacific cod trawling fisheries bycatch numbers (PCCRC 2007), species found in this area that may interact with this fishery include salmon sharks and Pacific sleeper sharks (Moiseev and Orlov 1999). Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

High

The gillnet gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the gillnet fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that shortfin mako sharks and salmon sharks were commonly caught as bycatch in this area (JWCS 2008), although the specific gear type and commercial fishery correlations were not analyzed. Although the shortfin mako is a pelagic species, it has been found at depths to 556 m (Loefer et al. 2005), which is within the range of this fishery. Unknown species of sharks are considered to be of high inherent vulnerability according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

High

The Danish seine gear type is likely to interact with sharks, but it is unknown which species of sharks are affected by the Danish seine net fishery. Estimations by the Japan Wildlife Conservation Society, which consolidates data from the National Research Institute of Far Seas Fisheries, revealed that salmon sharks and shortfin mako sharks were commonly caught as bycatch in this area (JWCS 2008), although the

specific gear type and commercial fishery correlations were not analyzed. 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). Within this area, there are no stock assessments or global-scale papers focusing on the Pacific sleeper shark, which is a poorly understood species. The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

High Concern

Catch statistics for shortfin mako sharks have been analyzed since 1994 (NRIFSF 2013). However, these numbers are inconclusive and the authors acknowledged that further assessments are required to determine the stock status. Overall, catch numbers appear to be decreasing, which would warrant a high concern. Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

High Concern

Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). Within this area, there are no stock assessments or global-scale papers focusing on the Pacific sleeper shark, which is a poorly understood species. The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

Catch statistics for shortfin mako sharks have been analyzed since 1994 (NRIFSF 2013). However, these numbers are inconclusive and the authors acknowledged that further assessments are required to determine the stock status. Overall, catch numbers appear to be decreasing, which would warrant a high concern. Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

High Concern

Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

High Concern

Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). Within this area, there are no stock assessments or global-scale papers focusing on the Pacific sleeper shark, which is a poorly understood species. The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Gillnet, Bottom

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Longline, Bottom

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). Within this area, there are no

stock assessments or global-scale papers focusing on the Pacific sleeper shark, which is a poorly understood species. The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Seine Net, Boat

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data is available to perform a stock assessment on this species (NRIFSF 2011). The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Japan: Tohoku region North Pacific, Trawl, Bottom

High Concern

According to historical catch data, blue shark populations in Japan appear to be stable (NRIFSF 2012). Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). Within this area, there are no stock assessments or global-scale papers focusing on the Pacific sleeper shark, which is a poorly understood species. The stock status of unknown species of sharks is considered to be of high concern according to the Seafood Watch criteria.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

High Concern

Catch statistics for shortfin mako sharks have been analyzed since 1994 (NRIFSF 2013). However, these numbers are inconclusive and the authors acknowledged that further assessments are required to determine the stock status. Overall, catch numbers appear to be decreasing, which would warrant a high concern. Catch statistics have been recorded for salmon sharks in Japan since 1994 (NRIFSF 2011). Though the numbers are inconclusive, catch numbers appear to be stable, and the authors feel that enough data are available to perform a stock assessment on this species (NRIFSF 2011). 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)

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region North Pacific, 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.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine net 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.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Japan, 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.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine net 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.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Hokkaido Mgmt. region Sea of Okhotsk, 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.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Japan: Tohoku region North Pacific, 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.

Japan: Tohoku region North Pacific, Seine Net, Boat

Low Concern

The impact of Danish seine net 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.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The impact of trawling 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.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The impact of gillnet 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.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The impact of Danish seine net 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.

Factor 2.4 - Discard Rate

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

<20%

There are no logbooks or records of discard rates associated with the Pacific cod commercial fishery in Japan (Narimatsu 2013). Japanese commercial fishermen are allowed to keep all bycatch (Hoshino 2013), and it is customary for them not to discard incidental catches as waste.

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
Hokkaido Mgmt. region North Pacific Gillnet, Bottom	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region North Pacific Longline, Bottom	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region North Pacific Seine Net, Boat	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region Sea of Japan Gillnet, Bottom	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region Sea of Japan Longline, Bottom	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region Sea of Japan Seine Net, Boat	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region Sea of Okhotsk Gillnet, Bottom	1.000	1.000	Red(1.000)
Hokkaido Mgmt. region Sea of Okhotsk Longline, Bottom	1.000	1.000	Red(1.000)

Hokkaido Mgmt. region Sea of Okhotsk Trawl, Bottom	1.000	1.000	Red(1.000)
Japan: Tohoku region North Pacific Gillnet, Bottom	1.000	1.000	Red(1.000)
Japan: Tohoku region North Pacific Longline, Bottom	1.000	1.000	Red(1.000)
Japan: Tohoku region North Pacific Seine Net, Boat	1.000	1.000	Red(1.000)
Japan: Tohoku region North Pacific Trap net	1.000	1.000	Red(1.000)
Japan: Tohoku region North Pacific Trawl, Bottom	1.000	1.000	Red(1.000)
Sea of Japan Mgmt. region Sea of Japan Gillnet, Bottom	1.000	1.000	Red(1.000)
Sea of Japan Mgmt. region Sea of Japan Seine Net, Boat	1.000	1.000	Red(1.000)
Sea of Japan Mgmt. region Sea of Japan Trap net	1.000	1.000	Red(1.000)

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
Hokkaido Mgmt. region North Pacific Gillnet, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region North Pacific Longline, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region North Pacific Seine Net, Boat	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Japan Gillnet, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Japan Longline, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Japan Seine Net, Boat	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Okhotsk Gillnet, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Okhotsk Longline, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Hokkaido Mgmt. region Sea of Okhotsk Trawl, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Japan: Tohoku region North Pacific Gillnet, Bottom	Ineffective	N/A	Highly Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Japan: Tohoku region North Pacific Longline, Bottom	Ineffective	N/A	Highly Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Japan: Tohoku region North Pacific Seine Net, Boat	Ineffective	N/A	Highly Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Japan: Tohoku region North Pacific	Ineffective	N/A	Highly Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective

Trap net							
Japan: Tohoku region North Pacific Trawl, Bottom	Ineffective	N/A	Highly Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Sea of Japan Mgmt. region Sea of Japan Gillnet, Bottom	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Sea of Japan Mgmt. region Sea of Japan Seine Net, Boat	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective
Sea of Japan Mgmt. region Sea of Japan Trap net	Ineffective	N/A	Moderately Effective	Ineffective	Moderately Effective	Ineffective	Moderately Effective

Since regulations to control catch are not implemented for this fishery, management has little effectiveness. The Japan Ministry of Agriculture, Forestry and Fisheries (MAFF) should consider implementing target limits prescribed by the Fisheries Research Agency (FRA) while also keeping records of incidental catch. Furthermore, the MAFF should put bycatch mitigation techniques in place.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Gillnetting is allowed year-round with the exception of the coastal area off Hachinohe city and Mutsu Bay, which is considered a critical nursing ground for Pacific cod (Takatsu et al. 2001). In these restricted areas, gillnetting is only allowed annually between January 15th and February 25th off the city of Hachinohe, and from mid-December through mid-March in Mutsu Bay (Narimatsu 2013). It is unclear how effective these moratoriums are, but the fact that annual acceptable biological catch (ABC) limits are regularly surpassed shows a lack of effective management strategy.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Longlining is allowed year-round throughout the entire North Pacific region. ABC limits are regularly

surpassed, showing a lack of effective management strategy.

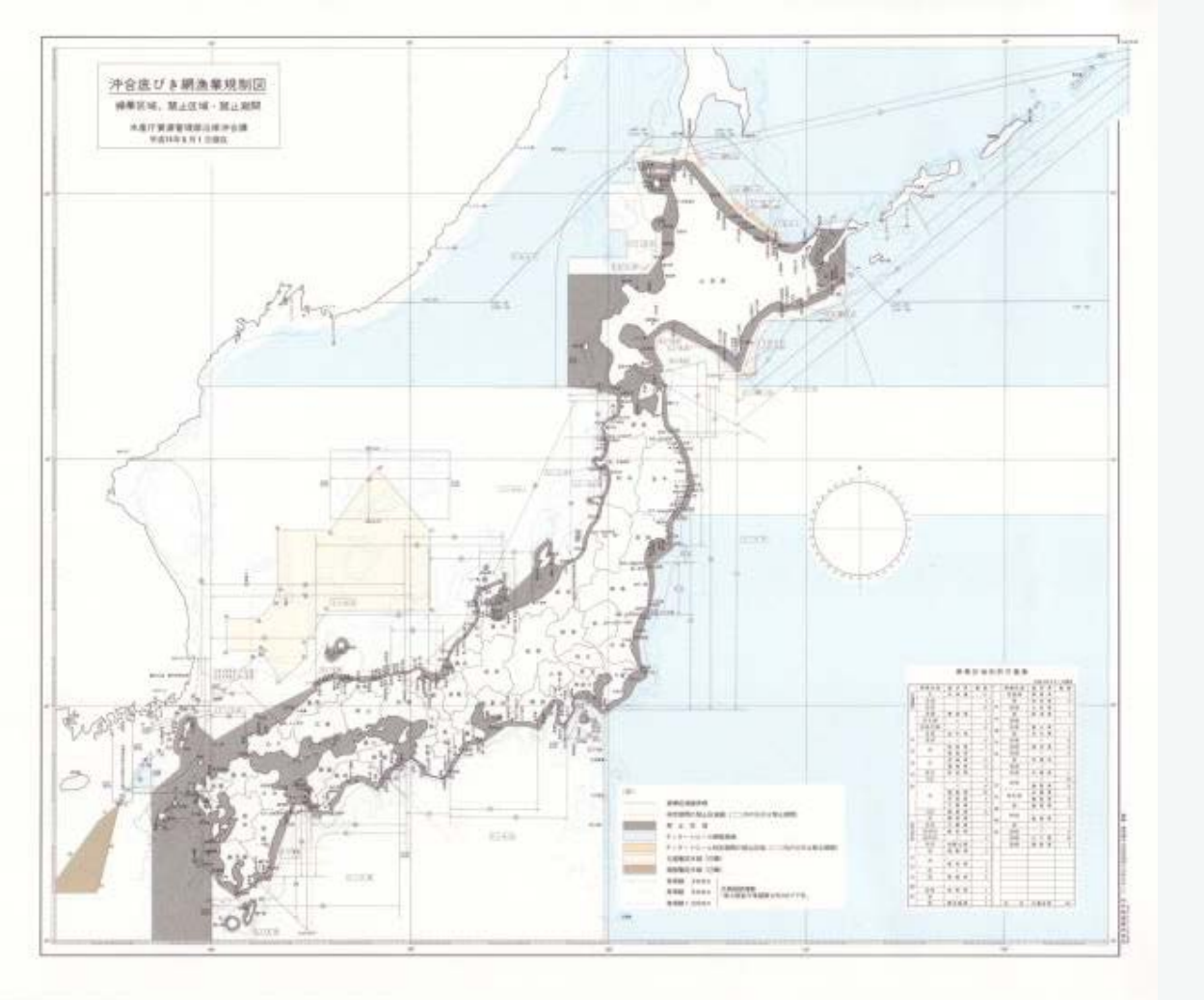
Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Danish seines are prohibited year-round in Mutsu Bay, Uchiura Bay, the Tsugaru Straits, and all coastal areas. Although this moratorium covers all the known Pacific cod spawning habitats in the south Hokkaido sub-region and a sizeable portion of the spawning habitat in the North Pacific as defined by the FRA, the fact that annual ABC limits are regularly surpassed shows that further management is required.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Rationale:



Prohibited fishing zones. The gray areas are where both trawling and Danish seining are prohibited year-round. The white areas are where trawling is prohibited, but Danish seining is allowed. The light blue areas are where both trawling and Danish seining are allowed. The orange zones are temporal prohibition zones for trawling.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Gillnetting is allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Longlining is allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Danish seines are prohibited year-round in all coastal areas off Honshu and west Hokkaido, including the entire area between the Nodo Peninsula and Sado Island. The trawling moratorium extends for up to 100 km off the west coast of Hokkaido, covering a sizeable portion of west Hokkaido's known Pacific cod spawning habitat. However, the fact that annual ABC limits are regularly surpassed shows a need for catch limit implementation instead of mere prohibition zones.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Gillnetting is allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Longlining is allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Trawling is prohibited year-round in all coastal areas. Although the moratorium covers all the critical spawning habitats in the Sea of Okhotsk, the fact that ABC limits are regularly surpassed shows a need for catch limits instead of mere prohibition zones.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Gillnetting is allowed year-round with the exception of the coastal area off the city of Hachinohe and Mutsu Bay, which is considered a critical nursing ground for Pacific cod (Takatsu et al. 2001). In these restricted areas, gillnetting is only allowed annually between January 15th and February 25th off Hachinohe, and from mid-December through mid-March in Mutsu Bay (Narimatsu 2013). It is unclear how effective these moratoriums are, but the fact that annual acceptable biological catch (ABC) limits are regularly surpassed shows a lack of effective management strategy.

Japan: Tohoku region North Pacific, Longline, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Longlining is allowed year-round throughout the entire North Pacific region. ABC limits are regularly surpassed, showing a lack of effective management strategy.

Japan: Tohoku region North Pacific, Seine Net, Boat

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Danish seines are prohibited year-round in Mutsu Bay, Uchiura Bay, the Tsugaru Straits, and all coastal areas. Although this moratorium covers all the known Pacific cod spawning habitats in the south Hokkaido sub-region and a sizeable portion of the spawning habitat in the North Pacific as defined by

the FRA, the fact that annual ABC limits are regularly surpassed shows that further management is required.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Japan: Tohoku region North Pacific, Trap net

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Trap nets are allowed year-round except in Mutsu Bay, where they are only allowed from mid-December through mid-March. It is unclear how effective this moratorium is, but the fact that annual ABC limits are regularly surpassed shows a lack of effective management strategy.

Japan: Tohoku region North Pacific, Trawl, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Trawling is prohibited year-round in Mutsu Bay, Uchiura Bay, the Tsugaru Straits, and all coastal areas. Trawling is also prohibited in all of Japan's EEZ between the Miyagi and Hokkaido prefectures. Although the moratorium covers all the known Pacific cod spawning habitats within the south Hokkaido sub-region and nearly all the spawning habitats within the North Pacific region defined by the FRA, the fact that annual ABC limits are regularly surpassed shows the need for catch limits instead of mere prohibition zones.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Gillnetting is allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Danish seines are prohibited year-round in all coastal areas off Honshu and west Hokkaido, including the entire area between the Nodo Peninsula and Sado Island. The trawling moratorium extends for up to 100 km off the west coast of Hokkaido, covering a sizeable portion of west Hokkaido's known Pacific cod spawning habitat. However, the fact that annual ABC limits are regularly surpassed shows a need for catch limit implementation instead of mere prohibition zones.

Because closures are the only management measures in place and there is no evidence of their effectiveness, management implementations appear to be ineffective.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

There are no catch limits, and regulations to meet management goals have not been implemented. Trap nets are allowed year-round throughout the entire zone and ABC limits are regularly surpassed, which shows a lack of effective management strategy.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

N/A

Catch limits have not been implemented and, aside from seasonal fishing moratoriums for specific gear types, there has been no effective management recovery strategy for Pacific cod. However, the fishery does not appear to be depleted, so recovery effectiveness is N/A.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderately Effective

The FRA regularly assesses the stock status by using total catch data and catch per unit effort (CPUE) analyses. Because scientific research surveys to monitor the populations are not conducted, research and monitoring may only be moderately effective.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Highly Effective

The FRA regularly conducts annual stock assessments utilizing both scientific monitoring surveys and commercial fisheries catch data.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderately Effective

The FRA regularly assesses the stock status by using total catch data and catch per unit effort (CPUE) analyses. Because scientific research surveys to monitor the populations are not conducted, research and monitoring may only be 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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

Management does not enforce acceptable biological catch targets and limits set forth by the Fisheries Research Agency.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is

uncertain.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Japan: Tohoku region North Pacific, Longline, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain.

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain. Fishers do not fish in closed areas based on an honor system, and the fishing community enforces these moratoriums (Narimatsu 2013).

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderately Effective

All commercially licensed fisheries are required to report total catches to the FRA. But dockside monitoring and regular independent scrutiny are not performed, so the effectiveness of enforcement is uncertain.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Ineffective

Management has not implemented any significant measures to maintain the long-term abundance of Pacific cod. Despite the presence of prohibited fishing zones, acceptable biological catch limits have been annually surpassed for 7 out of the 9 years since reference points have been available. Furthermore, acceptable biological catch targets have been annually surpassed all 9 years.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Ineffective

Management has not implemented any significant measures to maintain the long-term abundance of Pacific cod. Despite the presence of prohibited fishing zones, allowable biological catch limits have been

annually surpassed for 7 out of the 11 years since reference points have been available. Furthermore, acceptable biological catch targets have been annually surpassed every year, except the most recent assessment in 2012.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

Management has not implemented any significant measures to maintain the long-term abundance of Pacific cod. Despite the presence of prohibited fishing zones, acceptable biological catch limits have been annually surpassed every year until 2012, when fishing mortality finally returned to within management threshold levels.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderately Effective

Stakeholders and citizens are allowed to participate in the consultation process (Narimatsu 2013). Stakeholders always have some voice in final management decisions, which are quite transparent. However, it is unclear if stakeholders clearly understand the implications of management decisions. Furthermore, since management does not heed advice from the Fisheries Research Agency, it is also unlikely that they listen to stakeholders and citizens as well.

Bycatch Strategy

Factor 3.2: Management of fishing impacts on bycatch species						
Region / Method	All Kept	Critical	Strategy	Research	Advice	Enforce
Hokkaido Mgmt. region North Pacific Gillnet, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region North Pacific Longline, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region North Pacific Seine Net, Boat	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region Sea of Japan Gillnet, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region Sea of Japan Longline, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective

Hokkaido Mgmt. region Sea of Japan Seine Net, Boat	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region Sea of Okhotsk Gillnet, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region Sea of Okhotsk Longline, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Hokkaido Mgmt. region Sea of Okhotsk Trawl, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Japan: Tohoku region North Pacific Gillnet, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Japan: Tohoku region North Pacific Longline, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Japan: Tohoku region North Pacific Seine Net, Boat	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Japan: Tohoku region North Pacific Trap net	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Japan: Tohoku region North Pacific Trawl, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Sea of Japan Mgmt. region Sea of Japan Gillnet, Bottom	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Sea of Japan Mgmt. region Sea of Japan Seine Net, Boat	No	No	Ineffective	Ineffective	Ineffective	Ineffective
Sea of Japan Mgmt. region Sea of Japan Trap net	No	No	Ineffective	Ineffective	Ineffective	Ineffective

The lack of bycatch data associated with this fishery makes it difficult to assess the actual impact of this fishery on other species.

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.).

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

Based on the gear used, bycatch is possible and there have been no management measures implemented to limit or reduce bycatch.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

There is no regular collection or analysis of bycatch data.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

The FRA does not provide advice to commercial Pacific cod fishers for bycatch mitigation. Scientific advice is definitely not being followed for bycatch species.

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Ineffective

There is no enforcement of bycatch species because this fishery lacks bycatch management and collection of bycatch data.

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.
Hokkaido Mgmt. region North Pacific Gillnet, Bottom	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Hokkaido Mgmt. region North Pacific Longline, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**
Hokkaido Mgmt. region North Pacific Seine Net, Boat	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Hokkaido Mgmt. region Sea of Japan Gillnet, Bottom	2.00:Moderate Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (2.450)**
Hokkaido Mgmt. region Sea of Japan Longline, Bottom	2.00:Moderate Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (2.450)**
Hokkaido Mgmt. region Sea of Japan Seine Net, Boat	2.00:Moderate Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (2.598)**
Hokkaido Mgmt. region Sea of Okhotsk Gillnet, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**
Hokkaido Mgmt. region Sea of Okhotsk Longline, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**

Hokkaido Mgmt. region Sea of Okhotsk Trawl, Bottom	2.00:Moderate Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (2.598)**
Japan: Tohoku region North Pacific Gillnet, Bottom	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Japan: Tohoku region North Pacific Longline, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**
Japan: Tohoku region North Pacific Seine Net, Boat	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Japan: Tohoku region North Pacific Trap net	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Japan: Tohoku region North Pacific Trawl, Bottom	2.00:Moderate Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	**Yellow (2.739)**
Sea of Japan Mgmt. region Sea of Japan Gillnet, Bottom	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**
Sea of Japan Mgmt. region Sea of Japan Seine Net, Boat	3.00:Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	**Yellow (3.123)**
Sea of Japan Mgmt. region Sea of Japan Trap net	3.00:Low Concern	0.00:No Effective Mitigation	3.00:Moderate Concern	**Yellow (3.000)**

Within the Pacific cod fisheries regions in Japan, deep-water corals are only known to be found off West Hokkaido (Matsumoto 2005), so only the West Hokkaido sub-region fishery may interact with deep-water corals. Kelp forests are found around Hokkaido and northern Honshu. But kelp are generally found no deeper than 30 m (Minami et al. 2010), so this fishery is unlikely to affect kelp beds because most adult Pacific cod are found at depths of 50–300 m (NOAA 1988).

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.

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that gillnets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that longlines are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that Danish seines are generally set over sandy substrates. Nearshore habitats including kelp forests are protected from trawling as a result of established prohibited fishing zones.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Moderate Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that gillnets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds. Deepwater corals are found off the western coast of Hokkaido (Matsumoto 2005), and it is possible that this fishery may have an adverse impact on these habitats.

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Moderate Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that longlines are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds. Deepwater corals are found off the western coast of Hokkaido (Matsumoto 2005), and it is possible that this fishery may have an adverse impact on these habitats.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Moderate Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that Danish seines are generally set over sandy substrates. Nearshore habitats including kelp forests are protected from Danish seines as a result of established prohibited fishing zones. Deepwater corals are found off the western coast of Hokkaido (Matsumoto 2005), and it is possible that this fishery may have an adverse impact on these habitats, although the corals are partly protected by fishing moratoriums.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that gillnets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the

coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that longlines are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Moderate Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that trawling is generally performed over sandy substrates. Nearshore habitats including kelp forests are protected from trawling as a result of established prohibited fishing zones. Deepwater corals have only been found off the western coast of Hokkaido (Matsumoto 2005), so it is unclear if they exist in the Sea of Okhotsk and whether this fishery interacts with corals.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that gillnets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Japan: Tohoku region North Pacific, Longline, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that longlines are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the

coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Japan: Tohoku region North Pacific, Seine Net, Boat

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that Danish seines are generally set over sandy substrates. Nearshore habitats including kelp forests are protected from trawling as a result of established prohibited fishing zones.

Japan: Tohoku region North Pacific, Trap net

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that trap nets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that trawling is performed over sandy substrates. All substrates, including kelp forests and any possible deepwater corals, within a depth of 400 m are protected from trawling as a result of established prohibited fishing zones.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that gillnets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that Danish seines are generally set over sandy substrates. Nearshore habitats including kelp forests are protected from trawling as a result of established prohibited fishing zones.

Sea of Japan Mgmt. region Sea of Japan, Trap net

Low Concern

The substrate that this fishery interacts with is largely unknown. Pacific cod mostly prefer sand and gravel sediments at depths of 60–160 m (Garrison and Miller 1982), so it is probable that trap nets are generally set over sandy substrates. Since kelp forests are usually found no deeper than 30 m off the coasts of Japan (Minami et al. 2010), this fishery may not affect kelp beds.

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.*

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Minimal Mitigation

Gillnetting is prohibited during certain times of the year in the Mutsu Bay and off the coast of the city of Hachinohe, but this represents a small portion of the fishing zone.

Hokkaido Mgmt. region North Pacific, Longline, Bottom

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Minimal Mitigation

Danish seines are prohibited in all coastal areas, but deepwater habitats are not protected.

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Minimal Mitigation

Danish seines are prohibited year-round in all coastal areas, covering a substantial proportion of the Pacific cod spawning ground. However, deepwater habitats are not protected.

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Minimal Mitigation

Trawling is prohibited in all coastal areas, which covers all the known Pacific cod spawning habitats. However, none of the deepwater habitats is protected from contact.

Japan: Tohoku region North Pacific, Gillnet, Bottom

Minimal Mitigation

Gillnetting is prohibited during certain times of the year in the Mutsu Bay and off the coast of the city of Hachinohe, but this represents a small portion of the fishing zone.

Japan: Tohoku region North Pacific, Longline, Bottom

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

Japan: Tohoku region North Pacific, Seine Net, Boat

Minimal Mitigation

Danish seines are prohibited in all coastal areas, but deepwater habitats are not protected.

Japan: Tohoku region North Pacific, Trap net

Minimal Mitigation

Trap nets are only prohibited during certain times of the year in the Mutsu Bay, which represents a small portion of the fishing zone.

Japan: Tohoku region North Pacific, Trawl, Bottom

Moderate Mitigation

Trawling is prohibited in all coastal areas and in all of Japan’s EEZ between the Miyagami and Hokkaido prefectures, which cover nearly all known Pacific cod spawning habitats within the North Pacific. A substantial portion of habitat is protected from contact because trawling is typically only allowed in

water over 400 m.

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Minimal Mitigation

Danish seines are prohibited in all coastal areas, but deepwater habitats are not protected.

Sea of Japan Mgmt. region Sea of Japan, Trap net

No Effective Mitigation

No modifications of fishing gear, no controls on fishing intensity, and no efforts to limit the spatial extent of fishing are in place.

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.*

Hokkaido Mgmt. region North Pacific, Gillnet, Bottom

Hokkaido Mgmt. region North Pacific, Longline, Bottom

Hokkaido Mgmt. region North Pacific, Seine Net, Boat

Hokkaido Mgmt. region Sea of Japan, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Japan, Longline, Bottom

Hokkaido Mgmt. region Sea of Japan, Seine Net, Boat

Hokkaido Mgmt. region Sea of Okhotsk, Gillnet, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Longline, Bottom

Hokkaido Mgmt. region Sea of Okhotsk, Trawl, Bottom

Japan: Tohoku region North Pacific, Gillnet, Bottom

Japan: Tohoku region North Pacific, Longline, Bottom

Japan: Tohoku region North Pacific, Seine Net, Boat

Japan: Tohoku region North Pacific, Trap net

Japan: Tohoku region North Pacific, Trawl, Bottom

Sea of Japan Mgmt. region Sea of Japan, Gillnet, Bottom

Sea of Japan Mgmt. region Sea of Japan, Seine Net, Boat

Sea of Japan Mgmt. region Sea of Japan, Trap net

Moderate Concern

Pacific cod are not considered a species of exceptional importance. However, scientific assessment and management of ecosystem impacts have not been evaluated.

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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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