Monterey Bay Aquarium Seafood Watch

Environmental sustainability assessment of wild-caught Pacific salmon (*Oncorhynchus spp.*) from the United States caught using trolling lines, drift gillnets, purse seines, and gillnets and entangling nets



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Species:	Chinook salmon (*Oncorhynchus tshawytscha*), Chum salmon (*Oncorhynchus keta*), Coho salmon (*Oncorhynchus kisutch*), Pink salmon (*Oncorhynchus gorbuscha*), Sockeye salmon (*Oncorhynchus nerka*)
Location:	United States: Northeast Pacific
Gear:	Trolling lines, Drift gillnets, Purse seines, Gillnets and entangling nets
Type:	Wild Caught
Author:	Seafood Watch
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Assessed using Seafood Watch Fisheries Standard v2

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About Seafood Watch

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

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

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

Guiding Principles

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

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

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

Each criterion includes:

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

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

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

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

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

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

Summary

This report evaluates US West Coast commercial salmon fisheries (all five Pacific salmon species) in and off the coasts of California, Oregon, and Washington. Most species and fisheries were recommended as a "Good Alternative." However, Puget Sound Chinook salmon and Columbia River coho salmon caught above Bonneville Dam should be avoided primarily because the wild stock in these fisheries is listed under the Endangered Species Act (ESA), and harvests likely include a high proportion of the ESA component.

Evaluation of the abundance factor in Criterion 1 was based on spawning escapements relative to goals and the presence of hatchery fish on the spawning grounds. Nearly all fisheries on the US West Coast are supported by hatchery (sea ranching) production. Production hatcheries are often located on large watersheds that support wild salmon; therefore many hatchery fish stray to the streams and spawn with the wild salmon. Hatchery fish contribution to naturally spawning populations is generally not estimated. Thus the abundance factor for Chinook, coho and chum salmon was typically a "moderate" concern, because hatchery production is significant and may confound the status of the natural-origin stock. In contrast, pink and sockeye abundance was typically a "low" concern because these species have relatively little hatchery production. Puget Sound Chinook and Columbia River coho caught above Bonneville Dam were scored as "very high" concern because the primary stocks caught by the fishery are both ESA-listed.

Significant progress in fisheries management has occurred in all fisheries, largely in response to numerous listings of salmon under the Endangered Species Act. Essentially one or more ESA-listed salmon species is incidentally harvested in each of the fisheries. Fishing mortality on the targeted (recommended) species is therefore often constrained by these “weak” stocks, and fishing mortality on the targeted species was typically rated as a "low" or "moderate" concern because it was within the range of sustainability for the targeted species. However, Puget Sound Chinook (gillnet and troll) received a "high" concern because these fisheries, in addition to outside fisheries, likely harvested a number of ESA-listed fish while attempting to capture hatchery fish not listed by the ESA. Many hatchery Chinook in Puget Sound are ESA-listed.

Evaluation of Criterion 2 (impacts on other species) usually involved one or more ESA-listed salmon species; therefore, this criterion typically received the lowest score of all four criteria. Abundance of these species typically received a very high conservation concern, whereas fishing mortality sometimes received "low" concern because managers effectively reduced incidental impacts on these species. Fisheries receiving "moderate" concern included all west coast troll fisheries (Chinook, and sometimes coho) and Puget Sound sockeye (gillnet, seine). Fishing mortality of ESA-listed coho in the Klamath gillnet fishery was considered a "high" concern, largely because the population has continued to decline.

Management effectiveness (Criterion 3) typically was scored as "moderately effective." Management of these fisheries is complicated by the presence of ESA-listed species, a broad mixture of natural populations and hatchery stocks, gauntlet fisheries, multiple user groups (sport, treaty, non-treaty), and numerous hatchery fish entering the spawning grounds. Nevertheless, most of the fisheries are carefully managed with a reasonable strategy, recovery objectives, research, enforcement, and track record. Inclusion of stakeholders in a transparent process and incorporation of scientific advice were considered "highly effective." Bycatch was typically scored as "highly effective" when actions were taken to avoid ESA-listed species. Research has led to catch and release survival estimates that are incorporated into management.

Impacts on Habitat and Ecosystem (Criterion 4) typically received a "very low" concern with regard to impacts of the fishery on the substrate because salmon fishing gear usually has little contact with the bottom. However, ecosystem-based fisheries management was typically scored as a "high" concern because many hatchery fish are allowed to spawn in the rivers, leading to potential genetic and ecological impacts to the wild population.

Final Seafood Recommendations

SPECIES/FISHERY	CRITERION 1: IMPACTS ON THE SPECIES	CRITERION 2: IMPACTS ON OTHER SPECIES	CRITERION 3: MANAGEMENT EFFECTIVENESS	CRITERION 4: HABITAT AND ECOSYSTEM	OVERALL RECOMMENDATION
Chinook salmon United States of America Northeast Pacific, Trolling lines, United States of America, Chinook fishery - Humbug Mt. to Horse Mt.	Green (3.318)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.368)**
Chinook salmon Oregon Northeast Pacific, Trolling lines, United States of America, Chinook fishery - North of Cape Falcon	Green (3.318)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.368)**
Coho salmon Oregon Northeast Pacific, Trolling lines, United States of America, Coho fishery - North of Cape Falcon	Yellow (2.644)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.237)**
Chinook salmon Washington Northeast Pacific, Drift gillnets, United States of America, Chinook fishery	Green (3.318)	Yellow (2.236)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.838)**
Chum salmon Washington Northeast Pacific, Drift gillnets, United States of America, Chum fishery	Green (3.831)	Yellow (2.236)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.941)**
Coho salmon Washington Northeast Pacific, Drift gillnets, United States of America, Coho fishery	Green (3.318)	Yellow (2.236)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.838)**
Sockeye salmon Washington Northeast Pacific, Drift gillnets, United States of America, Sockeye fishery	Green (3.831)	Yellow (2.236)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.941)**

Chinook salmon United States of America Northeast Pacific, Trolling lines, United States of America, Chinook fishery - Cape Falcon to Humbug Mt.	Yellow (2.709)	Red (1.526)	Yellow (3.000)	Green (3.873)	**Good Alternative (2.632)**
Chinook salmon United States of America Northeast Pacific, Trolling lines, United States of America, Chinook fishery - Horse Mt. to U.S./Mexico Border	Yellow (2.644)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.237)**
Sockeye salmon United States of America Columbia River, Drift gillnets, Sockeye fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Chinook salmon United States of America Klamath River, Drift gillnets, Chinook fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Chinook salmon United States of America Puget Sound, Drift gillnets, United States of America, Chinook fishery	Red (1.000)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Avoid (1.911)**
Chinook salmon United States of America Puget Sound, Purse seines, United States of America, Chinook fishery	Red (1.526)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Avoid (2.124)**
Chinook salmon United States of America Puget Sound, Trolling lines, United States of America, Chinook fishery	Red (1.000)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Avoid (1.754)**
Chum salmon United States of America Puget Sound, Drift gillnets, United States of America, Chum fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**

Chum salmon United States of America Puget Sound, Purse seines, United States of America, Chum fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Coho salmon United States of America Puget Sound, Drift gillnets, United States of America, Coho fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Coho salmon United States of America Puget Sound, Purse seines, United States of America, Coho fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Coho salmon United States of America Puget Sound, Trolling lines, United States of America, Coho fishery	Green (3.318)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.368)**
Pink salmon United States of America Puget Sound, Drift gillnets, United States of America, Pink fishery	Green (5.000)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.858)**
Pink salmon United States of America Puget Sound, Purse seines, United States of America, Pink fishery	Green (5.000)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.858)**
Pink salmon United States of America Puget Sound, Trolling lines, United States of America, Pink fishery	Green (5.000)	Red (1.000)	Yellow (3.000)	Yellow (3.162)	**Good Alternative (2.624)**
Sockeye salmon United States of America Puget Sound, Drift gillnets, United States of America, Sockeye fishery	Green (3.831)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.673)**

Sockeye salmon United States of America Puget Sound, Purse seines, United States of America, Sockeye fishery	Green (3.831)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.673)**
Chinook salmon United States of America Columbia River, Drift gillnets, Chinook fishery	Green (3.318)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.579)**
Coho salmon United States of America Columbia River, Gillnets and entangling nets (unspecified), Coho fishery below Bonneville Dam	Green (3.831)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Good Alternative (2.673)**
Coho salmon United States of America Columbia River, Drift gillnets, Coho fishery above Bonneville Dam	Red (1.526)	Red (1.526)	Yellow (3.000)	Yellow (2.915)	**Avoid (2.124)**

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This report evaluates US West Coast commercial salmon fisheries (all five Pacific salmon species) in and off the coasts of California, Oregon, and Washington. Most species and fisheries were recommended as a "Good Alternative." However, Puget Sound Chinook salmon and Columbia River coho salmon should be avoided primarily because the wild stock in these fisheries is listed under the Endangered Species Act (ESA), and harvests likely include a high proportion of the ESA component.

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rated as a "low" or "moderate" concern because it was within the range of sustainability for the targeted species. However, Puget Sound Chinook (gillnet and troll) received a "high" concern because these fisheries, in addition to outside fisheries, likely harvested a number of ESA-listed fish while attempting to capture hatchery fish not listed by the ESA. Many hatchery Chinook in Puget Sound are ESA-listed.

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Scoring Guide

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

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

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

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

Introduction

Scope of the analysis and ensuing recommendation

The overall objective of this analysis is to assess wild salmon fisheries in the Northeast Pacific, particularly those that have not been certified as sustainable to the Marine Stewardship Council (MSC) standard. This report includes US West Coast commercial salmon fisheries in and off the coasts of California, Oregon, and Washington. Columbia River commercial fisheries, both treaty and non-treaty, are included as well. Recommendations are made for five Pacific salmon species: Chinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), chum salmon (O. keta), sockeye salmon (O. nerka), and pink salmon (O. gorbuscha).

Species Overview

Chinook salmon

Chinook salmon are the largest of the Pacific salmon species (*Oncorhynchus* spp.) and mature at the oldest ages. As with all Pacific salmon they are anadromous, spawning in freshwater but spending the majority of their lives in the ocean (Healey 1991). Like all salmon, maturing individuals home back to their natal areas to spawn. In North America, Chinook salmon spawn in freshwater rivers draining into the Pacific Ocean from San Francisco Bay to western Alaska. They also spawn in Russian rivers from Chukotka to Kamchatka but are less abundant there than in North America (Augerot 2005). Chinook salmon are often classified into two juvenile life history types: "stream-type" Chinook reside in freshwater for a year or more before migrating to the ocean; "ocean-type" Chinook migrate to the ocean within a year of emergence.

Coho salmon

Coho salmon are an anadromous species of Pacific salmon that occurs at relatively low abundances in small populations (Sandercock 1991). In North America they spawn in rivers from central California to Alaska, with higher concentrations of fish occurring from central Oregon to western Alaska. In Asia, they occur mostly in Russia from the Anadyr River basin to Sakhalin (Augerot 2005). Juvenile coho typically rear in freshwater for one to two years and utilize a wide range of freshwater habitats (Sandercock 1991). Nearly all coho return to spawn after 12 to 18 months at sea.

Chum salmon

Chum salmon are the most widely distributed of the Pacific salmon species (Augerot 2005). They spawn as far north as the McKenzie River on the arctic coast of Canada and historically as far south as Monterey, California, but they currently occur only as far south as Tillamook Bay on the northern Oregon coast. In Asia, they are found in Korea, Japan, and the far north of Russia. Chum salmon do not rear in freshwater for extended periods, typically migrating to estuarine or marine waters shortly after they hatch and emerge from gravel. They are one of the larger Pacific salmon species.

Sockeye salmon

Sockeye salmon are a smaller species of Pacific salmon that typically rears in lakes for one to two years during the juvenile life stage. Sockeye show a high diversity of life history strategies, with fish spawning in streams, rivers, and on lake shores (Burgner 1991). Most sockeye are anadromous, but there is a non-anadromous form known as kokanee that spend their whole lives in freshwater. In North America, anadromous sockeye spawn from the Columbia River to Point Hope in northwestern Alaska. In Russia, they occur from the Anadyr River area of Siberia to the Kuril Islands (Augerot 2005). Sockeye typically spend two or three winters at sea.

Pink salmon

Pink salmon are an anadromous species of Pacific salmon that are notable for their abundance and fixed age at maturity. Pink salmon are broadly distributed across the North Pacific, since their current spawning grounds range from Sakhalin and Kamchatka in Russia to the Columbia River in the United States (Augerot 2005). They are the most abundant of the Pacific salmon, especially at higher latitudes. Pink salmon have a fixed two-year

lifespan, which results in minimal interbreeding between populations that spawn in odd and even years (Heard 1991). As a result, odd and even year pink salmon are often treated as separate stocks. Juveniles spend minimal time in freshwater before migrating to the ocean. Pink salmon have relatively high rates of straying, where individuals do not return to their natal sites to spawn (Quinn 2011).

Management bodies
A variety of federal, state, and tribal authorities manage Pacific salmon fisheries on the US West Coast. These include the Pacific Fishery Management Council (PFMC), the National Marine Fisheries Service (NMFS), the North Pacific Anadromous Fish Commission, the US-Canadian Pacific Salmon Commission, state fisheries departments, and Native American tribes.

History of the fisheries
Pacific salmon have long been an important food and cultural resource for Native American tribes and First Nations along the US West Coast, with pre-industrial harvests in some regions (e.g., California) considerably greater than they are today. Despite the apparent plenitude of salmon runs, the US was well aware of the factors that can endanger salmon populations at an early stage. In 1875, America's first national Fish Commissioner, Spencer Baird, issued a report identifying habitat alteration, dam construction, and over-exploitation as factors with the potential to threaten salmon populations (Lichatowich et al. 1999). However, Baird believed each of these problems could be resolved through artificial propagation of fish. This untested belief paved the way to rampant loss of habitat, overfishing and the widespread construction of hatcheries. Harvests in rivers throughout the contiguous US generally peaked between 1880 and 1920 and have gradually declined despite management efforts. It took nearly 100 years of declining salmon runs before managers began to take a critical look at hatcheries, but by then many salmon runs were already extinct. By the early 1990s, native salmon species had been extirpated from an estimated 40% of their native spawning territory in the region, and numerous populations had been listed as "Threatened" or "Endangered" under the US Endangered Species Act (ESA). Negative impacts to wild salmon due to hatchery programs include the introduction of diseases, competition with naturally spawned fish, and alteration of genetic diversity through interbreeding, which may affect the fitness of subsequent generations (Naish et al. 2007). Today, Pacific salmon are one of the most intensively monitored and managed groups of fish in the world. Given their commercial importance as well as the ESA status of many stocks, considerable attention is devoted to assessing and maintaining stock abundance.

Production Statistics

According to North Pacific Anadromous Fish Commission statistical yearbooks, global production of Pacific salmon is on the order of 926,000 metric tonnes (MT) per year. Major producers include the United States (with the large majority of fish caught in Alaska), Canada, Russia, and Japan. Within the global context, lower US West Coast salmon fisheries (Washington, Oregon, and California) are relatively small producers, having landed an annual average of 12,986 MT from 1998 to 2012 (NMFS 2014d). The productivity of the fisheries assessed in this report relative to US and North American catches are shown in Table 1. Chinook salmon caught in the lower US make up a significant portion (57%) of the total US catch. The other Pacific salmon species comprise smaller portions of the total US catch (13% for coho, 8% for chum, 1% for both pink and sockeye).

Area	Species	Gear	Catch	% lower US catch	% US + AK catch	% NA catch
Columbia River	Chinook	gillnet	198913	0.27	0.16	0.14
Klamath River	Chinook	gillnet	23608	0.03	0.02	0.02
Puget Sound	Chinook	all gear	106219	0.14	0.09	0.07
WA Coast Inside	Chinook	gillnet	21434	0.03	0.02	0.01
Horse Mtn to US/Mexico	Chinook	troll	255556	0.35	0.21	0.18
Horse Mtn to Humbug Mtn	Chinook	troll	9791	0.01	0.01	0.01
Humbug Mtn to Cape Falcon	Chinook	troll	120869	0.16	0.10	0.08
North of Cape Falcon	Chinook	troll	5314	0.01	0.00	0.00
Puget Sound	chum	all gear	1210020	0.99	0.06	0.06
WA Coast Inside	chum	gillnet	2236	0.00	0.00	0.00
Columbia River	coho	gillnet	111660	0.19	0.02	0.02
Puget Sound	coho	all gear	300261	0.52	0.06	0.06
WA Coast Inside	coho	gillnet	114189	0.20	0.02	0.02
North of Cape Falcon	coho	troll	4975	0.01	0.00	0.00
Puget Sound	pink	all gear	1203346	1.00	0.01	0.01
Columbia River	sockeye	gillnet	9920	0.03	0.00	0.00
Puget Sound	sockeye	all gear	351403	0.97	0.01	0.01
WA Coast Inside	sockeye	gillnet	5060	0.01	0.00	0.00

Figure 1: Commercial catches (in numbers of fish) and proportions of total catches (lower U.S., total U.S., and North America), by species, for the fisheries assessed in this report. The lower U.S. catch includes only catches from Washington, Oregon, and California, while the total U.S. catch also includes Alaska catches. The North America catch combines U.S. and Canada catches. Annual data were obtained from the North Pacific Anadromous Fish Commission and were averaged over the past fifteen years (1999-2013).

Within Washington, Oregon, and California, commercial catches of Pacific salmon have been variable. The following figures show the majority of total commercial catches for these states but do not include recreational, tribal, and freshwater fisheries (Irvine et al. 2012). Chinook catches have increased following an especially low catch in 2008, while coho catches have been fairly stable (Fig. 1). Sockeye catches have been low in recent years, chum catches have increased slightly, and pink catches have been quite high since 2009 (Fig. 2).

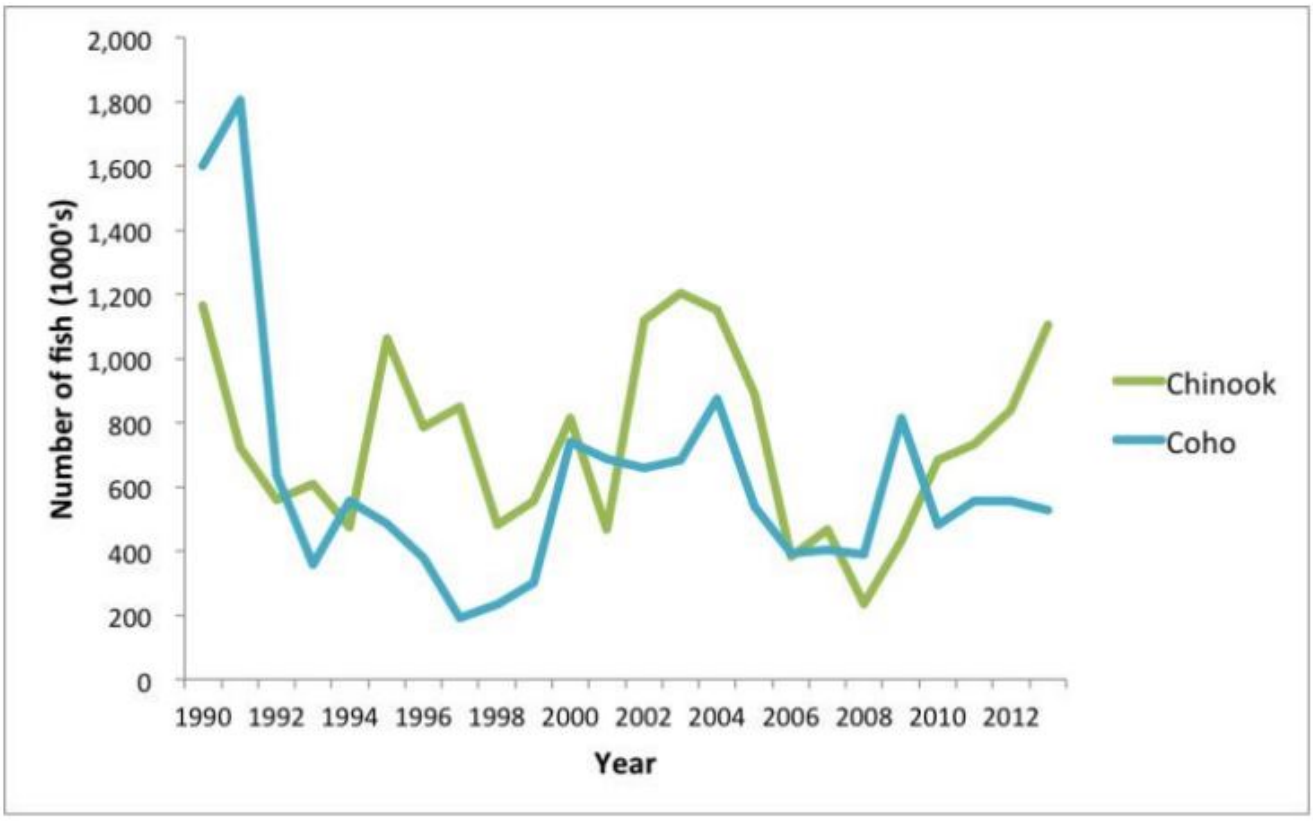


Figure 2: Catches of Chinook and coho salmon in Washington, Oregon, and California over time. Data from Irvine et al. 2012.

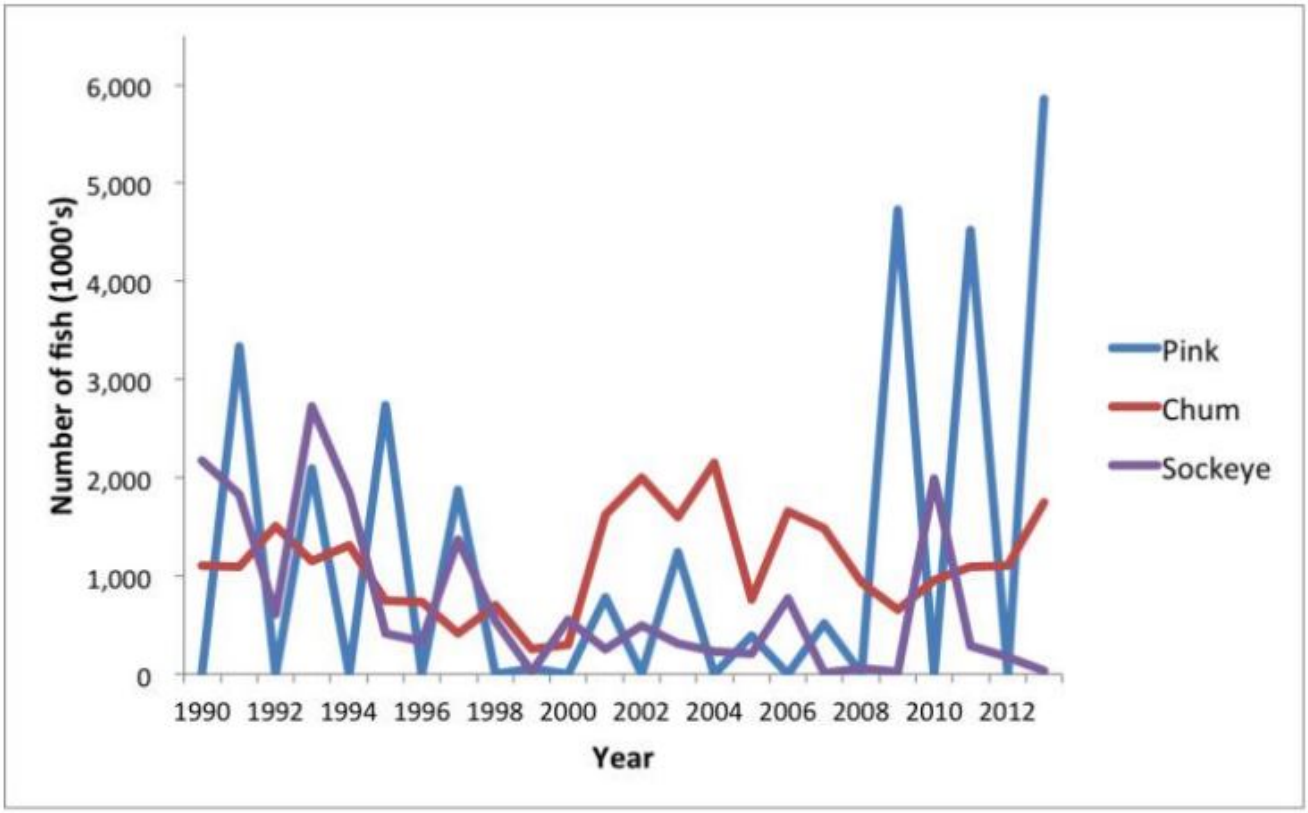


Figure 3: Catches of sockeye, chum, and pink salmon in Washington, Oregon, and California over time. Data from Irvine et al. 2012.

Importance to the US/North American market.

The US imported 280,680 MT of salmon products in 2013, with farmed Atlantic salmon making up over 99% of imports (NMFS 2013). Imports have come mostly from Chile, followed by Canada, China, and Norway. China is primarily a processor rather than a producer, so much of the product imported from China was produced by other countries, including the US. In 2013 the US exported 186,023 tons of salmon valued at USD 620 million (NMFS 2013). Salmon caught in the US are exported to Japan, the European Union, and to China. The fish exported to China are mostly reprocessed and then sold to markets in the US and European Union.

US imports of Pacific salmon have fluctuated over time but were at a record high in 2013, with particularly large imports of sockeye and pink salmon (Fig. 3).

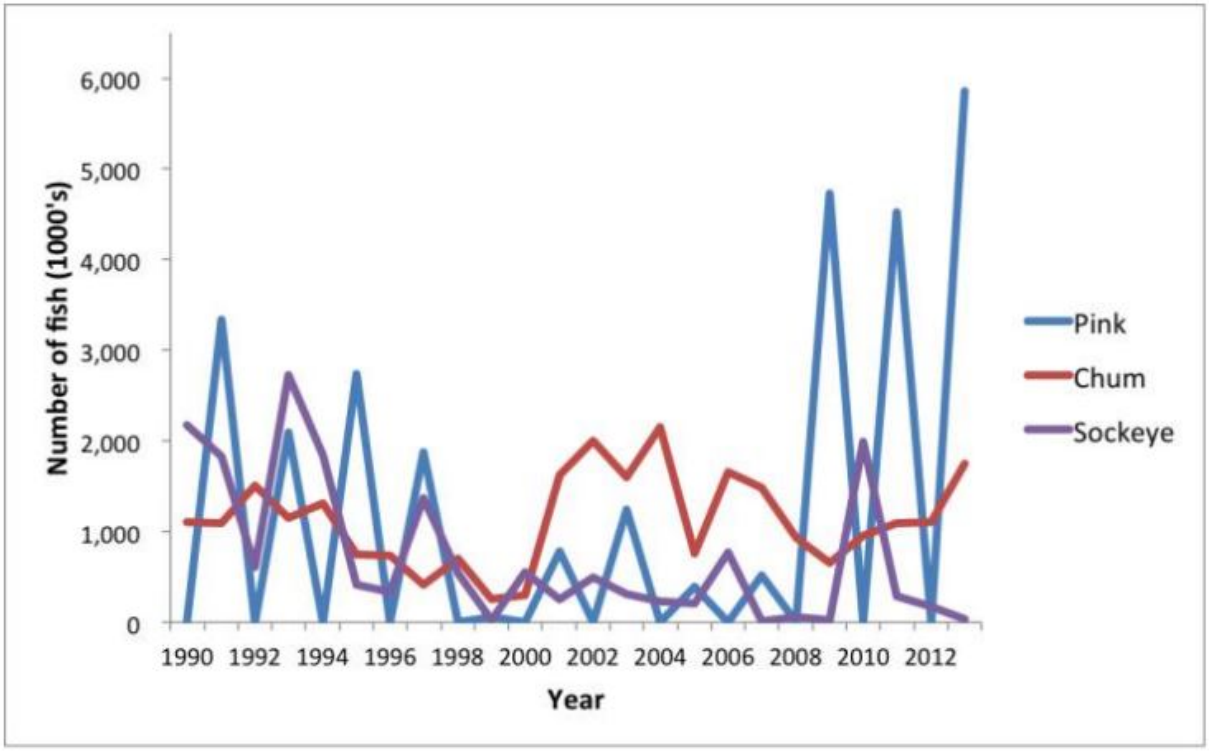


Figure 4: U.S. imports of Pacific salmon over time, by species. Data are in metric tons and are from the National Marine Fisheries Service Commercial Fisheries Statistics Division (http://www.st.nmfs.noaa.gov/commercial-fisheries/).

Common and market names.

Chinook salmon: king salmon, spring salmon
Coho salmon: silver salmon, medium red salmon
Chum salmon: keta salmon, dog salmon
Sockeye salmon: blueback salmon, red salmon
Pink salmon: humpback salmon

Primary product forms

Chinook salmon: fillets, steaks, and whole fish (fresh and frozen), canned, smoked, dried, salted, roe
Coho salmon: fillets and whole fish (fresh and frozen), canned, smoked, dried, salted, roe

Chum salmon: mostly canned but also sold as fillets (fresh and frozen), dried-salted, smoked, roe
Sockeye salmon: fillets, steaks, and whole fish (fresh and frozen), canned, smoked, dried, salted, roe
Pink salmon: mostly canned but also sold as fillets (fresh and frozen), dried-salted, smoked, roe

Assessment

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

Criterion 1: Impacts on the species under assessment

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

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

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

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

Criterion 1 Summary

CHINOOK SALMON				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
United States of America/Northeast Pacific Trolling lines | United States of America | Chinook fishery - Humbug Mt. to Horse Mt.	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
Oregon/Northeast Pacific Trolling lines | United States of America | Chinook fishery - North of Cape Falcon	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
Washington/Northeast Pacific Drift gillnets | United States of America | Chinook fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Northeast Pacific Trolling lines | United States of America | Chinook fishery - Cape Falcon to Humbug Mt.	2.00: Medium	2.00: High Concern	3.67: Low Concern	Yellow (2.71)

United States of America/Northeast Pacific Trolling lines | United States of America | Chinook fishery - Horse Mt. to U.S./Mexico Border	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)
United States of America/Klamath River Drift gillnets | Chinook fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Puget Sound Drift gillnets | United States of America | Chinook fishery	2.00: Medium	1.00: Very High Concern	1.00: High Concern	Red (1.00)
United States of America/Puget Sound Purse seines | United States of America | Chinook fishery	2.00: Medium	1.00: Very High Concern	2.33: Moderate Concern	Red (1.53)
United States of America/Puget Sound Trolling lines | United States of America | Chinook fishery	2.00: Medium	1.00: Very High Concern	1.00: High Concern	Red (1.00)
United States of America/Columbia River Drift gillnets | Chinook fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)

CHUM SALMON				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
Washington/Northeast Pacific Drift gillnets | United States of America | Chum fishery	2.00: Medium	4.00: Low Concern	3.67: Low Concern	Green (3.83)
United States of America/Puget Sound Drift gillnets | United States of America | Chum fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)

United States of America/Puget Sound Purse seines | United States of America | Chum fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)

COHO SALMON				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
Oregon/Northeast Pacific Trolling lines | United States of America | Coho fishery - North of Cape Falcon	2.00: Medium	3.00: Moderate Concern	2.33: Moderate Concern	Yellow (2.64)
Washington/Northeast Pacific Drift gillnets | United States of America | Coho fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Puget Sound Drift gillnets | United States of America | Coho fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Puget Sound Purse seines | United States of America | Coho fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Puget Sound Trolling lines | United States of America | Coho fishery	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Columbia River Gillnets and entangling nets (unspecified) | Coho fishery below Bonneville Dam	2.00: Medium	4.00: Low Concern	3.67: Low Concern	Green (3.83)

United States of America/Columbia River Drift gillnets | Coho fishery above Bonneville Dam	2.00: Medium	1.00: Very High Concern	2.33: Moderate Concern	Red (1.53)

PINK SALMON				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
United States of America/Puget Sound Drift gillnets | United States of America | Pink fishery	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
United States of America/Puget Sound Purse seines | United States of America | Pink fishery	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)
United States of America/Puget Sound Trolling lines | United States of America | Pink fishery	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	Green (5.00)

SOCKEYE SALMON				
Region | Method	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Score**
Washington/Northeast Pacific Drift gillnets | United States of America | Sockeye fishery	3.00: Low	4.00: Low Concern	3.67: Low Concern	Green (3.83)
United States of America/Columbia River Drift gillnets | Sockeye fishery	3.00: Low	3.00: Moderate Concern	3.67: Low Concern	Green (3.32)
United States of America/Puget Sound Drift gillnets | United States of America | Sockeye fishery	3.00: Low	4.00: Low Concern	3.67: Low Concern	Green (3.83)

United States of America/Puget Sound Purse seines | United States of America | Sockeye fishery	3.00: Low	4.00: Low Concern	3.67: Low Concern	Green (3.83)

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Inherent Vulnerability

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

Factor 1.2 - Abundance

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

Factor 1.3 - Fishing Mortality

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted,*

reasonable management is in place.

- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

CHINOOK SALMON

Factor 1.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Medium

The FishBase vulnerability score for Chinook salmon is 68, which corresponds to high inherent vulnerability. However, the productivity-susceptibility analysis (PSA) suggests moderate vulnerability based on attributes including age at maturity, maximum size, reproductive strategy, and trophic level (see Table 2 for estimates used). We rated inherent vulnerability as "medium."

Justification:

The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Data used for the productivity susceptibility analysis were obtained from Fishbase.org and are shown in Table 2.

Trait	Estimate	Score
Average at maturity (years)	4	3
Average maximum age (years)	8	3
Average maximum size (cm)	150	2
Average size at maturity (cm)	76.7	2
Reproductive strategy	demersal egg layer	2
Trophic level	4.4	1
Average score		2.17

Figure 5: Table of Chinook salmon trait estimates and scores used for determining inherent vulnerability using productivity and susceptibility analysis.

Factor 1.2 - Abundance

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

Moderate Concern

This area is referred to as the Klamath Management Zone (KMZ). The KMZ was created to focus management on Klamath River fall (KRF) Chinook because ocean fishery impacts on this stock occur primarily in this area. Other major contributing stocks include Sacramento River fall (SRF) Chinook and Southern Oregon/Northern California Coast (SONCC) Chinook. The SRF Chinook stock has met escapement goals in 67% of the past fifteen years (1999 to 2013), and the KRF Chinook stock (which serves as the indicator stock for both KRF and SONCC Chinook) has met escapement goals in 60% of the past fifteen years (PFMC 2014a). However, there is substantial hatchery production in both the Sacramento and Klamath River systems, and both natural and hatchery-origin fish on the spawning grounds are counted in "natural" escapements. Abundance for this fishery is of "moderate" concern because although escapement goals for indicator stocks are being met more than 50% of the time, escapement monitoring does not differentiate between wild and hatchery-origin fish.

Justification:

Management targets for KRF and SRF Chinook have varied over the past fifteen years, but when evaluating abundances, we compared escapement counts against the lower escapement goals, which are based on S_{MSY}. For Sacramento River fall Chinook, the lower escapement goal of 122,000 fish was met in 67% of the past fifteen years (1999 to 2013), with low escapements from 2007 to 2011 followed by two years of high escapements (Fig. 5)

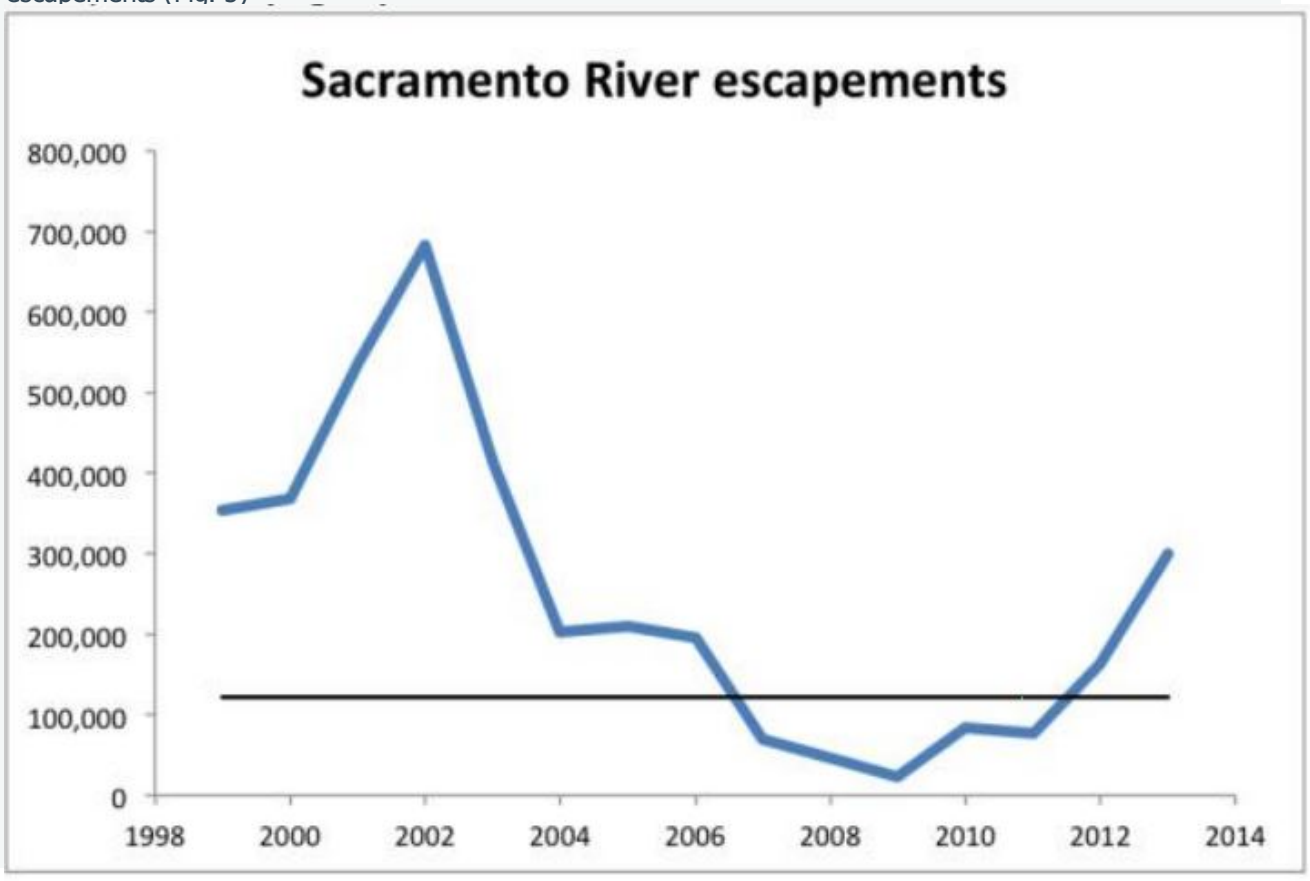


Figure 6: Sacramento River Fall Chinook escapements to natural areas (blue line) relative to the lower escapement target of 122,000 fish (black line). The escapement counts and target include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

(PFMC 2014a). Klamath River fall Chinook is the indicator stock for both KRF and SONCC Chinook. The escapement goal of 40,700 fish on the natural spawning grounds was met in 60% of the past fifteen years, with a period of low escapements from 2004 to 2006 (Fig. 6)

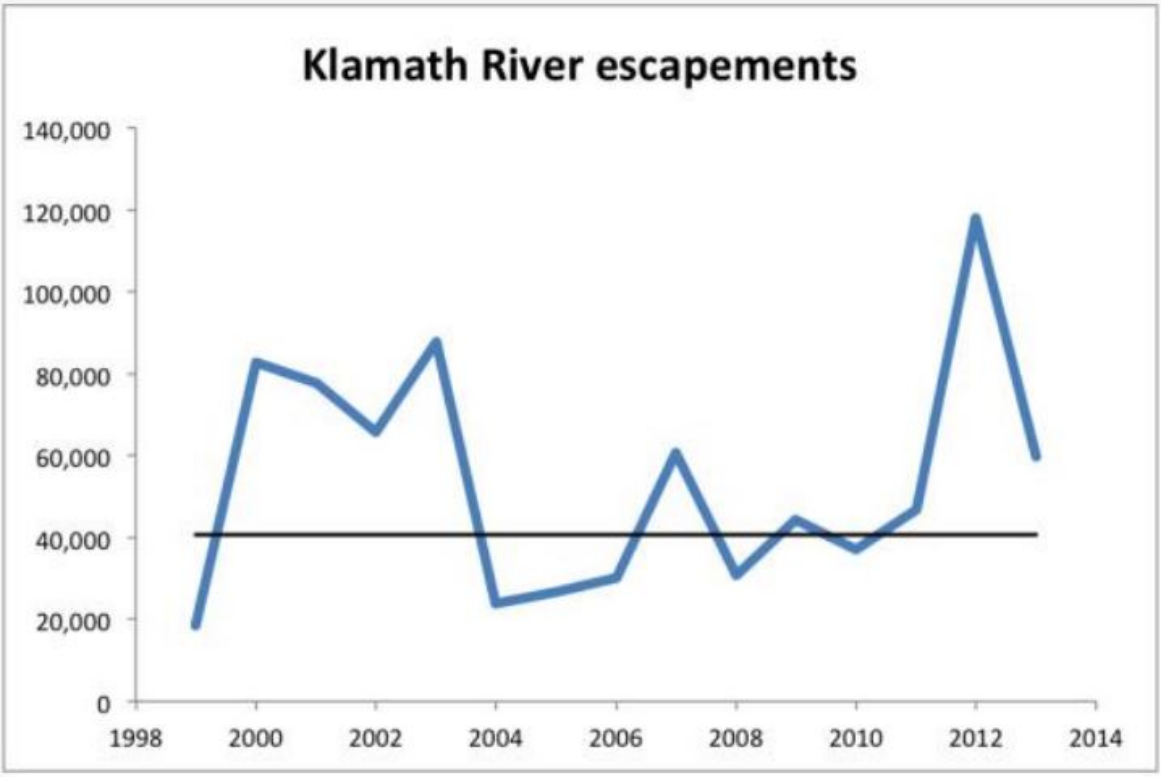


Figure 7: Klamath River Fall Chinook escapements (blue line) relative to the escapement target of 40,700 fish (black line). The escapement counts and target are for salmon spawning in natural areas in both the Klamath and Trinity rivers, but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

The escapement goal was exceeded in both 2012 and 2013 (PFMC 2014a). There are significant hatchery programs for both of these stocks. One study estimated that 90% of the Chinook salmon caught off the California Coast were of hatchery-origin (Barnett-Johnson et al. 2007). Proportions of hatchery-origin Chinook salmon in escapements to natural spawning areas in California have been estimated, and they vary from 0 to 90% (Palmer-Zwahlen and Kormos 2013) (Austing and Null 2013).

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON

Moderate Concern

Fisheries in this management area are heavily dependent on the production of Tule fall Chinook from Columbia River hatcheries, which can comprise over half of the catch in a typical year. Other stocks that contribute significant proportions to catches include Upper Columbia River summer and "bright" fall Chinook, and in some years, Sacramento River fall Chinook (PFMC 2011). Hatchery-produced Columbia River tule fall Chinook will not be evaluated for this factor because they are a hatchery stock. Upper Columbia River summer

and bright fall Chinook met their respective escapement goals in all of the past fifteen years (1999 to 2013), and the Columbia Lower River wild (LRW) indicator stock met its escapement goal for 87% of the past fifteen years (1999 to 2013). The Sacramento River fall Chinook stock met its escapement goal in 67% of the past fifteen years (PFMC 2014a). However, escapement counts for all of these stocks include hatchery-origin fish spawning in natural spawning areas. Thus even though the majority of natural stocks exceeded management goals more than 50% of the time, conservation concern was deemed "moderate."

Justification:

These stocks are managed as composite stocks, with escapement counts and goals including both hatchery-origin and wild salmon. The Lower Columbia River natural escapement goal is 5,700 spawners in the north Lewis River. The interim escapement goal for Upper Columbia River summer Chinook is 20,000 fish upstream of Priest Rapids Dam. This escapement goal is currently under review, in part because the Chief Joseph Hatchery became operational in 2013 (Joint Columbia River Management Staff 2014b). The escapement goal for Upper River Bright fall Chinook was 40,000 to 45,000 fish above McNary Dam plus enough fish to meet treaty obligations until 2011, when a goal of 60,000 fish was set. Management targets for Sacramento River fall Chinook have varied over the past fifteen years, but when evaluating abundances, we compared escapement counts against the lower escapement goal, which is based on S_{MSY}. For Sacramento River fall Chinook, the lower escapement goal of 122,000 fish was met in 67% of the past fifteen years (1999 to 2013), with low escapements from 2007 to 2011 followed by two years of high escapements (PFMC 2014a).

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY

Moderate Concern

There are eight Washington coastal Chinook stocks caught in this fishery: Willapa Bay, Grays Harbor, Queets River spring, Queets River fall, Hoh River spring/summer, Hoh River fall, Quillayute River spring/summer, and Quillayute River fall. All of these stocks have escapement goals for naturally spawning fish, and four of the eight stocks met their escapement goals for more than 50% of the past 15 years (PFMC 2014a). The stocks that have not been meeting their escapement goals in the majority of years have escapements fluctuating near the goal. Additionally, the Willapa Bay fall, Grays Harbor fall, Grays Harbor spring, Queets River fall, Hoh River fall, Hoh River spring/summer, Quillayute River fall, and Quillayute River spring/summer Chinook stocks have not exceeded "overfished" limit reference points (minimum stock size threshold) based on escapement data from 2011 to 2013 (PFMC 2014a). However, "natural" escapement counts for some stocks, such as Grays Harbor Chinook, explicitly include or may include hatchery-origin fish spawning in natural areas. Thus, conservation concern was deemed "moderate."

Justification:

Washington coastal Chinook stocks include all fall, summer, and spring stocks from coastal streams north of the Columbia River through the western Strait of Juan de Fuca. Escapement targets were generally set by the Washington Department of Fish and Wildlife and treaty Indian tribes and recognized in the PFMC Salmon Fishery Management Plan. Of the eight Washington coastal stocks, only the Willapa Bay fall Chinook stock has estimated natural escapements that were assumed to be derived from natural-origin parents (PFMC 2014a), but it is unclear how natural-origin fish are counted. Escapements to other streams likely include an unknown fraction of hatchery-origin Chinook.

The minimum stock size threshold (MSST) is a biomass level set below the level corresponding to maximum sustainable yield (MSY) to allow for fluctuations in abundance while maintaining the capability to produce MSY on a continuing basis. A stock is considered overfished if the 3-year geometric mean spawning escapement is less than MSST (PFMC 2014a).

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

High Concern

Southern Oregon Coast Chinook (south migrating/local stocks and the Umpqua River spring stock), Central Valley River Chinook, and Klamath River fall Chinook stocks contribute substantially to fisheries in this area (PFMC 2011). Southern Oregon Coast Chinook escapement goals were met in 20% of the past fifteen years (1999 to 2013) for fall stocks and 0% of the years from 1998 to 2012 for the two spring stocks (PFMC 2014a). The indicator stock for Central Valley River Chinook (Sacramento River fall Chinook) met its escapement goal in 67% of the past fifteen years (1999 to 2013), and Klamath River fall Chinook met its escapement goal in 60% of those years (PFMC 2014a). The escapement goal for Klamath River fall Chinook is for "natural" fish, but escapement counts include hatchery origin fish spawning in natural habitat. Southern Oregon Coast Chinook escapements were reportedly for naturally produced fish, though supporting data were not found. Abundance for this fishery is of "high" concern because more than 50% of stocks have not been meeting escapement goals, and escapement monitoring does not always differentiate between wild and hatchery fish.

Justification:

Escapement goals for south-migrating Oregon coastal fall and spring Chinook are expressed in terms of the geometric mean of individual index counts (number of adults per mile), and the goal of 60 to 90 adults per mile is the same for each stock or stock index. The south migrating Oregon coastal fall Chinook index (Deep Creek, Big Emily Creek, and Bear Creek combined) exceeded this goal in only three of the past fifteen years (1999 to 2013), and spring Chinook stocks (Rogue River and Umpqua River) never met this goal based on the fifteen most recent years of data (PFMC 2014a). Management targets for Sacramento and Klamath River fall Chinook have varied over the past fifteen years, but when evaluating abundances, we compared escapement counts against the lower escapement goals, which are equivalent to S_{MSY}. Sacramento River fall Chinook is primarily a hatchery stock. The lower escapement goal of 122,000 fish was met in 67% of the past fifteen years (1999 to 2013), with low escapements from 2007 to 2011 followed by two years of high escapements (Fig. 5)

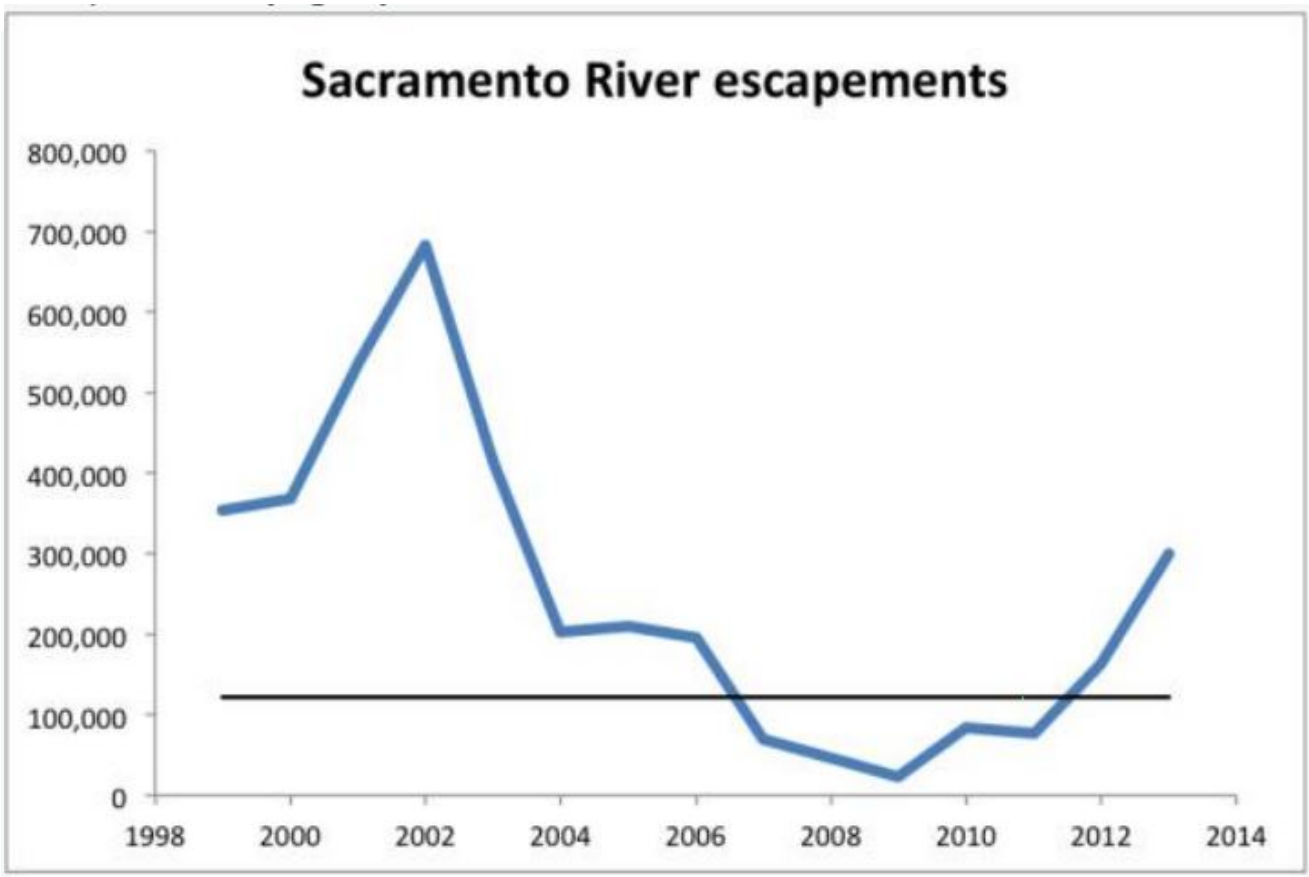


Figure 8: Sacramento River Fall Chinook escapements to natural areas (blue line) relative to the lower escapement target of 122,000 fish (black line). The escapement counts and target include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

(PFMC 2014a). For Klamath River fall Chinook, the escapement goal of 40,700 fish was met in 60% of the past fifteen years, with a period of low escapements from 2004 to 2006 (Fig. 6)

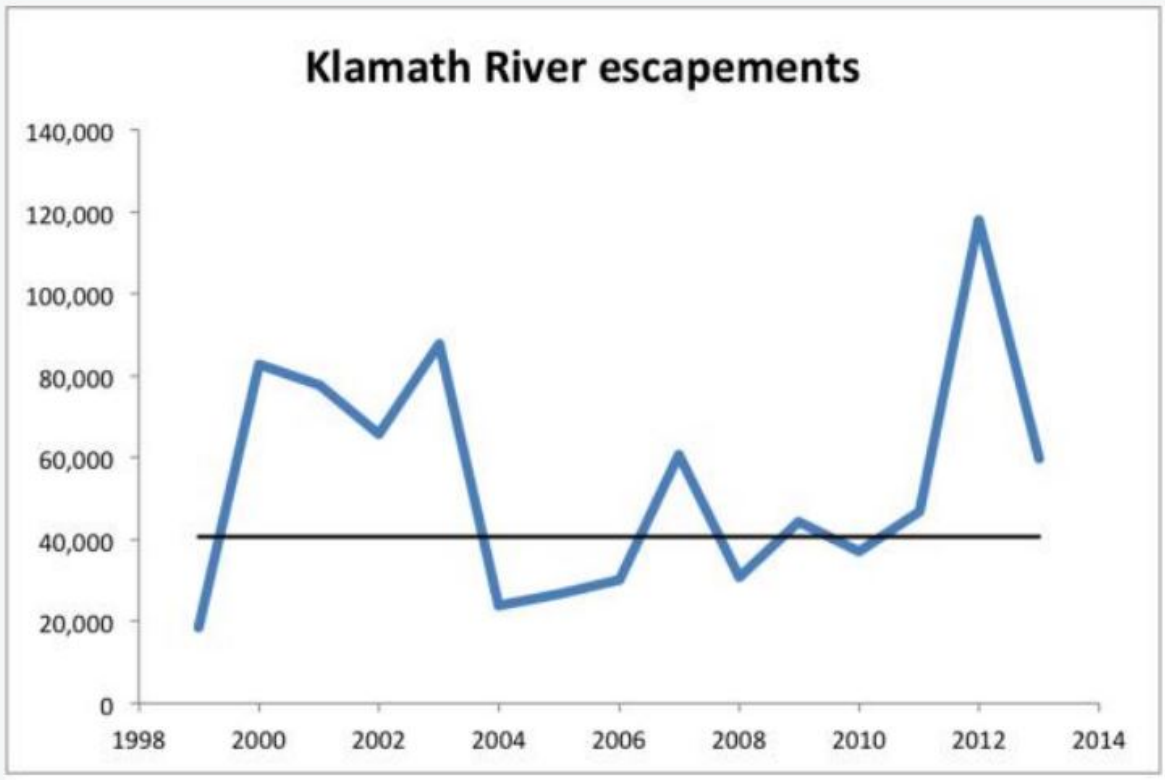


Figure 9: Klamath River Fall Chinook escapements (blue line) relative to the escapement target of 40,700 fish (black line). The escapement counts and target are for salmon spawning in natural areas in both the Klamath and Trinity rivers, but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

. The escapement goal was exceeded in both 2012 and 2013 (PFMC 2014a). Proportions of hatchery-origin salmon in escapements to natural spawning areas have been estimated, and they vary from 0 to 90% (Palmer-Zwahlen and Kormos 2013) (Austing and Null 2013).

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

Moderate Concern

California Central Valley Chinook stocks, particularly Central Valley fall (CVF) Chinook, are important contributors to fisheries throughout this area, and Southern Oregon/Northern California (SONCC) Chinook stocks contribute to fisheries in the northern part of this area (PFMC 2011). The indicator stock for the Central Valley fall (CVF) Chinook has met escapement goals in 67% of the past fifteen years (1999 to 2013) (PFMC 2014a), and the SONCC indicator stock has met natural spawning escapement goals in 60% of the past fifteen years (PFMC 2014a). However, because escapement monitoring and goals do not distinguish between wild and hatchery origin fish, abundance for this fishery is of "moderate" concern.

Justification:

Sacramento River fall (SRF) Chinook is the indicator stock for Central Valley fall Chinook, while Klamath River fall (KRF) Chinook is the indicator stock for Southern Oregon/Northern California Chinook. SRF Chinook is primarily a hatchery stock, and escapement monitoring does not distinguish between hatchery and wild fish (PFMC 2011). Management targets for Sacramento and Klamath River fall Chinook have varied over the past fifteen years, but when evaluating abundances, we compared escapement counts against the lower escapement goals (122,000 fish for Sacramento and 40,700 fish for Klamath), which are based on S_{MSY}. The lower escapement goal for SRF Chinook was met in 67% of the past fifteen years (1999 to 2013), with low escapements from 2007 to 2011 followed by two years of high escapements (Fig. 5)

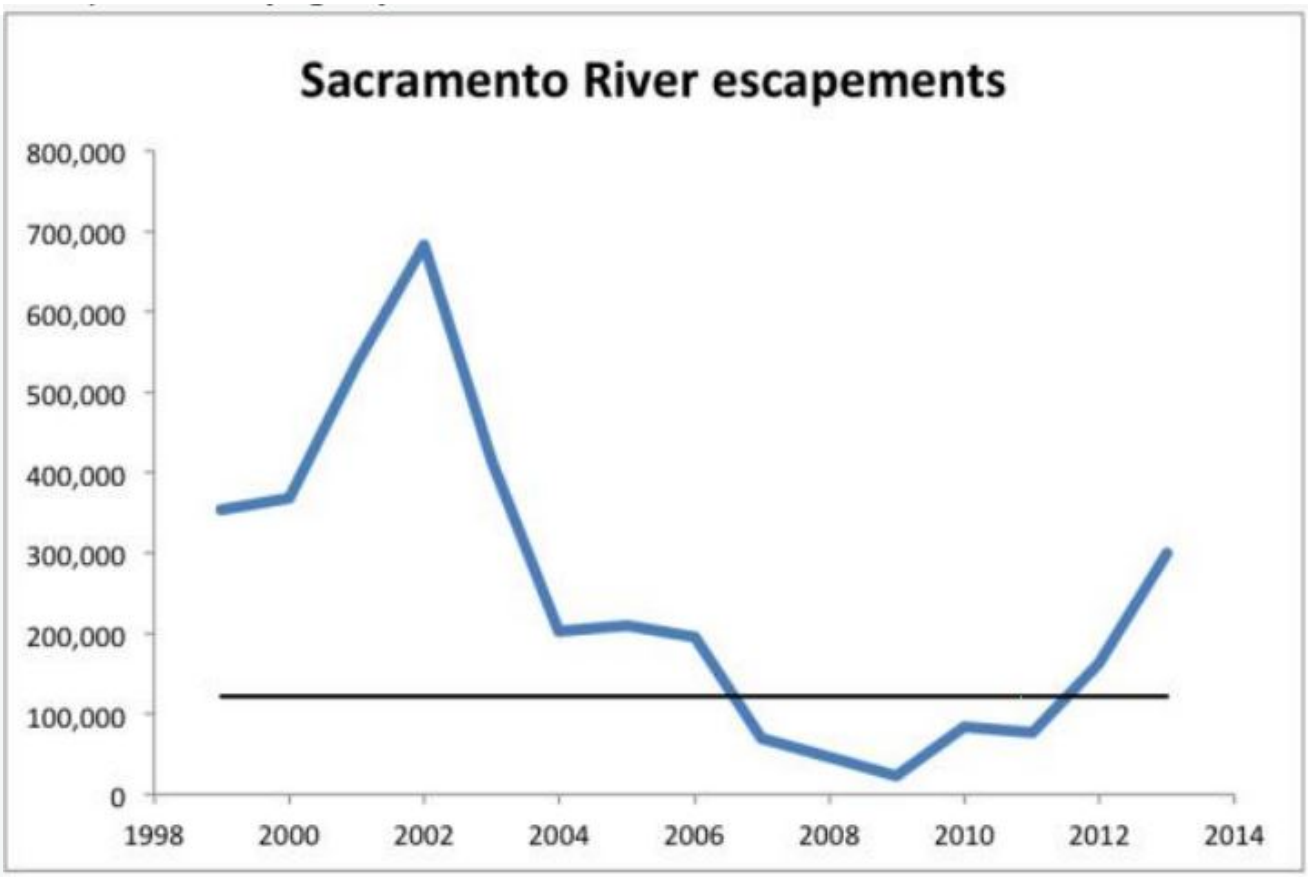


Figure 10: Sacramento River Fall Chinook escapements to natural areas (blue line) relative to the lower escapement target of 122,000 fish (black line). The escapement counts and target include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

(PFMC 2014a). The lower escapement goal for KRF Chinook was met in 60% of the past fifteen years, with a period of low escapements from 2004 to 2006 (Fig. 6)

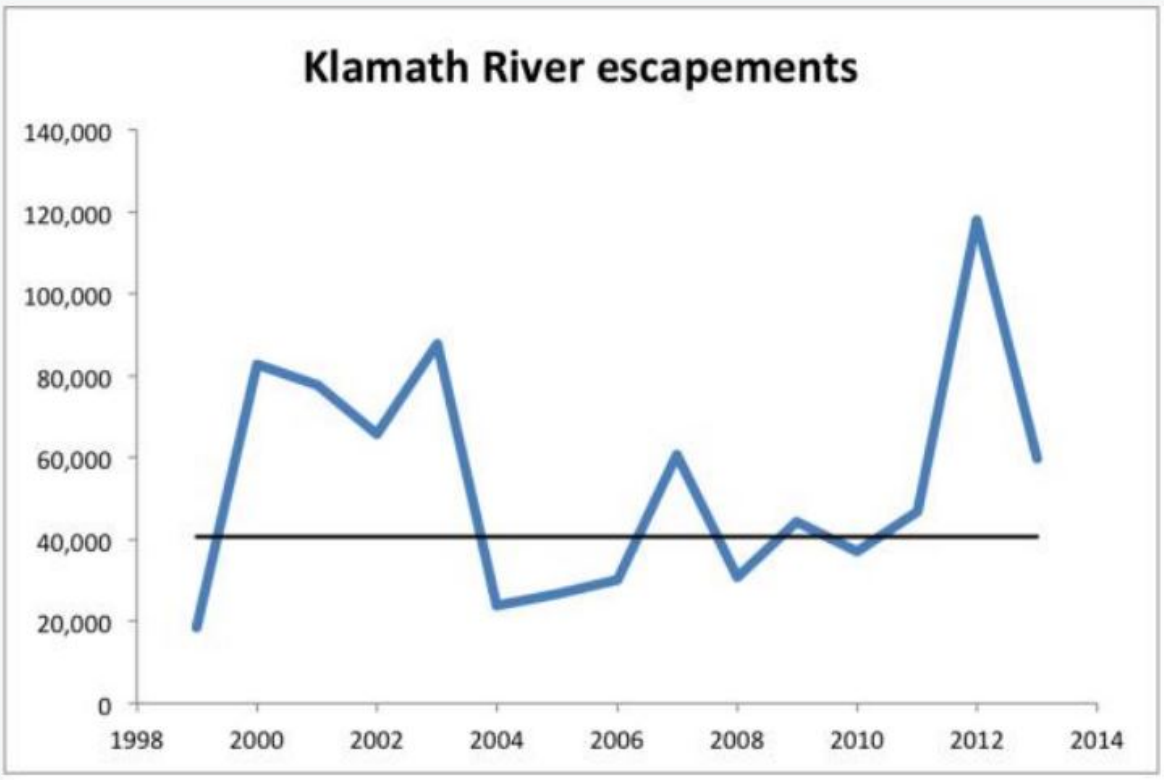


Figure 11: Klamath River Fall Chinook escapements (blue line) relative to the escapement target of 40,700 fish (black line). The escapement counts and target are for salmon spawning in natural areas in both the Klamath and Trinity rivers, but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

. The escapement goal was exceeded in both 2012 and 2013 (PFMC 2014a). Escapement goals for both stocks are for naturally spawning fish, which include hatchery-origin fish. There are significant hatchery programs for both of these stocks. One study estimated that 90% of the Chinook salmon caught off the California Coast were of hatchery-origin (Barnett-Johnson et al. 2007). Proportions of hatchery-origin salmon in escapements to natural spawning areas in California have been estimated, and they vary from 0 to 90% (Palmer-Zwahlen and Kormos 2013) (Austing and Null 2013).

UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderate Concern

The Klamath River commercial salmon fishery targets spring- and fall-run Chinook salmon returning to the Klamath basin (including the Trinity River). Klamath River fall (KRF) Chinook salmon is the indicator stock and has met the maximum sustained yield spawning (S_{MSY}) target for natural spawning fish (including hatchery-origin fish spawning in natural areas) in 60% of the past fifteen years (PFMC 2014a). Abundance for this fishery is of "moderate" concern because the S_{MSY} target and monitoring does not differentiate between wild and hatchery-origin fish.

Justification:

Klamath River Chinook include spring- and fall-run fish of natural and hatchery-origin (Williams et al. 2013). Klamath River Chinook stocks are not classified as “Endangered” or “Threatened.” KRF Chinook is the indicator stock for natural and hatchery stocks south of the Elk River, Oregon to, and including, the Klamath River, plus Umpqua River spring Chinook. The KRF S_{MSY} target of 40,700 naturally spawning fish (including hatchery-origin fish) was met in 60% of the past fifteen years, with a period of low escapements from 2004 to 2006. The S_{MSY} target was exceeded in both 2012 and 2013 (PFMC 2014a). However, management objectives and limits are set annually using a control rule that depends on the preseason abundance forecast (PFMC 2014e). As a result, the escapement objective can be set greater or less than S_{MSY} depending on the abundance forecast. Historically, the spring-run was much larger and likely the dominant run; however, habitat loss due to dams and other anthropogenic activities has reduced the spring-run to a few tributaries and hatcheries. Spring-run escapement is monitored only at a few index sites in the basin. These indices suggest that spring-run escapements are highly variable but have likely not declined since the early 1980s (Williams et al. 2013). The effect of Klamath hatchery programs on the natural Chinook population is not well understood but is thought to be significant. According to the Regional Mark Processing Center (RMPC), about 8.3 million fall-run and 1.2 million spring-run hatchery Chinook are released in the Klamath/Trinity basin each year. On average, hatchery-origin fish were estimated to represent 23% of the naturally spawning fall Chinook in the Klamath River (from Iron Gate Hatchery down to the Shasta River) (CHSRG 2012c) and 46% of those in the Trinity River (upstream of the Junction City weir) (CHSRG 2012d). The uncertainty of estimates of the hatchery-origin fish in the Klamath River was considered large because, until recently, the Iron Gate Hatchery did not mark their releases, or had marked them at very low rates (Williams et al. 2013).

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY

Very High Concern

The Puget Sound Chinook salmon fishery primarily targets hatchery Chinook while attempting to minimize bycatch of natural-origin ESA-listed ("Threatened") stocks. Many of the hatchery stocks are also protected by ESA because they are deemed necessary for rebuilding. The abundance factor receives a "very high" conservation concern because more than 5% of the harvested Chinook likely includes Chinook listed as "Threatened," and many of the monitored stock components were not consistently meeting the lower abundance threshold, especially those stocks having goals based on natural origin returns (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW and PSIT 2013) (PSC 2012) (Ford et al. 2011).

Justification:

The Puget Sound Chinook ESU includes 22 extant populations originating in 12 river basins, plus 26 artificial production programs. Abundance and productivity of Puget Sound Chinook populations is currently between 10% and 25% of historical levels (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010). Puget Sound Chinook were listed as a "Threatened" species in 1999, and that status was reaffirmed in 2005. Spawning escapement of Chinook is monitored annually in most watersheds using a variety of methods, expansions, and assumptions. Estimates of hatchery fish in the spawning grounds have often been documented in recent years. Upper management thresholds (approx. MSY escapement) and lower abundance thresholds (set well above the level that might cause population instability) have been established in most watersheds, although only three watersheds have goals specifically for natural-origin (NOR) spawners (excluding hatchery fish). Watersheds with NOR spawner goals typically have not met the lower threshold during the most recent 15 years for which data are available (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010). Some watersheds and hatcheries have an integrated production strategy whereby hatchery fish are intended to spawn in the wild. The ability to meet the total spawner goals (natural and hatchery spawners combined) was mixed: five of the eleven watersheds exceeded the lower threshold only 20% of the years. The upper management goal was met in a few of the watersheds, i.e., those where counts include both natural and hatchery origin fish. Regarding spawning escapement trends, the managers state: "*Of the 22 Chinook populations comprising the Puget Sound ESU, 14 exhibit positive escapement trends over the past fifteen years (1994–2008), all but one trend is biologically significant. Five populations exhibit negative trends, but none are significant. Trends for three populations were not assessed because they lack a 15-year time series of escapement estimates.*" These trends apparently included both natural and hatchery origin spawners; therefore, it is difficult to evaluate the status of the natural component. Comparison of the spawning thresholds with spawning observations was not straightforward. The evaluation required comparison of multiple tables throughout the management document.

NOAA Fisheries concluded during its recent review:

"All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified in the 2005 assessment are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat" (Ford et al. 2011).

During 2008 to 2012, approximately 27% of the natural Skagit River stock was harvested in Puget Sound commercial fisheries (PFMC 2014a).

In summary, the Puget Sound Chinook salmon fishery primarily targets hatchery Chinook while attempting to minimize bycatch of ESA-"Threatened" stocks which also include the hatchery stocks that are deemed necessary for rebuilding. The abundance factor is scored as a "very high" conservation concern because more than 5% of the harvested fish likely includes Chinook listed as threatened (Ford et al. 2011). Escapements of natural-origin Puget Sound Chinook have been low but somewhat stable (Fig. 4).

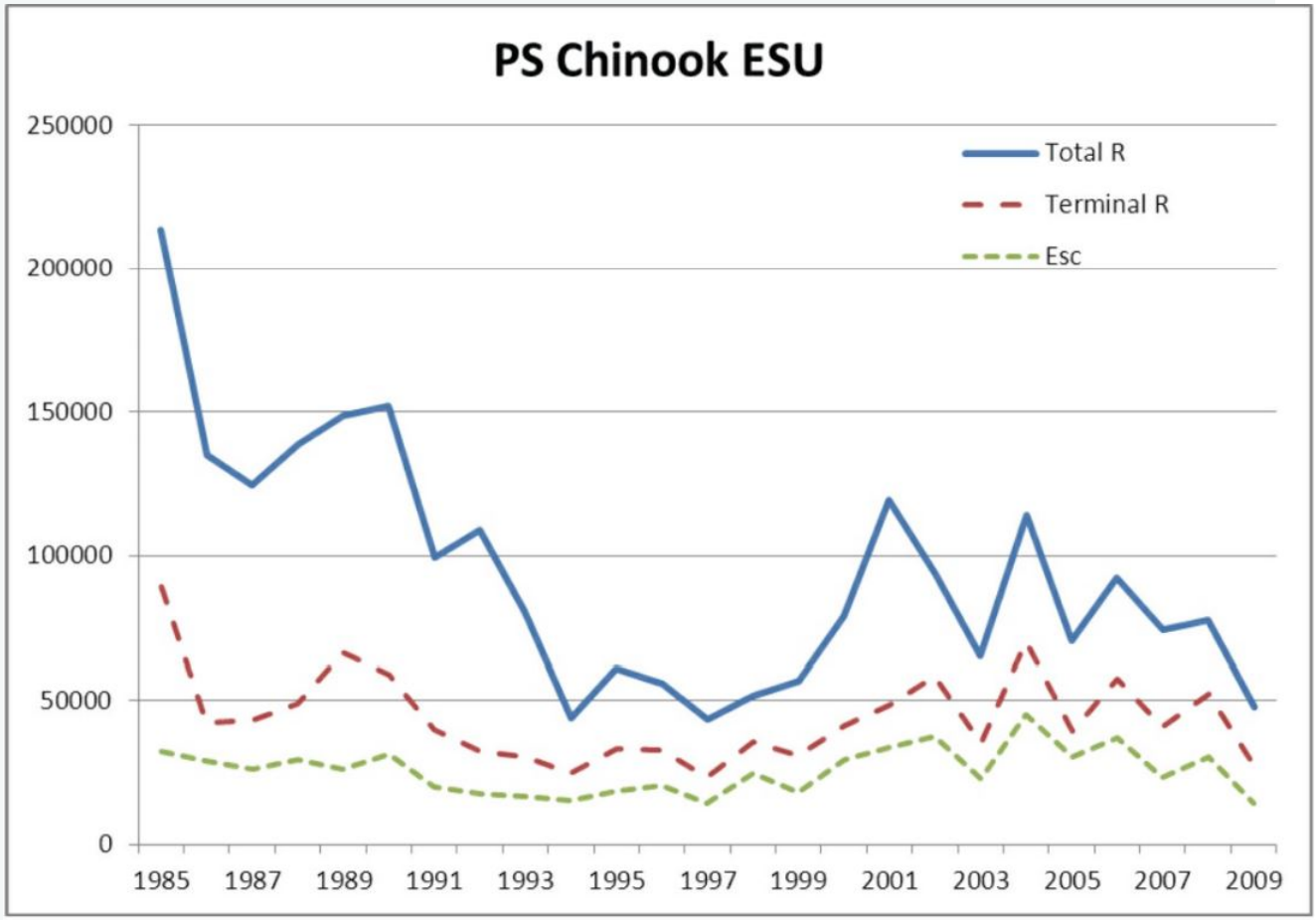


Figure 12: Total natural origin returns of chinook to Puget Sound in return years representing total return (pre any harvest and brood stock take), terminal return (pre terminal harvest and broodstock take), and natural origin spawners to the spawning grounds.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Very High Concern

The Puget Sound Chinook salmon seine fishery primarily targets other salmon species while minimizing bycatch of natural-origin ESA-"Threatened" stocks. Many of the Chinook hatchery stocks are protected by ESA because they are deemed necessary for rebuilding. The purse seine fishery is often required to live-release all Chinook salmon prior to October 20, except in Area 7B near the Nooksack River (WDFW 2013). According to the Pacific Fishery Management Council, approximately 40% of the Chinook salmon harvested in the Nooksack/Samish area (purse seine and gillnet) are natural-origin fish; therefore, they are

considered a major component of the catch. The Nooksack stock is not meeting its lower abundance threshold of 1,000 Chinook (WDFW and PSIT 2013) (PSIT and WDFW 2013). Therefore, the abundance factor for the purse seine fishery is scored as a "very high" concern.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Very High Concern

The Puget Sound troll fishery occurs in the Strait of Juan de Fuca and is relatively small. Chinook salmon captured in this fishery originate from a variety of rivers. Stock composition of this catch was not readily available for recent years, but genetic data collected in previous years indicate that most Chinook are destined for the Columbia River and Puget Sound (CDFO, NMFS, and WDFW 1988). The contribution of Puget Sound Chinook increases to the east, but most troll catch is taken in the western portion of the Strait of Juan de Fuca. All natural and some hatchery Chinook in Puget Sound are ESA listed. Many Chinook returning to the Columbia are ESA listed although a large fraction of the fall run is natural and robust (Upriver bright). This fishery does not attempt to live-release unmarked Chinook. We assume that 5% or more of the catch involves ESA listed Chinook, therefore the concern is judged to be "very high."

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderate Concern

The Columbia River fisheries considered here include non-treaty and treaty (tribal) commercial fisheries as well as fisheries below and above Bonneville Dam. Columbia River fisheries harvest fish from about fourteen Chinook salmon stocks, many of which include hatchery-produced fish. The Mid-Columbia River spring, Upper Columbia River summer (UCS) and Upper Columbia River fall (Upriver Bright, URB) ESUs are the only non ESA-listed Chinook stocks in the Columbia Basin. Escapement goals have been established for the UCS and URB stocks (20,000 fish above Priest Rapids Dam for UCS Chinook and 60,000 fish above McNary Dam for URB Chinook). The UCS goal has been been met 100%, and the URB goal over 75%, of the fifteen years from 1999 to 2013 (PFMC 2014a), but the goals are for natural and hatchery-origin fish combined (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). Thus we rated conservation concern as "moderate."

Justification:

Fall Chinook stocks include Lower River Hatchery tule, Lower River Wild fall, Bonneville Pool Hatchery, Upriver Bright, Mid-Columbia Bright, and Select Area Brights Chinook (Joint Columbia River Management Staff 2014a). Spring Chinook stocks include Willamette River Spring, Clackamas River Spring, Sandy River Spring, Washington Lower River Spring, Select Area Spring, and Upriver Spring Chinook. The one summer stock is Upper Columbia River Summer Chinook (the Snake River summer run is included in the Upriver Spring Chinook evolutionarily significant unit) (Joint Columbia River Management Staff 2014b). Some of these stocks, such as Lower River Wild fall and spring Chinook, are assessed under Criterion 2 due to their status as ESA-listed stocks. Most of the catch consists of robust natural origin fall Chinook (e.g., Hanford Reach stock) and hatchery-produced Chinook; no ESA-listed stocks (ESUs) constitute more than 5% of landings (Joint Columbia River Management Staff 2015b).

Based on a study using data from coded wire tags, the proportion of hatchery fish in Upriver Bright fall Chinook escapements may be around 30% in some areas (Evenson et al. 2002). The current Upriver Bright

escapement target is 60,000 fish, but prior to 2008, the target was 40,000 fish plus sufficient fish for meeting treaty Indian obligations.

Factor 1.3 - Fishing Mortality

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

Low Concern

Major stocks in this fishery include Sacramento River fall (SRF) Chinook and Southern Oregon/Northern California Coast (SONCC) Chinook, both of which include large hatchery programs. Management in this area is primarily focused on Klamath River fall (KRF) Chinook which is the indicator stock for SONCC Chinook. Management limits exploitation rates on Klamath River stocks through an intensive pre-season regulatory process and in-season monitoring. Ocean harvest rates of KRF Chinook have been greatly reduced since the 1980s, averaging 13% between 1999 and 2013 (PFMC 2014a). However, the KRF Chinook stock includes a large hatchery component, and harvest rates on the natural-origin component are unknown. Escapement monitoring for SRF and SONCC Chinook do not suggest that stocks are declining, although index escapement counts for Southern Oregon Coast Chinook are low and near the threshold of being considered overfished (Fig. 9). Because ocean harvest rates are relatively low, the conservation concern regarding fishing mortality was rated "low."

Justification:

This area is known as the Klamath Management Zone (KMZ) which was established in the mid-1980s to manage ocean harvests (commercial and sport) of KRF Chinook. KRF Chinook are the indicator stock for SONCC and Upper Klamath/Trinity Chinook ESUs. Management of KRF Chinook harvest is designed to meet a number of objectives (PFMC 2014d) including: 1) achieve a minimum escapement of 40,700 natural spawners (including hatchery strays); 2) achieve a 50/50 allocation between tribal (inriver) and non-tribal fisheries; and 3) NMFS ESA consultation standard restricts the KRF Chinook harvest rate to no more than 16% to limit fishery impacts on ESA listed California Coastal Chinook (which are not directly monitored). This latter objective has greatly reduced KRF Chinook ocean harvest rates since it was implemented in 1992. Between 1999 and 2013 ocean harvest rates on age-4 KRF Chinook ranged from 0 to 34%, averaging 13% (Fig. 11)



Figure 13: Estimated ocean harvest rates on age-4 Klamath River Fall Chinook salmon, 1986-2013. Data taken from Table II-5 PFMC 2014d.

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON

Low Concern

Major stocks in this area include Tule fall Chinook from Columbia River hatcheries and Columbia River summer and bright fall Chinook. In some years, Sacramento River fall Chinook comprise a moderate portion of the catch. Upper Columbia River bright Chinook did not experience overfishing from 2011 to 2012, and neither did Sacramento River fall Chinook from 2011 to 2015 (PFMC 2015a). Upper Columbia River summer Chinook did not experience overfishing in 2011, but in 2012 the total exploitation rate on the stock was 76%, just exceeding the maximum fishing mortality threshold of 75% (PFMC 2015a). Overall, it appears that overfishing occurs only occasionally, and escapement data suggest that at least 75% of major monitored stocks in this fishery are not in decline (PFMC 2014a). Conservation concern regarding fishing mortality was rated as "low."

Justification:

According to the PFMC, a stock experiences overfishing if the total annual exploitation rate exceeds the maximum fishing mortality threshold (MFMT), which is based on the maximum sustainable yield exploitation rate (F_{MSY}) (PFMC 2015a). MFMTs for stocks in this area are as follows: 75% for Upper Columbia River summer Chinook, 85% for Upper Columbia River bright Chinook, and 78% for Sacramento River fall Chinook (PFMC 2015a).

Escapement data suggest that the predominantly wild stocks are not declining (Figs. 7, 12)

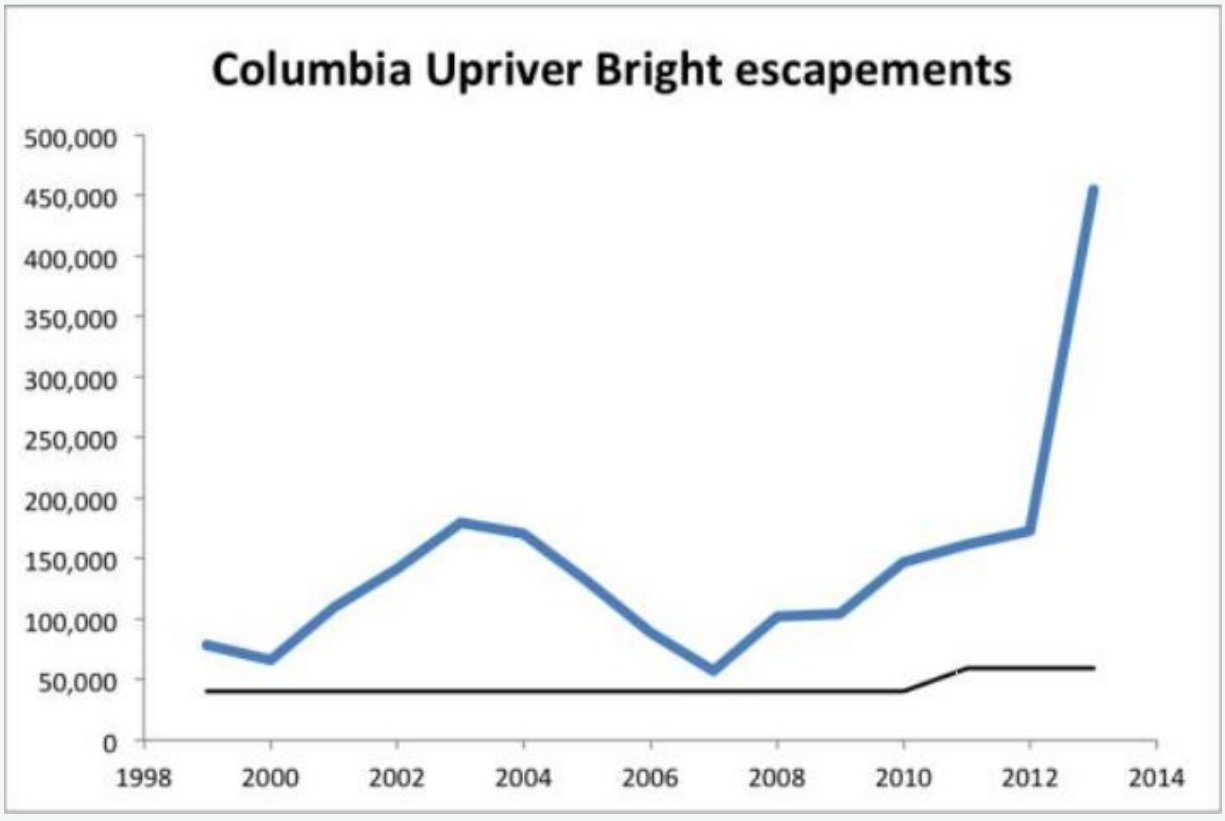


Figure 14:

Columbia Upriver Bright fall Chinook escapements past McNary Dam (blue line) relative to the

escapement target of 40,000 to 60,000 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

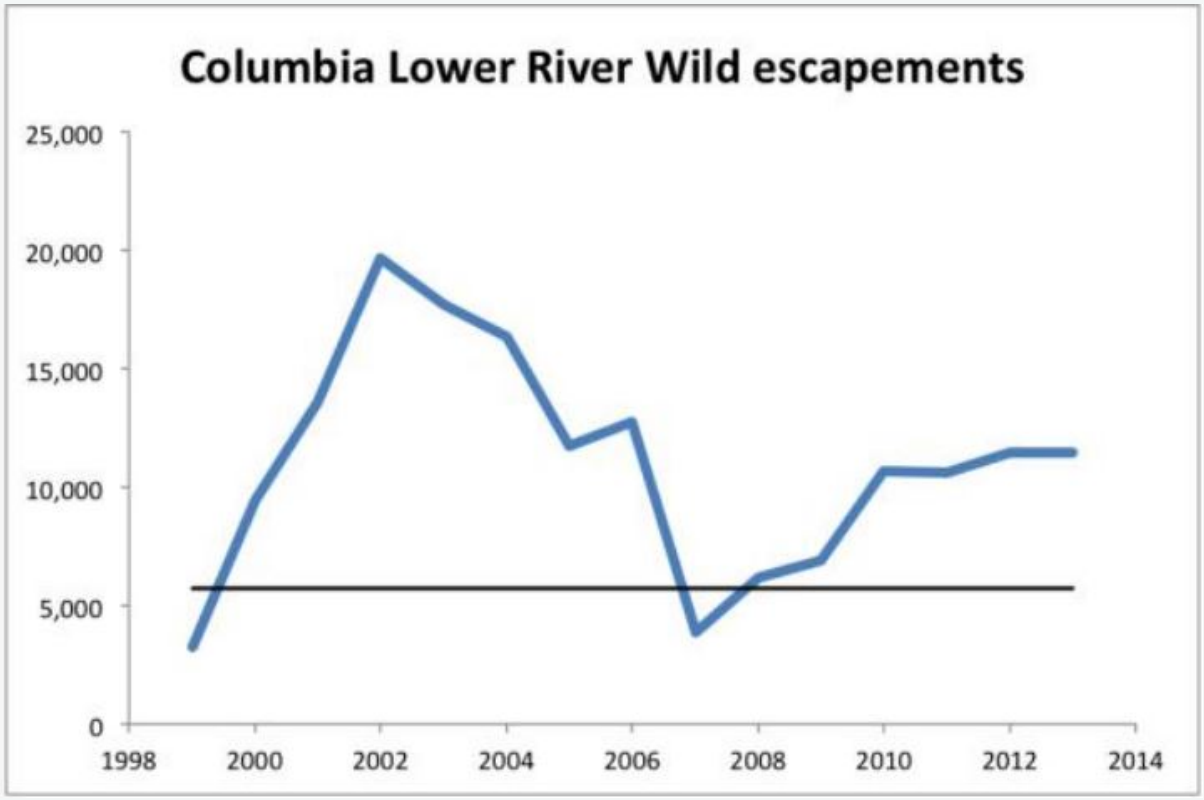


Figure 15 Columbia River Lower River Wild Fall Chinook escapements (blue line) relative to the escapement target of 5,700 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

. However, escapement counts for most of these stocks do not differentiate between natural and hatchery-origin fish spawning in the wild. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on natural-origin fish. Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs.

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY

Low Concern

Major stocks in this area include Willapa Bay, Grays Harbor, Queets River spring, Queets River fall, Hoh River spring/summer, Hoh River fall, Quillayute River spring/summer, and Quillayute River fall Chinook. Total exploitation rates do not appear to have been estimated in recent years (PFMC 2015a), but escapement data suggest that none of the major stocks is declining (PFMC 2014a). The policy document for Grays Harbor Basin salmon management includes objectives for focusing harvest on hatchery fish and reducing fishing mortality on natural stocks by implementing mark selective fisheries that release unmarked (natural-origin) fish (WDFW 2014c). Additionally, exploitation rates on fall Chinook are limited to 5% when escapements to natural spawning areas are relatively low. Thus fishing mortality concern was rated "low."

Justification:

According to the PFMC, a stock experiences overfishing if the total annual exploitation rate exceeds the maximum fishing mortality threshold (MFMT), which is based on the maximum sustainable yield exploitation rate (F_{MSY}) (PFMC 2015a). All of the major stocks in this fishery have an MFMT (ranging from 78 to 90%), but exploitation rates do not appear to have been estimated since 2012, and even then they were estimated for the Queets fall stock only (PFMC 2015a).

Counts of escapements to natural spawning areas suggest that none of the major stocks is declining (e.g., Figs. 13, 14).



Figure 16: Grays Harbor fall Chinook escapements (blue line) relative to the escapement target of 14,600 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

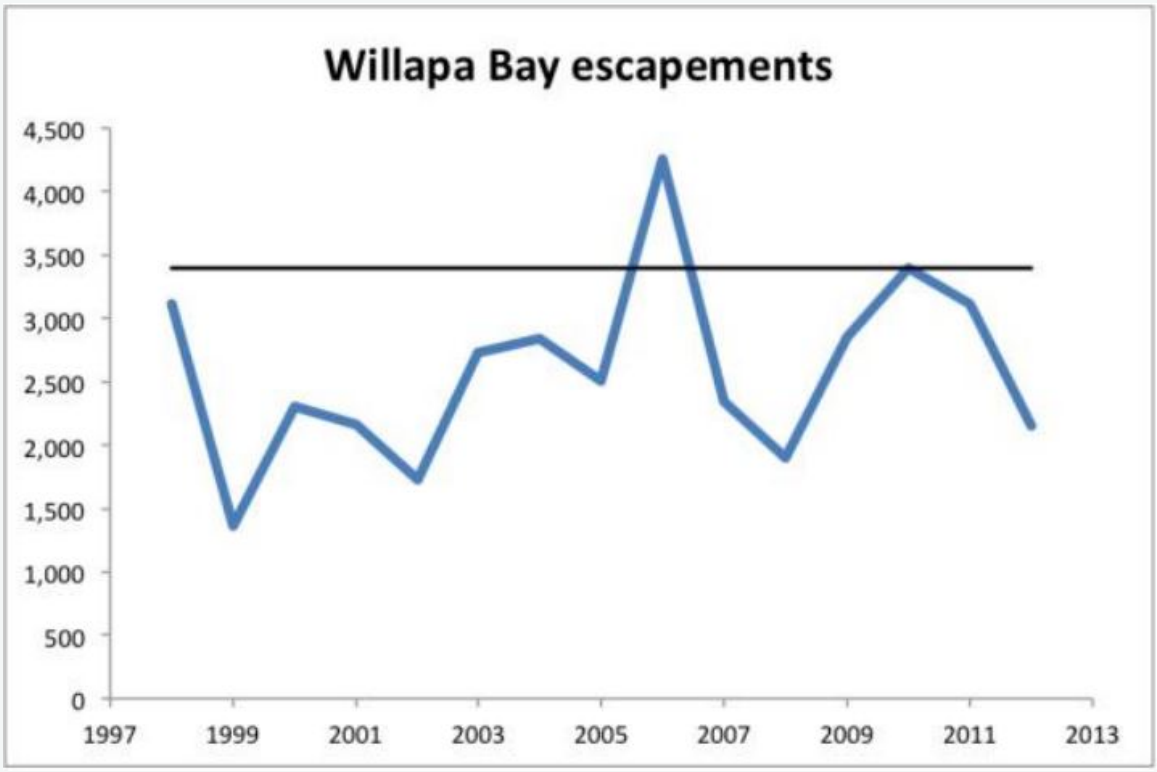


Figure 17: Willapa Bay fall Chinook escapements (blue line) relative to the escapement target of 3,393 fish (black line). The escapement counts and target are for naturally produced fish, though supporting documentation is needed to show that hatchery-origin fish are not included in counts.

However, escapement counts for most of these stocks do not differentiate between natural and hatchery-origin fish spawning in the wild. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on natural-origin fish. Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

Low Concern

Major stocks in this area include Southern Oregon Coast Chinook (south migrating/local stocks and the Umpqua River spring stock), Central Valley River fall Chinook, and Klamath River fall Chinook (PFMC 2011). The indicator stock for Central Valley River fall Chinook is Sacramento River fall Chinook. Total exploitation rates on the Sacramento and Klamath River fall Chinook stocks were estimated from 2011 to 2015, and they did not exceed the maximum fishing mortality threshold (78% for Sacramento, 71% for Klamath) (PFMC 2015a). Thus overfishing did not occur. Escapement monitoring for Oregon Coast Chinook (Fig. 9), Sacramento River fall Chinook (Fig. 5), and Klamath River fall Chinook (Fig. 6) suggests that stocks are not declining. Impact of the fishery on these stocks is of "low" concern because overfishing is not occurring, and more than 75% of stocks appear stable. Additionally, ocean harvests of Chinook in this region are relatively small, no more than 20,000 fish per year since 2005 (PFMC 2014a). However, these stocks are supplemented by large hatchery programs, and escapement counts do not clearly distinguish between natural and hatchery-origin fish. Thus harvest impacts on natural-origin fish are somewhat unclear.

Justification:

According to the PFMC, a stock experiences overfishing if the total annual exploitation rate exceeds the maximum fishing mortality threshold, which is based on the maximum sustainable yield exploitation rate (F_{MSY}) (PFMC 2015a).

Escapements to natural spawning areas suggest that stocks are not declining. However, escapement counts for most of these stocks do not differentiate between natural and hatchery-origin fish spawning in the wild. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on natural-origin fish. Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs.

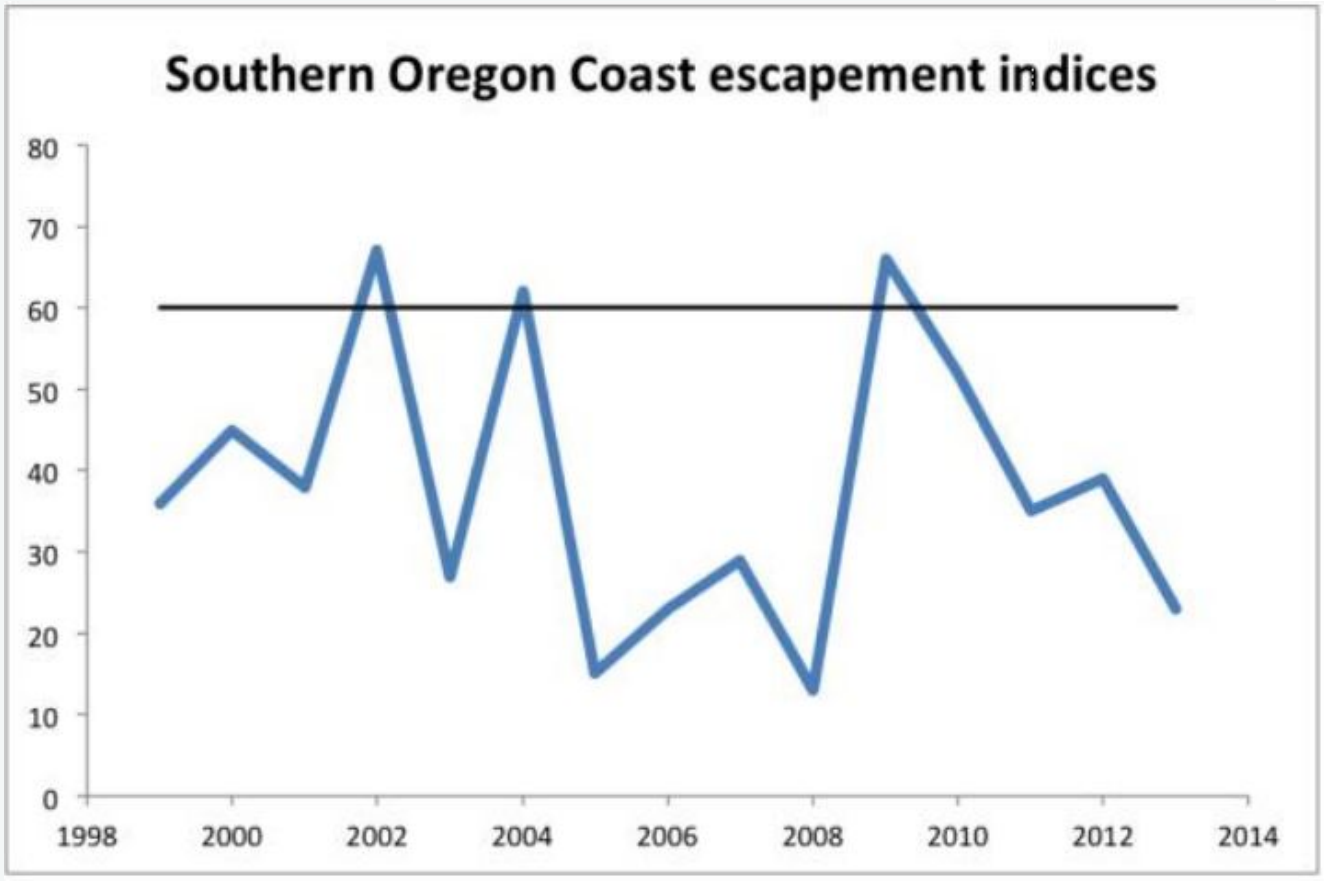


Figure 18: Southern Oregon Coast Chinook escapement index counts (for Deep, Big Emily, and Bear creeks combined; blue line) relative to the escapement index target of 60 fish per mile (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from Table B-8 in the 2014 Pacific Fishery Management Council Salmon Assessment and Fishery Evaluation Document.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

Moderate Concern

Major stocks in this fishery include Central Valley Fall (CVF) Chinook and Southern Oregon/Northern California Coast (SONCC) Chinook. Both of these stocks include large hatchery programs that can sustain relatively high harvest rates compared to wild stocks. The indicator stock for Central Valley River fall Chinook is Sacramento River fall Chinook, and the indicator stock for SONCC Chinook is Klamath River fall Chinook. Total exploitation rates on the Sacramento and Klamath River fall Chinook stocks were estimated from 2011 to 2015, and they did not exceed the maximum fishing mortality threshold (78% for Sacramento, 71% for Klamath) (PFMC 2015a). Thus overfishing did not occur, and escapements for these stocks do not appear to be declining (Figs. 5, 6, 9). However, the exploitation rates on the natural-origin stock components are unknown and may be too high to maintain the populations without hatchery supplementation. Additionally, ocean harvests of Chinook are substantial in this region, with over 150,000 fish landed each year since 2012 (PFMC 2014a). Conservation concern regarding fishing mortality was rated "moderate."

Justification:

According to the PFMC, a stock experiences overfishing if the total annual exploitation rate exceeds the maximum fishing mortality threshold, which is based on the maximum sustainable yield exploitation rate (F_{MSY}) (PFMC 2015a).

The proportion of hatchery-origin Chinook salmon caught off the California Coast was estimated to be 90% (Barnett-Johnson et al. 2007). The primary stock harvested in this area is Sacramento River Fall Chinook (SRFC). Proportions of hatchery-origin Chinook salmon in escapements to natural spawning areas in California have been estimated, and they vary from 0 to 90% (Palmer-Zwahlen and Kormos 2013) (Austing and Null 2013). Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs. SRFC harvest rates ranged from 44 to 87% until the stock collapsed in 2007 and California fisheries were closed (Fig. 10) (PFMC 2014d).

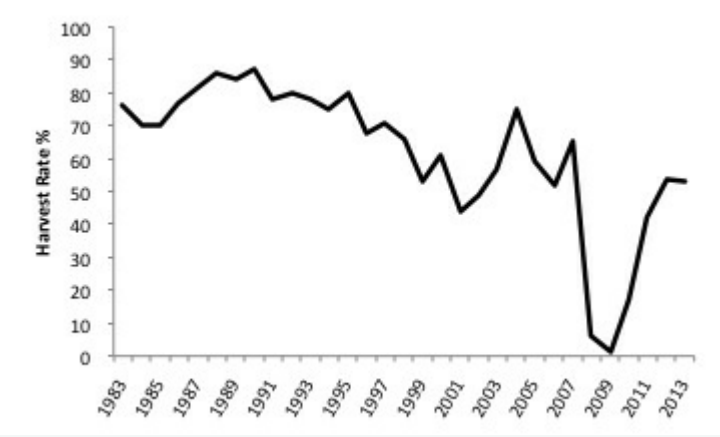


Figure 19: Estimated total harvest rate on Sacramento River Fall Chinook salmon, 1983-2013. Data taken from Table II-1 PFMC 2014d.

UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Low Concern

Escapements of Klamath River fall (KRF) Chinook have been fluctuating around S_{MSY} (met 60% of time over past 15 years) indicating that abundance has been relatively stable over the long- and short-term. The Klamath River commercial fishing mortalities (expressed as exploitation rates) have been relatively stable or slightly increasing over the past thirty years (Williams et al. 2013). Since 2012, annual management objectives for KRF have been determined by a control rule that specifies maximum allowable exploitation rates as a function of pre-season forecasted abundance (PFMC 2014e}. Exploitation rates vary from year to year based on the control rule and abundance forecast. Because abundance has been relatively stable, the fishing mortality conservation concern was rated "low."

Justification:

Harvest of KRF Chinook is co-managed by federal, state, and tribal agencies with tribal government having responsibility for managing the Klamath River commercial fishery (Pierce 1998). The total allowable catch of KRF Chinook is set pre-season through the PFMC process. Management of KRF Chinook harvest is designed to meet a number of goals (PFMC 2014d) including: 1) achieve a minimum escapement of 40,700 natural spawners (S_{MSY}) (including hatchery strays); 2) achieve a 50/50 allocation between tribal (inriver) and non-tribal fisheries; and, 3) NMFS ESA consultation standard restricts the KRF Chinook harvest rate to no more than 16% to limit fishery impacts on ESA listed California Coastal Chinook (which are not directly monitored). Since 2012, annual management objectives for KRF Chinook have been determined by a control rule that specifies maximum allowable exploitation rates as a function of forecast abundance (PFMC 2014e). Use of the control rule to set annual management objectives means that escapement objectives can vary from year to year, and that KRF Chinook are no longer strictly managed to meet S_{MSY} each year. As a result, the sustainable exploitation rate changes from year to year based on the pre-season forecast. For example, the acceptable fishery exploitation rate can be much higher during years of strong forecasted abundance, but much lower in years of poor forecasts. In-river tribal fishing mortalities (expressed as inriver exploitation rates) have been relatively stable or slightly increasing over the past thirty years (Williams et al. 2013) and have typically been less than 30% (Fig. 8)

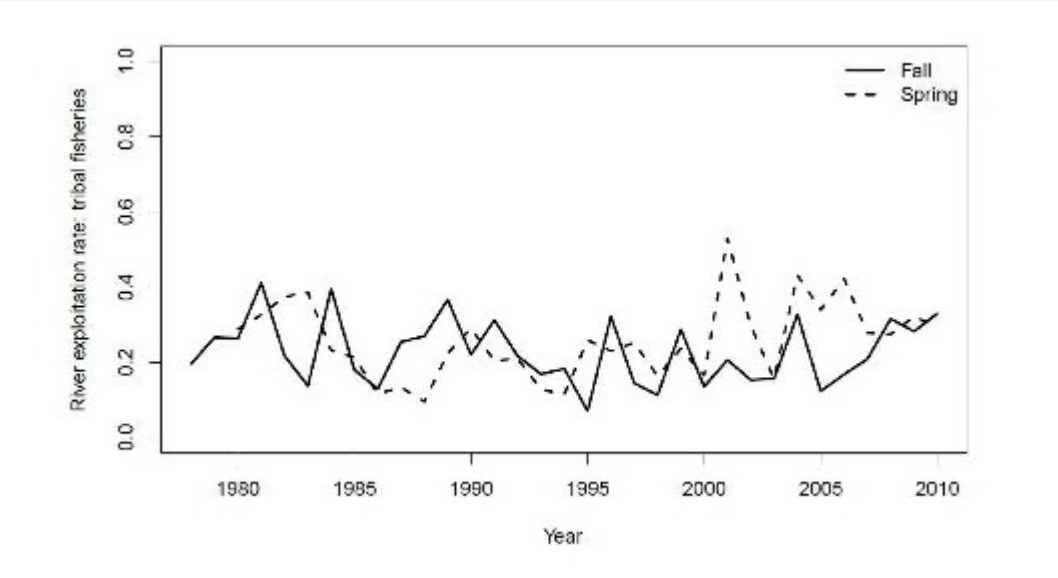


Figure 20: Time series of Chinook salmon in-river tribal fishery exploitation rate (taken from Williams et al. 2011).

KRF Chinook salmon has met S_{MSY} for natural spawning fish (including hatchery-origin fish spawning in natural areas) in 60% of the past fifteen years (PFMC 2014a). Though abundance has varied widely over time, the overall trend has been stable over the long- and short-term.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY

High Concern

Fisheries management has improved during the past 10 to 20 years in response to the ESA-listing of Puget Sound Chinook salmon. Monitoring of fishery impacts has improved, and relative proportions of hatchery and natural-origin fish are often estimated on the spawning grounds. Co-managers indicate that the escapement trends (hatchery plus natural) have been increasing over time, whereas NOAA Fisheries reported that the escapement of natural-origin returns (NOR) declined from 32,794 Chinook during 2000 to 2004 to 25,848 Chinook during 2005 to 2009 (the most recent period available in the report). The estimated recent over-all harvest rate of 42% on an ESA-listed population is high (Ford et al. 2011), especially for the natural-origin component. Although the NMFS Biological Opinion on the Paciific Salmon Treaty fisheries concludes that the fisheries would not cause jeopardy to the Puget Sound Chinook ESU, the fisheries are still having an adverse impact (NMFS 2008). The Fishing Mortality factor is judged to be a "high" concern based on this information. The score does not warrant a critical concern because co-managers are actively managing the fishery, significant improvements have been made over time, some data suggest very low exploitation rates on some natural stocks (<5%) (PSC 2012), and managers have implemented programs to monitor progress against goals.

Justification:

The Chinook Harvest Management Plan (Plan) establishes management guidelines for annual harvest regimes (WDFW 2010). In each catch area, harvest is focused on the target species or stock according to its migration timing through that area. Chinook-directed commercial fisheries are of limited scope and most are directed at abundant hatchery production in terminal areas.

Total exploitation rates for each of the 22 Chinook populations, including fish taken in Alaska and British Columbia, was estimated by Ford et al. (2011). Median exploitation rates have declined from over 50% during the 1980s to 38% during the early 1990s, to 42% during brood years 2002 to 2006 (see Table 3). Exploitation rates in the Puget Sound fishery have been relatively low, ranging from 10 to 15% during the 1980s to 4 to 9% during the 1990s, to 16% during brood years 2002 to 2006.

(Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (Washington Department of Fish and Wildlife and Puget Sound Indian Tribes 2013) (Washington Department of Fish and Wildlife and Puget Sound Indian Tribes 2014)

	Mix Mat Fishery		Mature Fishery		Total AEQ ER	
BY	pop range	pop median	pop range	pop median	pop range	pop median
1982-1986	0.36-0.72	0.58	0.02-0.39	0.15	0.44-0.9	0.77
1987-1991	0.29-0.65	0.55	0.01-0.29	0.10	0.39-0.84	0.67
1992-1996	0.22-0.56	0.38	0-0.32	0.04	0.23-0.8	0.43
1997-2001	0.29-0.53	0.45	0.01-0.35	0.09	0.31-0.73	0.51
2002-2006	0.09-0.63	0.42	0.02-0.33	0.16	0.12-0.72	0.56
Trend	-0.12 - +0.02	-0.04	-0.03 - +0.01	-0.01	-0.15 - +0.02	-0.05

Figure 21: Median exploitation rates on 22 Puget Sound Chinook salmon populations (ESA-listed) in fisheries outside Puget Sound, inside Puget Sound, and all fisheries combined.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Moderate Concern

Fisheries management has improved during the past 10 to 20 years in response to the ESA-listing of Puget Sound Chinook salmon. Monitoring of fishery impacts has improved, and relative proportions of hatchery and natural-origin fish are often estimated on the spawning grounds. Co-managers indicate that the escapement trends (hatchery plus natural) have been increasing over time, whereas NOAA Fisheries reported that the escapement of natural-origin returns (NOR) declined from 32,794 Chinook during 2000 to 2004 to 25,848 Chinook during 2005 to 2009 (the most recent period available in the report). The estimated recent over-all harvest rate of 42% on an ESA-listed population is high (Ford et al. 2011), especially for the natural-origin component. The purse seine fishery typically does not target Chinook salmon in Puget Sound and seiners are required to live-release Chinook in most areas until October 20. Managers assume an incidental mortality rate of 45% for immature Chinook and 33% for mature Chinook that are live-released (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010). The primary directed Chinook fishery using purse seine is in area 7B near the Nooksack River. The terminal area exploitation rate goal for the Nooksack stock is 7%; average exploitation has averaged ~4% (2003 to 2010) and has been within the goal (PSIT/WDFW 2013). Exploitation of this stock in all US and Canada fisheries is 20 to 30% per year. The Fishing Mortality factor is judged to be a "moderate" concern based on this information. The score does not warrant a "high" concern because the co-managers are actively managing the fishery, significant improvements have been made over time, and Chinook are often live-released from purse seines.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

High Concern

The Puget Sound troll fishery is limited to the Strait of Juan de Fuca, and harvests are moderate to small. For example, in 2010, only 2,910 Chinook were harvested (WDFW and PSIT 2013). In recent years, annual harvests ranged from 400 to over 20,600 in the winter fishery, and from 100 to 4,500 in the spring/summer fishery.

Limited genetic data indicate Columbia River and Puget Sound Chinook salmon are the primary stocks taken in this fishery, which occurs over multiple seasons. Given that many Chinook returning to Puget Sound (including some hatchery stocks) and the Columbia River are ESA-listed, we assume a portion of the troll catch is on ESA Chinook, though we are not aware of specific estimates. Cumulative harvest rates on these ESA salmon in the fisheries is high, e.g. 56% for brood years 2002 to 2006 (Table 3) (Ford et al. 2011) (PSIT and WDFW 2013). Trends in catch versus predicted catch have been relatively constant (flat) over the past 6 years, indicating catch is meeting pre-season expectations. Long-term annual catch statistics for this fishery were not readily available in reports. However, there is no attempt to reduce mortality on natural fish by live-releasing umarked salmon, even though many Puget Sound populations are not meeting escapement goals for natural-origin fish. Although the NMFS Biological Opinion on the Paciific Salmon Treaty fisheries concludes that the fisheries are achieving recovery exploitation rates and that fisheries would not cause jeopardy to the Puget Sound Chinook ESU, the fisheries are still having a negative impact (NMFS 2008). Therefore, given high harvest rates on an ESA-listed stock and no attempt to live-release ESA salmon, fishing mortality is judged to have a "high" concern.

Justification:

	Mix Mat Fishery		Mature Fishery		Total AEQ ER	
BY	pop range	pop median	pop range	pop median	pop range	pop median
1982-1986	0.36-0.72	0.58	0.02-0.39	0.15	0.44-0.9	0.77
1987-1991	0.29-0.65	0.55	0.01-0.29	0.10	0.39-0.84	0.67
1992-1996	0.22-0.56	0.38	0-0.32	0.04	0.23-0.8	0.43
1997-2001	0.29-0.53	0.45	0.01-0.35	0.09	0.31-0.73	0.51
2002-2006	0.09-0.63	0.42	0.02-0.33	0.16	0.12-0.72	0.56
Trend	-0.12 - +0.02	-0.04	-0.03 - +0.01	-0.01	-0.15 - +0.02	-0.05

Figure 22: Median exploitation rates on 22 Puget Sound Chinook salmon populations (ESA-listed) in fisheries outside Puget Sound, inside Puget Sound, and all fisheries combined.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Low Concern

Under the US versus Oregon 2008–2017 Management Agreement, fishery exploitation rates on specific stocks are managed using harvest rate schedules, where harvest limits are determined each year based on in-season monitoring of fish abundance. There are harvest rate schedules for Lower Columbia River wild tule Chinook, Upper Columbia River Summer Chinook, and Chinook in the fall and spring management periods (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). As an example, the fall harvest rate schedule limits harvest on Snake River fall Chinook to 21.5% to 45% for all fisheries (non-treaty commercial, non-treaty recreational, treaty commercial, treaty ceremonial and subsistence). These harvest rate limits were met in 2013 (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b), and the limits appear appropriate because escapements of major stocks, including Upper Columbia River summer and Upriver Bright Chinook, have been stable. Conservation concern was therefore rated "low."

Justification:

Columbia River salmon fisheries are complex, spanning essentially all seasons (fall, summer, winter, spring), including multiple components (e.g., commercial and recreational, treaty and non-treaty), and catching both hatchery and non-hatchery stocks, many of which are listed under the Endangered Species Act. The largest Chinook salmon fishery occurs in fall and largely harvests Hanford Reach Chinook, a productive, mostly natural-origin stock. A portion of hatchery-produced Chinook are marked. Columbia treaty gillnet fisheries do not selectively harvest marked hatchery Chinook, but there is a non-treaty commercial spring Chinook fishery that is mark selective. Select Area commercial fisheries target hatchery-produced fish in off-channel areas.

Upriver Bright (URB) fall Chinook are one of the major stocks caught in this fishery. Escapement data suggest that population abundances are steady or possibly increasing (Fig. 7)

, although the status of the natural-origin stock is somewhat uncertain because hatchery-produced fish are included in escapement counts.

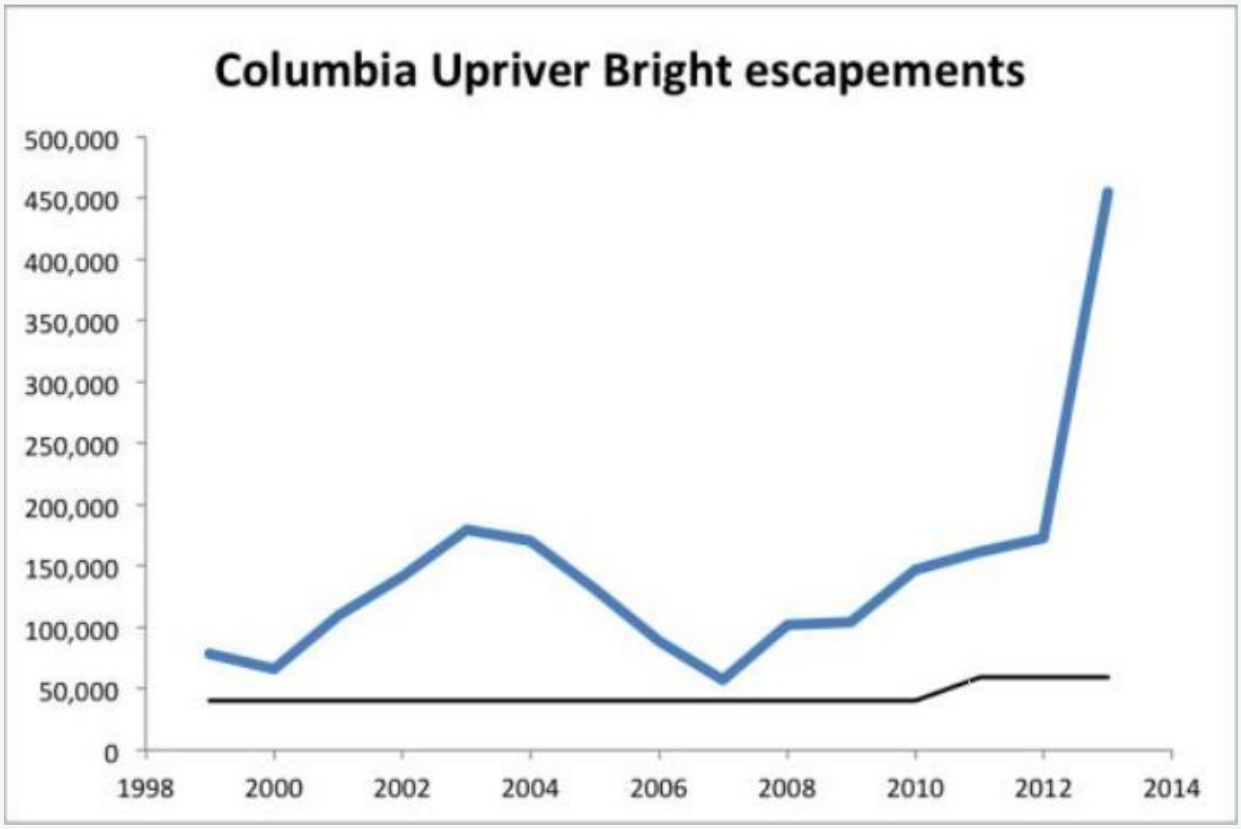


Figure 23: Columbia Upriver Bright fall Chinook escapements past McNary Dam (blue line) relative to the escapement target of 40,000 to 60,000 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

CHUM SALMON

Factor 1.1 - Inherent Vulnerability

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

Medium

The FishBase vulnerability score for chum salmon is 49, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Chum salmon have "medium" vulnerability because although they are a relatively large salmon, they have the widest natural geographic distribution of all Pacific salmon species.

Factor 1.2 - Abundance

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY

Low Concern

Grays Harbor and Willapa Bay chum are the two major Washington coastal chum stocks. Grays Harbor chum met the escapement goal of 21,000 fish in 40% of the years from 1997 to 2011, whereas Willapa Bay chum met the escapement goal of 35,400 fish in 67% of those years (data from http://wdfw.wa.gov/fishing/salmon/chum/coastal/data.html). Both Grays Harbor and Willapa Bay escapements were relatively low from 2005 to 2009, but have since increased. Escapement goals and monitoring are for fish spawning in natural areas and may include some fish produced in small hatchery projects; however, the proportion of hatchery-origin chum is low (generally 5% or less). Because escapement levels are fluctuating about their respective escapement goals, and population sizes have increased in the short term; thus, conservation concern was rated "low."

Justification:

There is a third group of Washington coastal chum (North Coast), but North Coast populations are not closely monitored. Natural spawning chum escapement estimates in the Coastal region are typically based on analysis of live chum counts collected within each watershed.

From 1997 to 2011, the proportion of hatchery-origin fish in the total chum run averaged 3% for Grays Harbor and 2% for Willapa Bay (see data sheets on http://wdfw.wa.gov/fishing/salmon/chum/coastal/data.html).

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY

Moderate Concern

The fall and winter chum runs in Puget sound are considered "healthy," and approximately 70% of the return are natural-origin spawners (Fig. 15). Escapement goals have been established throughout the sound for the timing groups. The escapement goals are typically met for both the winter and fall chum stocks. Approximately 30% of the chum run to Puget Sound is hatchery-origin. Hatchery chum are typically not distinguished from natural-origin chum on the spawning grounds, therefore the status and trends of the natural population is less certain. Hood Canal summer chum is listed as "Threatened" under ESA, but this stock is not considered here because the fisheries avoid most summer chum (WDFW 2014b) (WDFW and Point No Point Treaty Tribes 2000). The abundance factor is ranked as a "moderate" concern because hatchery chum are counted along with natural chum on the spawning grounds.

Justification:

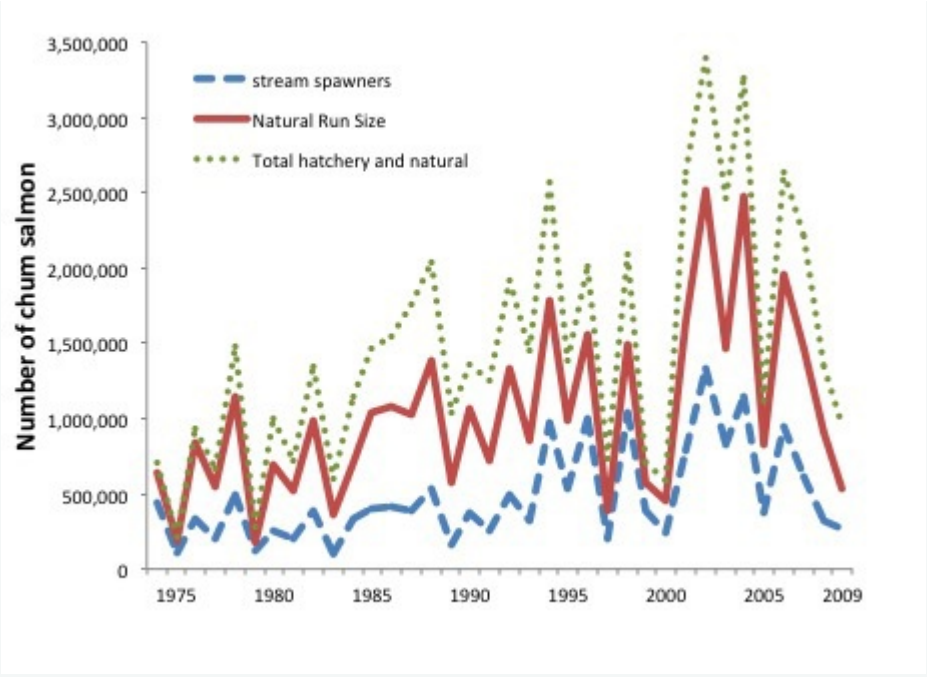


Figure 24: Abundance of chum spawning in rivers, total abundance of natural origin chum, and total abundance of hatcheyr and natural chum salmon in Puget Sound.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

Moderate Concern

The fall and winter chum runs in Puget sound are considered "healthy," and approximately 70% of the return are natural-origin spawners. Escapement goals have been established throughout the sound for the timing groups. The escapement goals are typically met for both the winter and fall chum stocks. Approximately 30% of the chum run to Puget Sound is hatchery origin. Hatchery chum are typically not distinguished from natural origin chum on the spawning grounds; therefore, the status and trends of the natural population are less certain. Hood Canal summer chum is listed as threatened under ESA, but this stock is not considered here because the fisheries avoid most summer chum (WDFW 2014b) (WDFW and Point No Point Treaty Tribes 2000). The abundance factor is ranked as a "moderate" concern because hatchery chum are counted along with natural chum on the spawning grounds.

Factor 1.3 - Fishing Mortality

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY

Low Concern

The two major stocks caught in this fishery are Grays Harbor and Willapa Bay chum. Directed fisheries for chum salmon occur in both the Grays Harbor and Willapa Bay systems when returns are large enough to meet escapement needs, and escapement data suggest that Washington coastal chum salmon stocks are stable and increasing in the short term. In addition, the policy document for Grays Harbor Basin salmon management states that exploitation rates on chum will be limited to 5% when escapements to natural spawning areas are relatively low (WDFW 2014c). Conservation concern was therefore rated "low."

Justification:

The Willapa Bay commercial fishery generally involves non-Indian fishers, whereas the Grays Harbor commercial fishery is managed jointly by the Washington Department of Fish and Wildlife (WDFW) and the Quinault Indian Nation. When returns are low, chum salmon are mostly caught incidentally in fisheries targeting coho. In Grays Harbor, coho and chum timing overlap; such chum fishing seasons may not be set if harvest rates on coho may be too high.

Both Grays Harbor and Willapa Bay escapements were relatively low from 2005 to 2009 but have since increased (Figs. 16, 17).

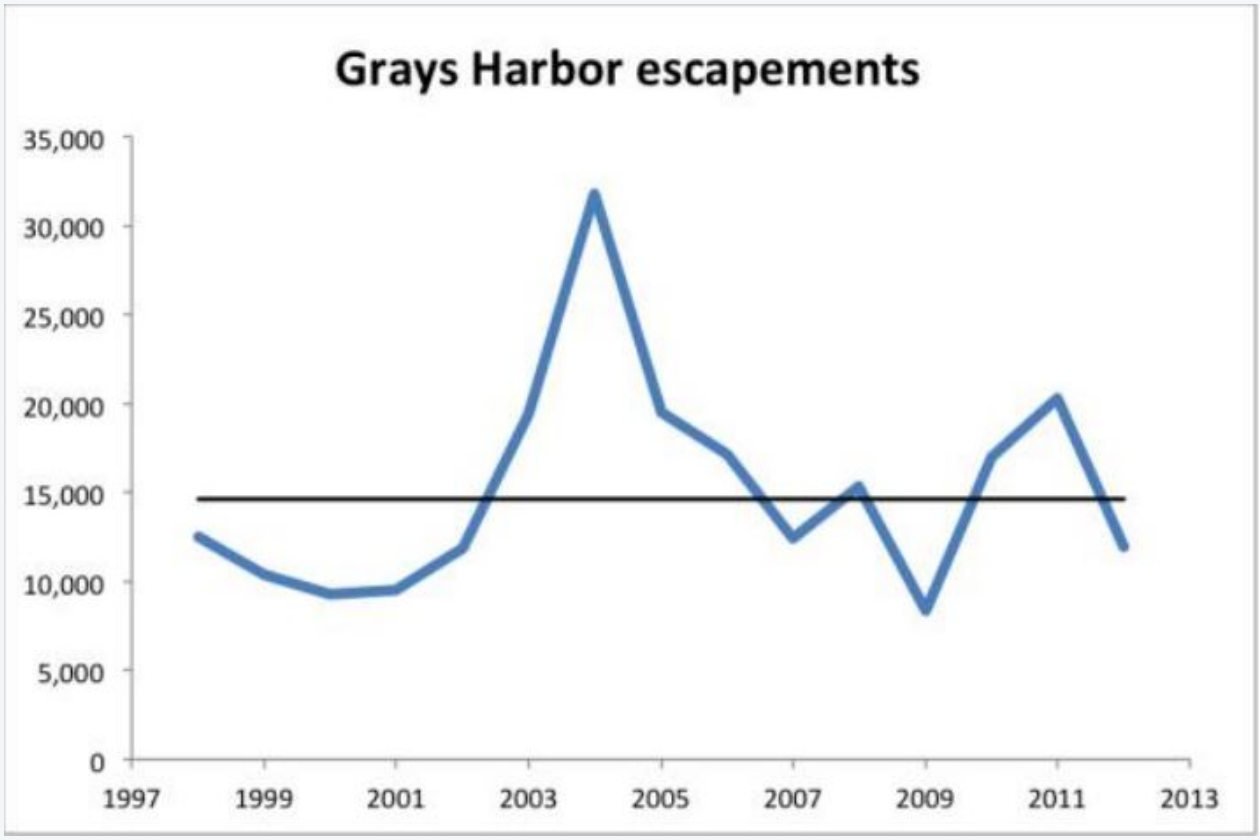


Figure 25: Grays Harbor fall Chinook escapements (blue line) relative to the escapement target of 14,600 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

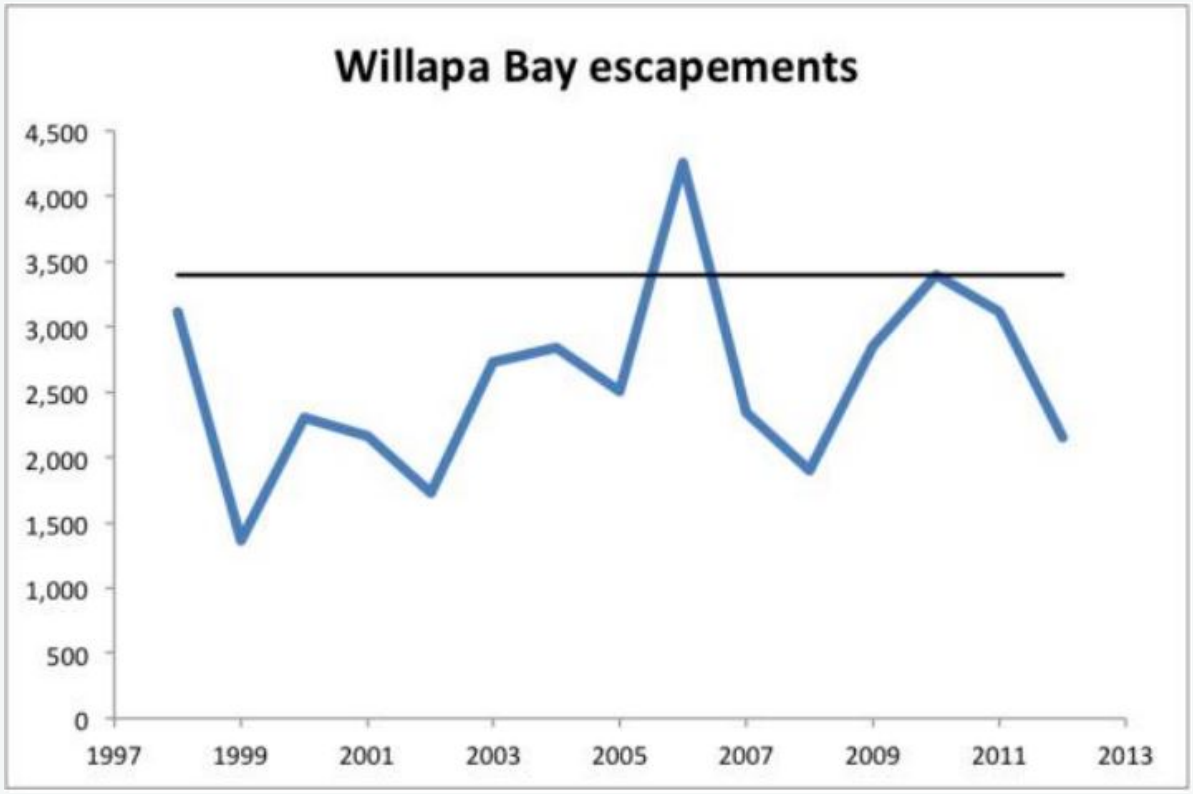


Figure 26: Willapa Bay fall Chinook escapements (blue line) relative to the escapement target of 3,393 fish (black line). The escapement counts and target are for naturally produced fish, though supporting documentation is needed to show that hatchery-origin fish are not included in counts.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY

Low Concern

The fall and winter chum runs in Puget sound are considered "healthy." Escapement goals have been established throughout the sound for the timing groups. The escapement goals are typically met for both the winter and fall chum stocks, and trends over time are variable but not declining. Approximately 30% of the chum run to Puget Sound is hatchery-origin. Hatchery chum are typically not distinguished from natural-origin chum on the spawning grounds; therefore, the status and trends of the natural population are less certain (WDFW 2014b) (WDFW and Point No Point Treaty Tribes 2000). Harvest rates on "wild" fall chum averaged 56% during 2000 to 2009, whereas it was 34% for winter chum. The fishing mortality factor is ranked as a "low" concern because the spawning escapement has been relatively stable over time.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

Low Concern

The fall and winter chum runs in Puget sound are considered "healthy." Escapement goals have been established throughout the sound for the timing groups. The escapement goals are typically met for both the winter and fall chum stocks, and trends over time are variable but not declining. Approximately 30% of the chum run to Puget Sound is hatchery-origin. Hatchery chum are typically not distinguished from natural-origin chum on the spawning grounds; therefore, the status and trends of the natural population are less

certain (WDFW 2014b) (WDFW and Point No Point Treaty Tribes 2000). Harvest rates on "wild" fall chum averaged 56% during 2000 to 2009, whereas it was 34% for winter chum. The fishing mortality factor is ranked as a "low" concern because the spawning escapement has been relatively stable over time.

COHO SALMON

Factor 1.1 - Inherent Vulnerability

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for coho salmon is 53, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Coho salmon have "medium" vulnerability because they are widely distributed but occur in somewhat small and isolated populations.

Factor 1.2 - Abundance

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Moderate Concern

Major coho salmon stocks in this area include the Columbia River and Washington coastal stocks, with Columbia River early and late hatchery coho dominating ocean catches (PFMC 2014a). Naturally-produced Columbia River coho salmon are listed under the Endangered Species Act and are evaluated under Criterion 2. Five Washington coastal stocks (Willapa Bay, Grays Harbor, Queets River, Hoh River, Quillayute River) have escapement goals and monitoring for naturally spawning fish, and 60% of these stocks have exceeded the goal for at least 50% of the past fifteen years in which data were collected (1998 to 2012 or 1999 to 2013) (PFMC 2014a). Escapement counts include hatchery-origin fish spawning in natural areas. Conservation concern is therefore rated "moderate."

Justification:

Willapa Bay and Grays Harbor coho escapements have exceeded escapement targets more than 70% of the past fifteen years, with relatively low escapements from 1998 to 2000 and 2006 to 2008. Escapement goals are expressed as ranges for the Queets, Hoh, and Quillayute rivers to reflect uncertainty. The lower bound is the escapement estimated to result in maximum sustainable yield (MSY) assuming a high estimate of recruits per spawner and a low estimate of smolt carrying capacity, whereas the upper bound is the estimated MSY escapement assuming a low estimate of recruits per spawner and a high estimate of smolt carrying capacity. Here we assumed that escapements exceeding the midpoint of the escapement goal range had met the target

(PFMC 2014a). Hoh River coho escapement counts exceeded the escapement target in 73% of the past fifteen years, whereas Queets and Quillayute river coho escapements exceeded the target in 20% and 0% of the past fifteen years, respectively. Escapements were particularly low from 2006 to 2008 and 2012 to 2013.

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

Moderate Concern

The major coho salmon stocks in this fishery are Washington coastal stocks. Five of these stocks (Willapa Bay, Grays Harbor, Queets River, Hoh River, Quillayute River) have escapement goals and monitoring for naturally spawning fish, and all five have exceeded the goal for at least 50% of the past fifteen years in which data were collected (1998 to 2012 or 1999 to 2013) (PFMC 2014a). However, there is substantial hatchery production, and most escapement counts include hatchery-origin fish spawning in natural areas, so conservation concern is rated "moderate."

Justification:

Willapa Bay and Grays Harbor coho escapements have exceeded escapement goals more than 70% of the past fifteen years, with relatively low escapements from 1998 to 2000 and 2006 to 2008. Escapement goals are expressed as ranges for the Queets, Hoh, and Quillayute rivers. The lower bound is the escapement estimated to result in maximum sustainable yield (MSY) assuming a high estimate of recruits per spawner and a low estimate of carrying capacity, whereas the upper bound is the estimated MSY escapement assuming a low estimate of recruits per spawner and a high estimate of carrying capacity. Here we assumed that escapements exceeding the lower bound had met the goal (PFMC 2014a). Queets, Hoh, and Quillayute river escapement counts exceeded the goal in 60 to 90% of the past fifteen years, with relatively low escapements from 2006 to 2008 and 2012 to 2013.The 2014 pre-season forecast of wild and hatchery coho returns indicated that Washington coastal coho stocks may be comprised of about 40% hatchery-produced fish in aggregate (http://wdfw.wa.gov/fishing/northfalcon/2014/coho.pdf).

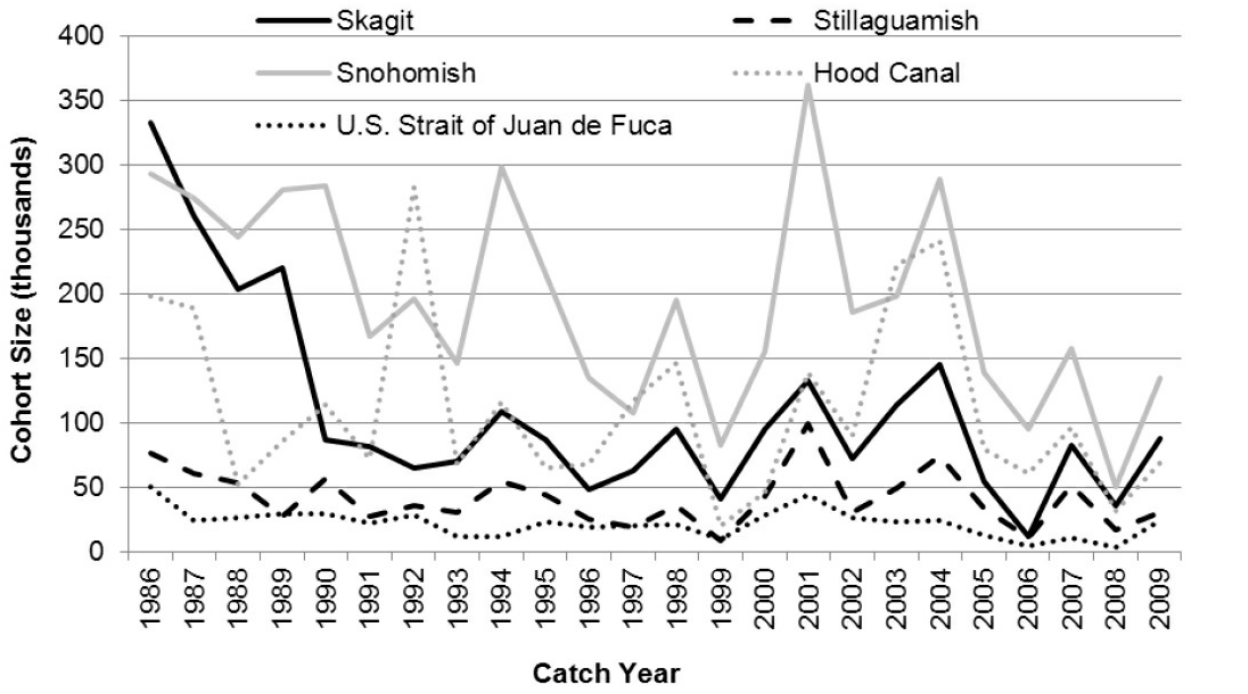
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

Moderate Concern

Escapement of coho salmon to rivers and hatcheries in Puget Sound is monitored each year (PFMC 2014a). Escapement goals have been established for coho spawning in most large watersheds, and spawning levels have typically exceeded the goals during the past 15 years. However, the spawner counts and goals do not distinguish between hatchery-origin and natural-origin spawners in the stream, and it is likely that numerous hatchery fish contribute to the spawner counts in watersheds where hatcheries are located. The abundance factor for coho is therefore scored as a "moderate" concern.

Justification:

Coho abundances in Puget Sound appear variable but stable (Fig. 18).



Estimated ocean age-3 abundances of U.S. Inside Coho Salmon Management Units; catch years 1986-2009.

Figure 27: Abundances of Puget Sound coho salmon , 1986-2009.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY

Moderate Concern

Escapement of coho salmon to rivers and hatcheries in Puget Sound is monitored each year (PFMC 2014a). Escapement goals have been established for coho spawning in most large watersheds, and spawning levels have typically exceeded the goals during the past 15 years. However, the spawner counts and goals do not distinguish between hatchery-origin and natural-origin spawners in the stream, and it is likely that numerous hatchery fish contribute to the spawner counts in watersheds where hatcheries are located. The abundance factor for coho is therefore scored as a "moderate" concern.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY

Moderate Concern

The Puget Sound troll fishery occurs in the Strait of Juan de Fuca. Relatively few Puget Sound coho are harvested here; exploitation rates on each Puget Sound coho management unit is typically less than 2% (PSC 2013c). We therefore assume that the coho stock composition is similar to that in the north of Falcon troll fishery, which extends into the outer portion of the Strait. Major coho salmon stocks in the north of Falcon fishery include the Columbia River and Washington coastal stocks, with Columbia River early and late hatchery coho dominating ocean catches (PFMC 2014a). Escapements to natural spawning areas in the Columbia River

are tracked, but there is no explicit escapement goal (Joint Columbia River Management Staff 2014a), and escapement counts include hatchery-origin fish. Five Washington coastal stocks (Willapa Bay, Grays Harbor, Queets River, Hoh River, Quillayute River) have escapement targets and monitoring for naturally spawning fish, and all five have exceeded the target for at least 50% of the past fifteen years in which data were collected (1998 to 2012 or 1999 to 2013) (PFMC 2014a). Again however, escapement counts include hatchery-origin fish spawning in natural areas. Conservation concern is therefore rated "moderate."

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Low Concern

Fisheries for coho in the Lower Columbia River are heavily restricted in order to minimize impacts on Lower Columbia River natural coho, which are listed as "Threatened" under the Endangered Species Act (ESA) (PFMC 2014e). As a result, the majority of coho caught in the commercial fisheries are in Select Area fisheries taking place in Youngs Bay, Blind and Knappa Sloughs, Tongue Point, and Deep River. These fisheries are targeting hatchery-origin fish (Table V) (Joint Columbia River Management Staff 2019). Between 1996 and 2004 fisheries in Select Areas were dominated by fish originating from net-pen releases in these areas; 88.3% in Deep River, 80.1% in Blind Slough, 87.2% in Youngs Bay, and 79.9% in Tongue Point (North et al. 2006).

Fisheries for coho in the mainstem (management zones 1 to 5) of the Columbia River are mark-selective fisheries (Joint Columbia River Management Staff 2018); therefore, only hatchery-origin fish (marked with a clipped adipose fin) are permitted to be retained. These fisheries take place with tangle nets (rather than the traditional gillnets) to allow harvesting of hatchery-origin fish while allowing any natural-origin fish to be returned alive with minimal impact (Joint Columbia River Management Staff 2018). The landings of coho from the mainstem of the Columbia River are now minor, relative to landings from Select Area fisheries in order to minimize impacts on the threatened Lower Columbia River Natural coho (Table VI).

As the majority of the fish caught and landed in the Lower Columbia River basin are of hatchery origin, and natural origin fish must be released with minimal harm in the mainstem fishery, we consider abundance to be a "low" conservation concern.

Justification:

The Select Area fisheries take place in four main areas: Youngs Bay, Tongue Point, Blind and Knappa Sloughs, and Deep River. Table V shows the hatcheries that supply smolt to the release areas where Select Area fisheries take place.

Table V: Number of coho smolts released in Select Areas of the Lower Columbia River basin from 2010 to 2016 (Joint Columbia River Management Staff 2019).

Release Site	Hatchery	Coho Released						
		2010	2011	2012	2013	2014	2015	2016
Youngs Bay	South Fork Klaskanine Hatchery	390610	386668	336856	260289	209923	209745	487415

	Klaskanine Hatchery	489060	607824	732994	903119	1552458	1487362	1693979
	Youngs Bay Net Pens	757474	769971	774533	684309	766193	550062	761511
Blind Slough	Big Creek Hatchery	532082	571616	537811	537661	568328	536144	567394
	Blind Slough Net Pens	372265	586277	623649	569921	574243	349156	509235
Tongue Point	Tongue Point Net Pens	491330	849381	928589	935023	842341	747057	922455
Deep River	Deep River Net Pens	800000	600000	725000	654000	920000	855000	723000
	Grays River Hatchery	163000	165000	155000	165000	156000	53000	43550

Table VI: Number of coho landed in fall commercial fisheries in the mainstem and Select Areas from 2009 to 2018. Data compiled from annual Oregon Fish & Wildlife and Washington Department of Fish and Wildlife Joint Staff Reports.

Year	Mainstem	Select Area
2009	45241	80950
2010	No Data	No Data
2011	13482	49513
2012	2615	15354
2013	9766	42295
2014	69376	168497
2015	3892	27401
2016	1269	34723
2017	931	37979
2018	380	12111

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Very High Concern

Wild coho populations were largely extirpated from Columbia River tributaries by the 1930s (Joint Columbia River Management Staff 2014a). The only remaining natural stock is Lower Columbia River coho, which is listed under the Endangered Species Act as "Threatened" (NOAA 2014a). The Lower Columbia River coho evolutionarily significant unit includes both naturally spawned and hatchery produced fish, with the large majority being hatchery produced. Because the major stock is listed as "Threatened," conservation concern was deemed "very high."

Justification:

Coho salmon averaged 30% of the total Columbia River fall commercial harvest from 1999 to 2013 (Joint Columbia River Management Staff 2014a), and much of this catch was hatchery-produced Lower Columbia River coho. Thus, we evaluated Lower Columbia River coho as a major stock.

The Lower Columbia River coho evolutionarily significant unit includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood Rivers (inclusive), and from the Willamette River and its tributaries below Willamette Falls. Coho produced in 21 artificial propagation programs are included as well. Unmarked, naturally produced coho have also been returning to the Columbia River system in increasing numbers since 2000, but their origin is unknown (Joint Columbia River Management Staff 2014a). However, the Washington and Oregon Departments of Fish and Wildlife have improved monitoring of the wild-origin stock by estimating coho escapements and proportions of wild and hatchery fish in some Columbia River tributaries. Some of these data are posted on the Salmon Conservation and Reporting Engine (SCoRE; https://fortress.wa.gov/dfw/score/score/).

Another positive management development is that the Yakama Nation has re-introduced coho to the Yakima, Wenatchee, and Methow River basins (Bonneville Power Administration et al. 2012). These fish are not marked because they are attempting to rebuild the stocks, and some fisheries target marked fish.

Factor 1.3 - Fishing Mortality

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Moderate Concern

The major coho salmon stocks in this fishery include Columbia River and Washington coastal stocks. Escapement counts in natural spawning areas do not indicate declining population trends (Joint Columbia River Management Staff 2014a) (PFMC 2014a). Lower Columbia River natural coho salmon are listed under the Endangered Species Act as "Threatened," but exploitation rate limits (20% or lower) are in place to constrain harvest impacts on the stock. Estimated exploitation rates on LCN coho did not exceed limits in 78% of the years from 2005 to 2013 (PFMC 2014a). However, hatchery- and natural-origin fish are essentially managed together as a single stock, so there is some uncertainty regarding fishing mortality levels on the wild stock component. Because the depleted natural stock is subject to some fishing mortality, but there is management aimed at maintaining abundances, conservation concern was rated "moderate."

Justification:

Escapement data suggest that stocks are not declining.

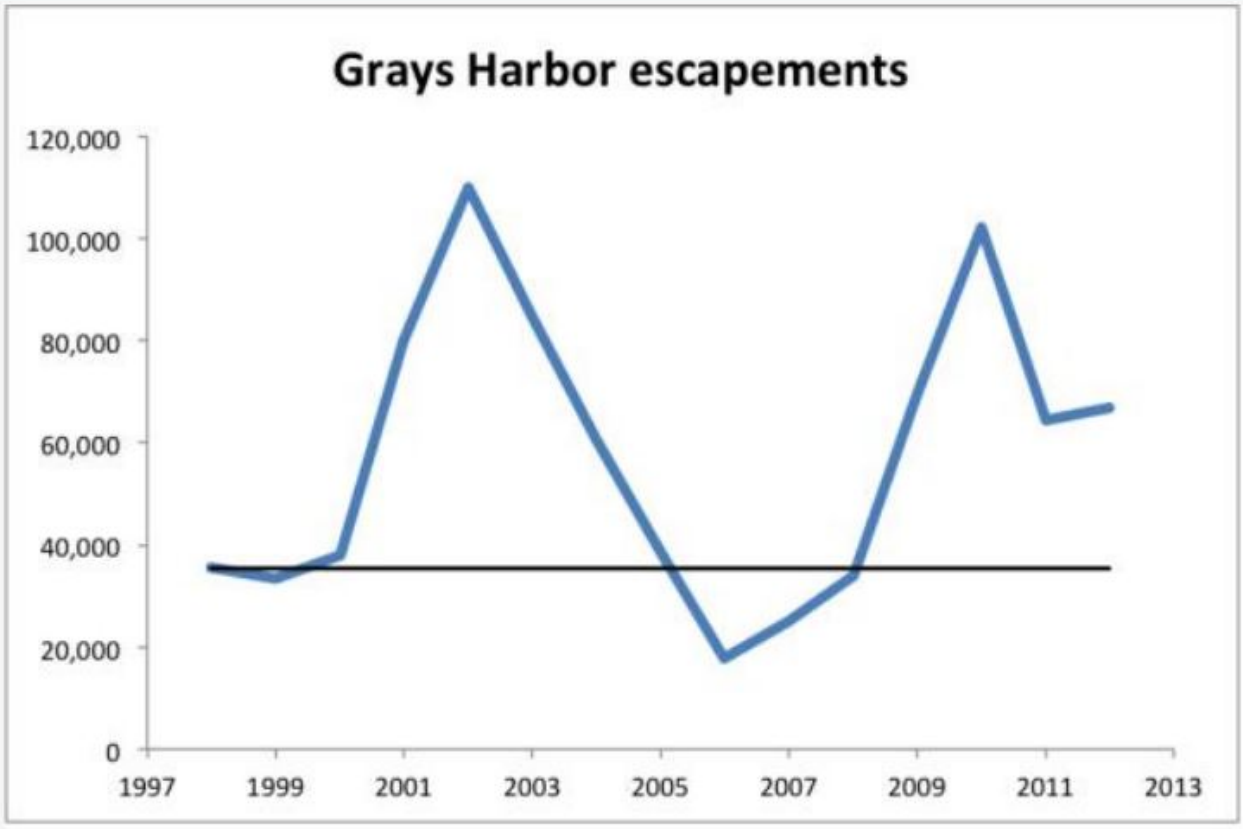


Figure 28 : Grays Harbor coho escapements (blue line) relative to the escapement target of 35,400 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

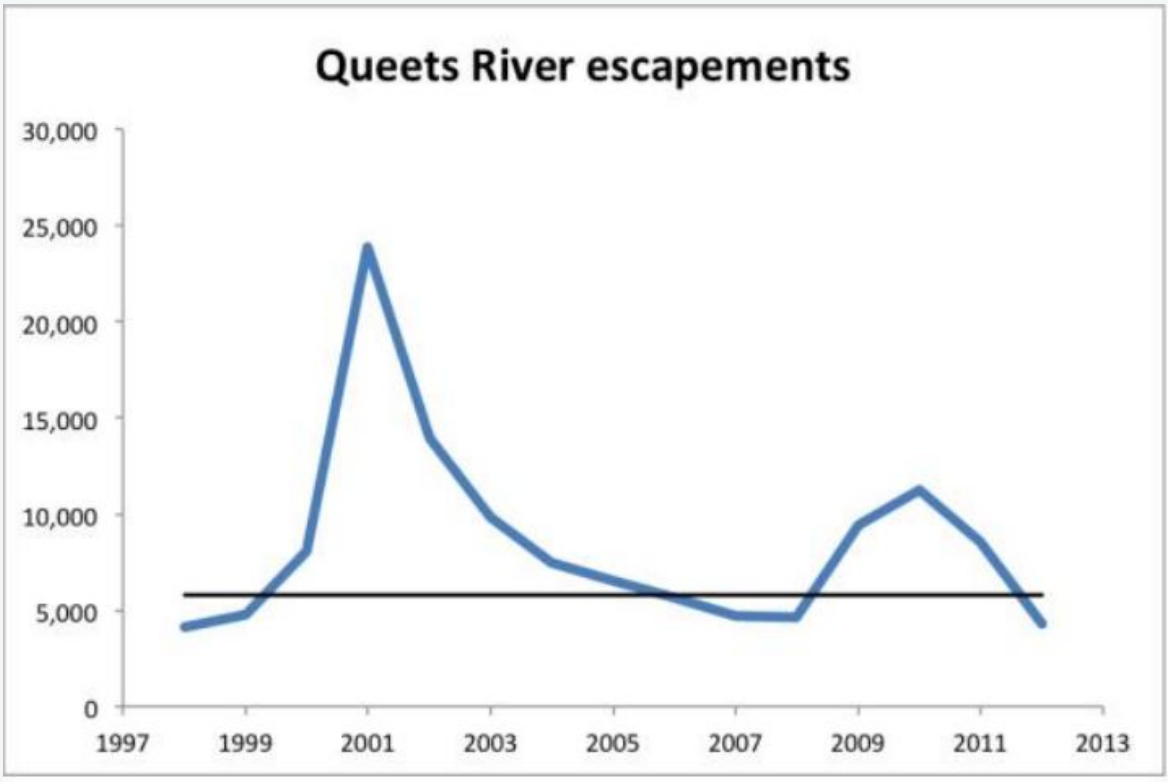


Figure 29: Queets River coho escapements (blue line) relative to the escapement target of 5,800 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

However, escapement counts for most of these stocks do not differentiate between natural and hatchery-origin fish spawning in the wild. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on natural-origin fish. Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs.

A stock is considered overfished if the 3-year geometric mean spawning escapement is less than the minimum stock size threshold (MSST), which is a biomass level set below the level corresponding to maximum sustainable yield (MSY) to allow for fluctuations in abundance while maintaining the capability to produce MSY on a continuing basis. The Grays Harbor, Queets River, Hoh River, and Quillayute River coho stocks exceeded their respective MSSTs based on their geometric mean escapement from 2011 to 2013 (PFMC 2014a). The MSST for Willapa Bay coho has not yet been defined.

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

Low Concern

The major coho salmon stocks in this fishery are Washington coastal stocks. Escapement data suggest that these stocks have generally stable abundances (PFMC 2014a). The policy document for Grays Harbor Basin salmon management includes objectives for focusing harvest on hatchery fish and reducing fishing mortality on natural stocks by implementing mark selective fisheries that release unmarked (natural-origin) fish (WDFW 2014c). In addition, exploitation rates on coho are limited to 5% when escapements to natural spawning areas are relatively low. Based on abundance data and management measures taken to reduce fishing mortality on natural stocks, concern regarding fishing mortality was deemed "low."

Justification:

Escapement data suggest that stocks are not declining (Figs. 20, 21, 22).

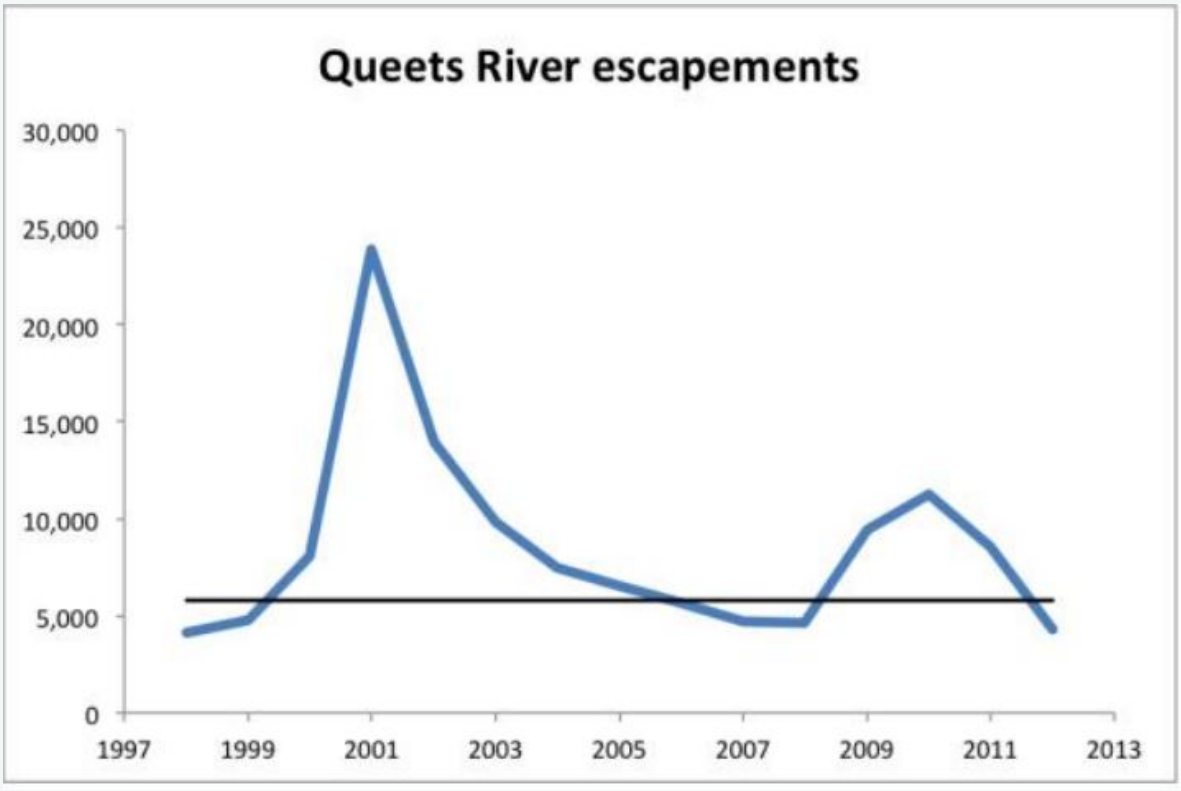


Figure 30: Queets River coho escapements (blue line) relative to the escapement target of 5,800 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

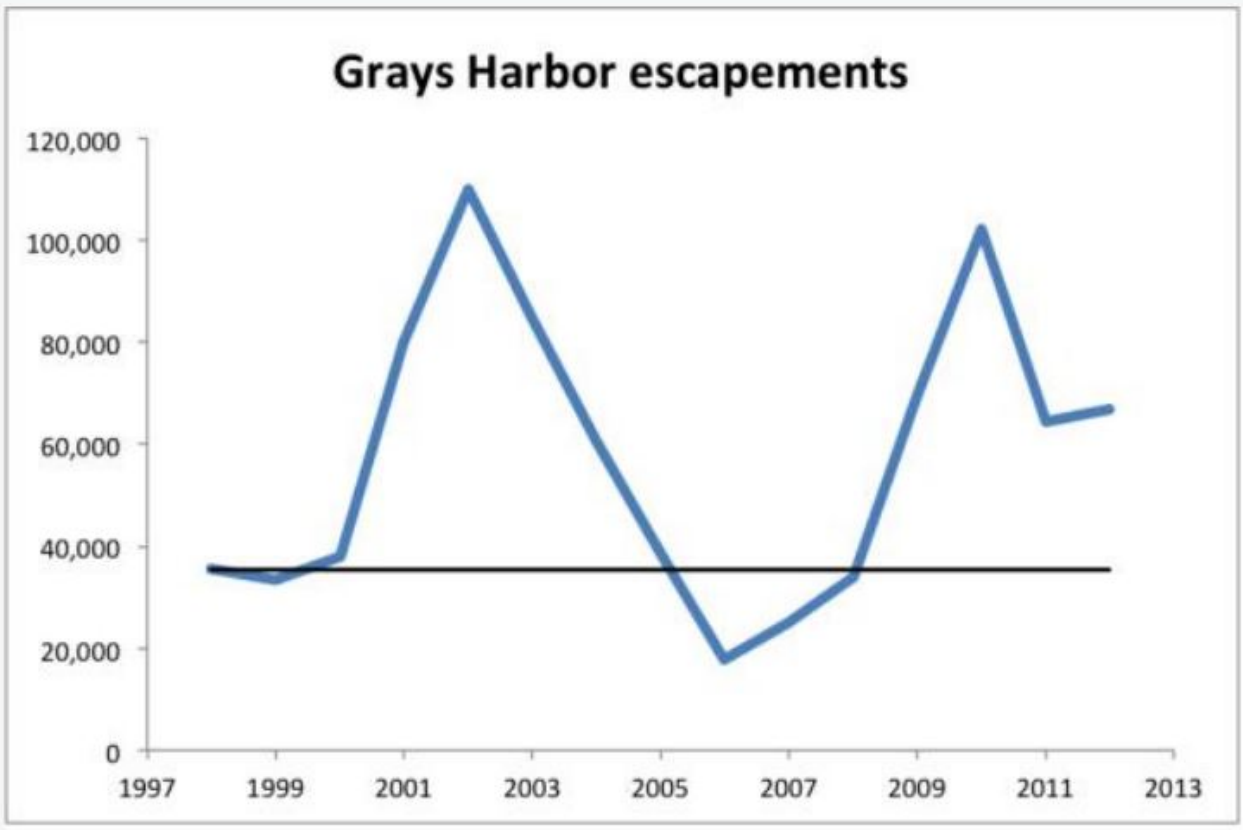


Figure 31 : Grays Harbor coho escapements (blue line) relative to the escapement target of 35,400 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

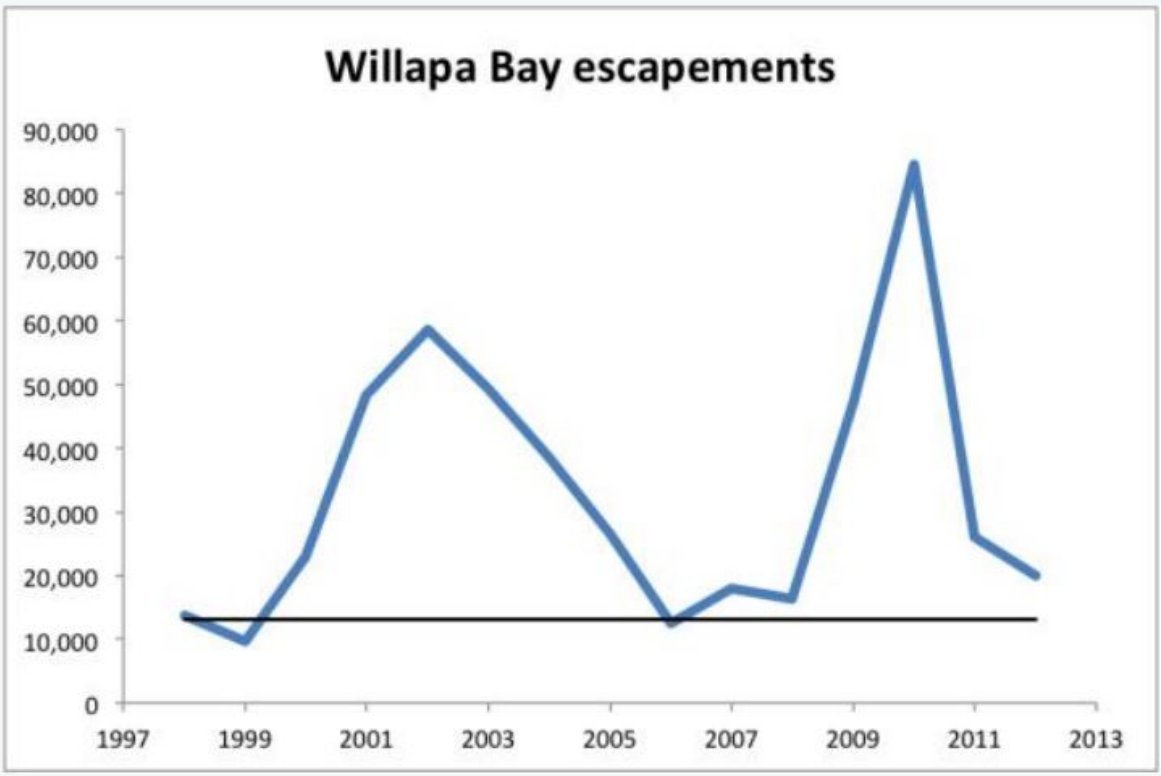


Figure 32: Willapa Bay coho escapements (blue line) relative to the escapement target of 13,090 fish (black line). The escapement counts and target are for fish spawning in natural areas but may include both hatchery and natural-origin fish. Data from the Pacific Fishery Management Council.

However, failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate. Hatchery stocks can withstand higher harvest rates than wild stocks due to enhanced fertilization and survival of eggs.

A stock is considered overfished if the 3-year geometric mean spawning escapement is less than the minimum stock size threshold (MSST), which is a biomass level set below the level corresponding to maximum sustainable yield (MSY) to allow for fluctuations in abundance while maintaining the capability to produce MSY on a continuing basis. The Grays Harbor, Queets River, Hoh River, and Quillayute River coho stocks exceeded their respective MSSTs based on their geometric mean escapement from 2011 to 2013 (PFMC 2014a). The MSST for Willapa Bay coho has not yet been defined.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

Low Concern

Coho fisheries are managed to allow adequate spawning escapement to Puget Sound rivers. Spawning levels have typically exceeded the goals during the past 15 years (PFMC 2014a). Population trends appear to be

stable over time, but hatchery coho contribute to counts on the spawning grounds, leading to some uncertainty about the accuracy of harvest rates on the natural origin coho. Total exploitation rates (US and Canada) have been relatively stable since 1998 and moderate for most management units (e.g., 20% for Stilliguamish, Snohomish; 30% for Skagit, 15% for Strait of Juan de Fuca), but exploitation has increased for Hood Canal coho (60% during 2005-2009) (PSC 2013c). The fishing mortality factor for coho is therefore scored as a "low" concern.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY

Low Concern

Coho salmon are typically taken incidentally to seine fisheries directed on other salmon species in Puget Sound. Coho are managed to allow adequate spawning escapement to Puget Sound rivers. Spawning levels have typically exceeded the goals duirng the past 15 years (PFMC 2014a). Population trends appear to be stable over time, but hatchery coho contribute to counts on the spawning grounds, leading to some uncertainty about the adequacy of harvest rates on the natural origin coho. Total exploitation rates (US and Canada) have been relatively stable since 1998 and moderate for most management units (e.g., 20% for Stilliguamish, Snohomish; 30% for Skagit, 15% for Strait of Juan de Fuca), but exploitation has increased for Hood Canal coho (60% during 2005 to 2009) (PSC 2013c). The fishing mortality factor for coho is therefore scored as a "low" concern.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY

Low Concern

Relatively few Puget Sound coho are harvested here; exploitation rates on each Puget Sound management unit is typically less than 2 (PSC 2013c). We therefore assume that the coho stock composition is similar to that in the north of Falcon troll fishery, which extends into the outer portion of the Strait. Major coho salmon stocks in the north of Falcon fishery include Columbia River and Washington inside coastal stocks. Escapement counts in natural spawning areas do not indicate declining population trends (Joint Columbia River Management Staff 2014a) (PFMC 2014a), and none of these stocks are currently considered overharvested, although the Queets River coho stock was considered "overfished" before its status was updated by NOAA fisheries in 2011 to "rebuilt." Total harvest rates (including Canada) on Quillayute, Hoh, Queets and Grays Harbor coho were typically 30 to 40% (PSC 2013c). Escapement counts do not clearly differentiate between natural and hatchery-origin fish. Concern regarding fishing mortality was deemed "low."

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Low Concern

The majority of the coho caught and landed in the Lower Columbia River basin are from Select Area fisheries and are primarily of hatchery origin. Between 1996 and 2004, fisheries in Select Areas were dominated by fish originating from net-pen releases in these areas; 88.3% in Deep River, 80.1% in Blind Slough, 87.2% in Youngs Bay, and 79.9% in Tongue Point (North et al. 2006). Fisheries in the mainstem of the Columbia River below Bonneville Dam (zones 1 to 5) are mark-selective fisheries (Joint Columbia River Management Staff 2018), meaning that only hatchery-origin fish that are marked by removing the adipose fin may be retained;

any unmarked, natural-origin fish that are caught must be returned and live-boxes are used to allow fish to recover prior to release, maximizing survival rates (Joint Columbia River Management Staff 2018). As more than 75% of the fish landed in the fishery are of hatchery origin and therefore impact on natural stocks is minimized, fishing mortality is considered a "low" conservation concern.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Moderate Concern

The only major Columbia River coho stock is Lower Columbia River natural (LCN) coho, which is listed under the Endangered Species Act but harvested in fall Columbia gillnet fisheries. Lower Columbia River coho escapements do not appear to be declining, and estimated wild abundance was especially high in 2014 (see Fig. 19 in Detailed Rationale). Under the US versus Oregon 2008–2017 Management Agreement, fishery exploitation rates on specific stocks (including LCN coho) are managed using harvest rate schedules, where harvest limits are determined each year based on in-season monitoring of salmon abundances. For LCN coho these limits have ranged from 8 to 20%, and estimated exploitation rates on LCN coho did not exceed limits in 78% of the years from 2005 to 2013 (PFMC 2014a). Starting in 2015, a new harvest matrix that considers parameters of ocean survival and parental escapement has been used. The new matrix is designed to concentrate fishing in the 18 to 23% range while allowing for exploitation rates up to 30% when marine survival is very high; at the same time, exploitation rates are supposed to be lowered in years when levels of artificial juvenile seeding is low (< 30% of full seeding) (PFMC 2014f). This change may make harvest limits more responsive to stock status information, but the target exploitation rates do not appear more conservative than they have been since the ESA-listing of LCN coho. Additionally, fishing mortality is estimated on hatchery- and natural-origin fish combined, so there is some uncertainty regarding fishing mortality levels on the wild stock component. Conservation concern was rated "moderate" concern.

Justification:

Columbia River salmon fisheries are complex, spanning essentially all seasons (fall, summer, winter, spring), including multiple components (e.g., commercial and recreational, treaty and non-treaty), and catching both hatchery and non-hatchery stocks, many of which are listed under the Endangered Species Act. Hatcheries in the lower Columbia River mark the coho they produce. Columbia River treaty gillnet fisheries do not selectively harvest marked hatchery salmon, but Select Area commercial fisheries target hatchery-produced fish in off-channel areas, sometimes using tangle net gear and recovery boxes in more recent years (Joint Columbia River Management Staff 2015b).

The allowable exploitation rate on LCN coho is for ocean and non-tribal Columbia River fisheries (downstream of Bonneville Dam) combined. The allocation of non-Indian catch and ESA impacts between ocean and in-river fisheries is determined annually by the states and occurs during the Pacific Fishery Management Council and North of Falcon meetings (Joint Columbia River Management Staff 2015b).

According to run reconstructions conducted by the Oregon Production Index Technical Team, wild LCN coho abundances have been stable and showed a large increase in 2014 (Fig. 19) (ODFW 2015a). Exploitation rates on this stock are estimated using the Coho Fishery Regulation Assessment Model (FRAM), which uses data from fish that have been marked using coded wire tags.

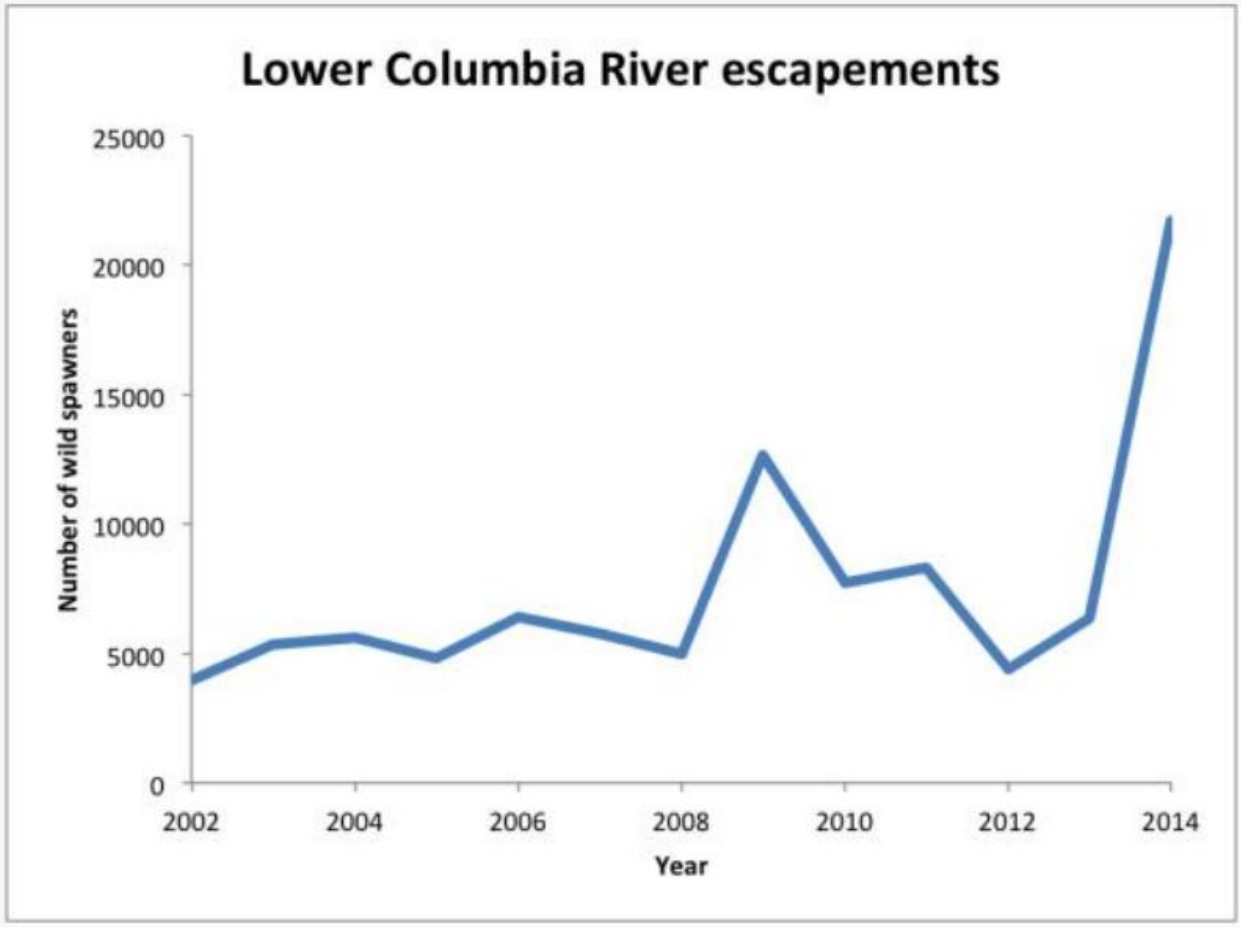


Figure 33 : Estimated numbers of wild coho spawners (blue line) for the Oregon portion of the Lower Columbia River coho ESU. Data from Oregon Production Index Technical Team run reconstructions.

PINK SALMON

Factor 1.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Medium

The FishBase vulnerability score for pink salmon is 37, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Pink salmon have medium to low vulnerability because this species matures quickly and has a relatively small body size. They have homogenous life history characteristics and are widely distributed.

Factor 1.2 - Abundance

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Very Low Concern

Pink salmon return to Puget Sound primarily in odd-numbered years owing to their two-year life cycle. They are the most abundant salmon species in Puget Sound with annual abundances up to 10 million salmon in recent years (PFMC 2014a). Hatchery pink salmon production is very small, typically less than 1% of the total. Spawning escapement goals have been established for most but not all the areas. The goals have been met or exceeded 75% of the past fifteen years. Given the high abundance (Fig. 23) and lack of hatchery fish on the spawning grounds, the abundance of Puget Sound pink salmon is judged to have a "very low" conservation concern.

Justification:

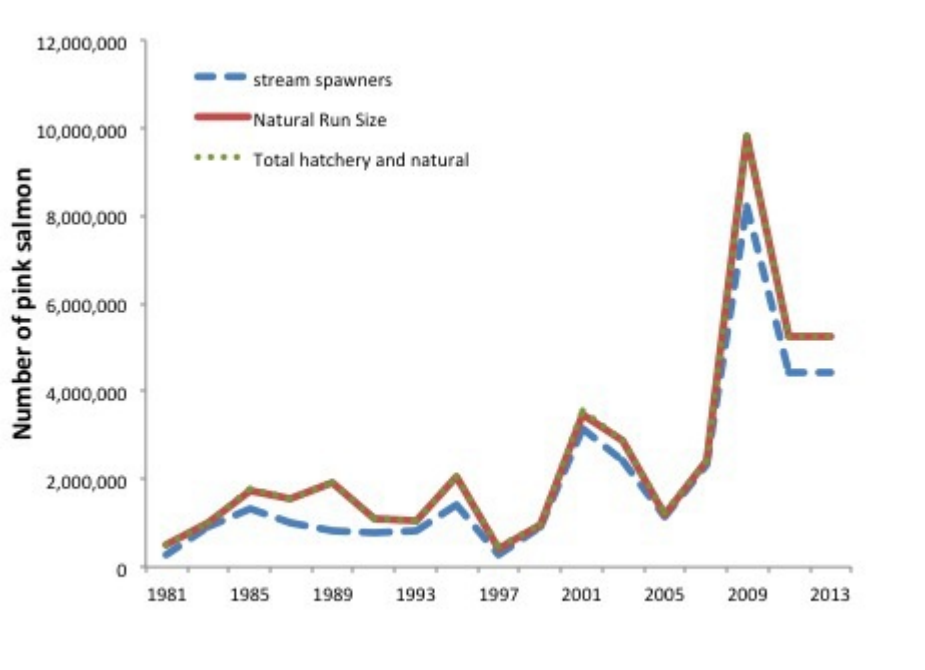


Figure 34: Abundance of pink salmon returning to Puget Sound, 1981-2013. Only odd years are shown because very few return in even years.

Factor 1.3 - Fishing Mortality

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Very Low Concern

Pink salmon are the most abundant salmon species in Puget Sound with annual abundances up to 10 million salmon in recent years(PFMC 2014a). Hatchery pink salmon production is very small, typically less than 1% of the total. Abundance has been increasing during the past 10 or more years. Given the high abundance and lack of hatchery fish on the spawning grounds, fishing mortality of Puget Sound pink salmon is judged to have a "very low" conservation concern.

SOCKEYE SALMON

Factor 1.1 - Inherent Vulnerability

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low

The FishBase vulnerability score for sockeye salmon is 32, making inherent vulnerability "low." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Sockeye salmon have "low" vulnerability because they have high diversity in life history traits.

Factor 1.2 - Abundance

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

Washington coastal sockeye salmon stocks include Lake Pleasant and Quinault sockeye. The Lake Pleasant spawning population is small but stable (mean of 1,039 fish from 1999 to 2013) and probably caught only incidentally. Quinault sockeye are a naturally produced stock with an annual escapement goal of 15,000 fish, which has been met for 73% of the past fifteen years from 1999 to 2013 (Rawson et al. 2009) (L. Gilbertson, personal communication). There is currently no significant hatchery production for Washington coastal sockeye stocks. Because the major stock is generally meeting escapement goals, conservation concern was deemed "low."

Justification:

Lake Ozette is another Washington coastal sockeye stock, but the stock is listed under the Endangered Species Act as "Threatened" and will not be evaluated here. Quinault sockeye escapements appear cyclical, with peak abundances from 2001 to 2004 and 2009 to 2012

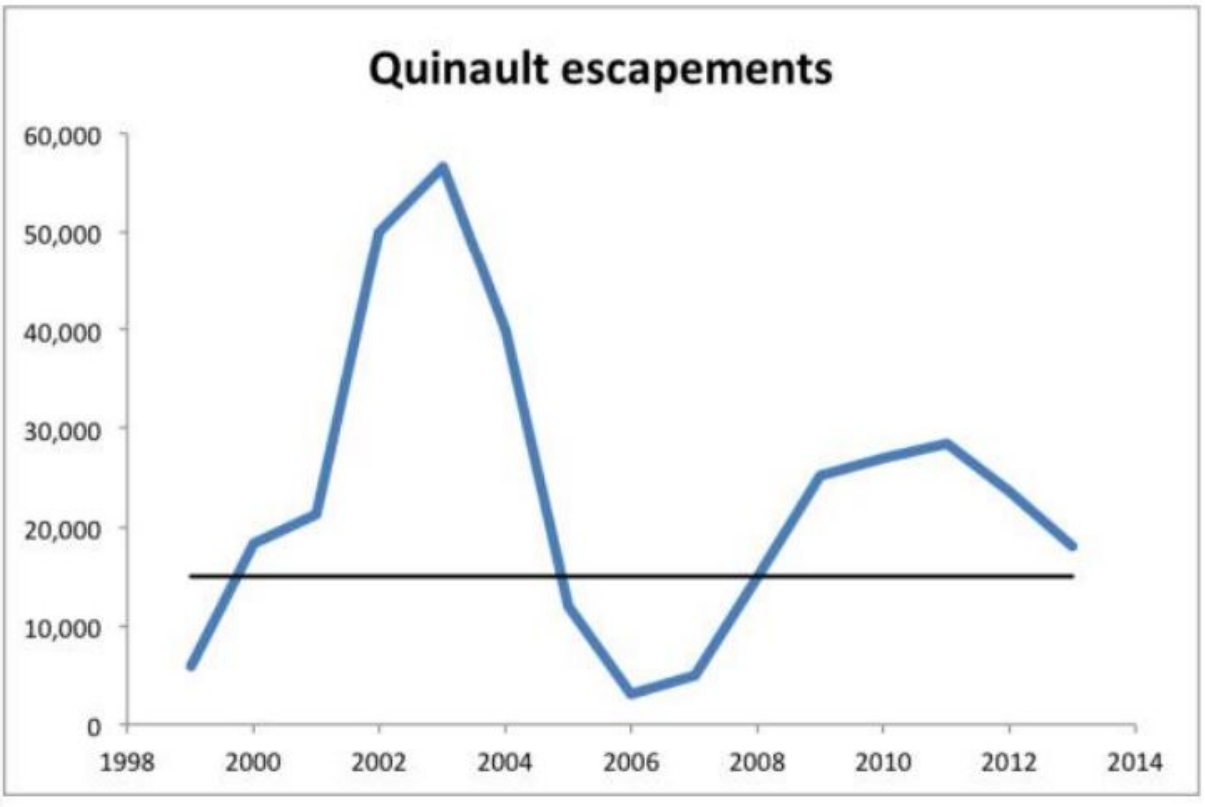


Figure 35 : Quinault sockeye escapements (blue line) relative to the escapement target of 15,000 fish (black line).

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY

Moderate Concern

Sockeye salmon stocks in the Columbia Basin have declined substantially from historic levels. Currently, most ocean-migrating (anadromous), naturally-produced sockeye originate from the Okanogan and Wenatchee basins. Escapement goals for Bonneville Dam (relating to all stocks) have been met in 93% of the past fifteen years (1999 to 2013), and the goal for Wenatchee sockeye has been met in 53% of the past fifteen years (Joint Columbia River Management Staff 2014b). However, Wenatchee sockeye are a mixed natural and hatchery stock, and the escapement goal and escapement counts do not differentiate between natural and hatchery-origin fish. Conservation concern was therefore rated "moderate."

Justification:

The escapement goal of 65,000 sockeye salmon at Priest Rapids Dam requires that 75,000 sockeye migrate past Bonneville Dam. The Wenatchee River has a current escapement goal of 23,000 adult sockeye. Escapements to the Wenatchee River have been cyclical and have frequently not met the management goal. Nonetheless, escapements have been relatively high since 2008 (Joint Columbia River Management Staff 2014b). Wenatchee sockeye are a mixed natural and hatchery stock that includes native fish.

Snake River sockeye is another anadromous sockeye stock occurring in the Columbia River basin, but it is listed as "Endangered" under the Endangered Species Act and is evaluated under Criterion 2. In addition,

sockeye have recently been re-introduced in the Yakima River, and passage has been re-established at Round Butte Dam on the Deschutes River. However, these stocks are not currently considered major contributors to the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

The Puget Sound sockeye salmon fishery primarily targets Fraser River sockeye salmon originating from British Columbia. Relatively small sockeye runs occur in Lake Washington and Baker Lake, but these runs often are not sufficient to allow a directed commercial harvest. The Fraser sockeye salmon stock consists of many populations, but is managed according to four migration timing groups; spawning escapements are monitored on about 18 populations. Fraser sockeye abundance is cyclic, and productivity has been highly variable in recent years. In 2009, a peak cycle year, the sockeye run was much lower than anticipated, leading to multiple inquiries (Peterman et al. 2010). However, in 2010, the run was one of the largest in the past 50 or more years. The 2014 return is expected to be near 20 million sockeye salmon. Spawning escapements of the timing groups have fluctuated about the escapement targets, which vary year-to-year (Fraser River Panel 2012). Some populations include artificial spawning channel sockeye, which are enumerated separately. Fraser sockeye abundance is judged to have a "low" concern regarding overall abundance because the majority of major stocks typically meet or exceed management targets. Weak sockeye stocks are evaluated under Criterion 2.

Justification:

Although the major stocks have been relatively abundant, some smaller stocks have been depressed (CSAS 2013). For example, the Cultus population was determined to be "Endangered" by COSEWIC (Committee on the Status of Endangered Wildlife in Canada), leading to actions to reduce harvest rates to some extent (see Criterion 2). Fraser sockeye abundance is judged to have a "low" concern regarding overall abundance because the majority of major stocks typically exceed management targets.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

The Puget Sound sockeye salmon fishery primarily targets Fraser River sockeye salmon originating from British Columbia. Relatively small sockeye runs occur in Lake Washington and Baker Lake, but these runs often are not sufficient to allow a directed commercial harvest. The Fraser sockeye salmon stock consists of many populations but is managed according to four migration timing groups; spawning escapements are monitored on about 18 populations. Fraser sockeye abundance is cyclic, and productivity has been highly variable in recent years. In 2009, a peak cycle year, the sockeye run was much lower than anticipated, leading to multiple inquiries (Peterman et al. 2010). However, in 2010, the run was one of the largest in the past 50 or more years. The 2014 return is expected to be near 20 million sockeye salmon. Spawning escapements of the timing groups have fluctuated about the escapement targets, which vary year-to-year (Fraser River Panel 2012). Some populations include artificial spawning channel sockeye, which are enumerated separately. Fraser sockeye abundance is judged to have a "low" concern regarding overall abundance because the majority of major stocks typically meet or exceed management targets. Weak sockeye stocks are evaluated under Criterion 2.

Justification:

Although the major stocks have been relatively abundant, some smaller stocks have been depressed (CSAS 2013). For example, the Cultus population was determined to be "Endangered" by COSEWIC (Committee on the Status of Endangered Wildlife in Canada), leading to actions to reduce harvest rates to some extent (see Criterion 2). Fraser sockeye abundance is judged to have a "low" concern regarding overall abundance because the majority of major stocks typically exceed management targets.

Factor 1.3 - Fishing Mortality

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

Quinault sockeye are the major stock caught in this fishery. Escapement data indicate that this stock is not currently in decline (Fig. 24), and the National Oceanic and Atmospheric Administration does not consider the stock overfished. Harvest is managed to not exceed a 40% exploitation rate (L. Gilbertson, personal communication), and exploitation rates have not exceeded this limit in any of the past 15 years (1999 to 2013), although there was a 40% exploitation rate in 2003 (Rawson et al. 2009). Conservation concern was rated "low."

Justification:

There is currently no significant hatchery production, so the estimated exploitation rates are assumed to be on the naturally produced stock. Quinault sockeye escapements appear cyclical, with peak abundances from 2001 to 2004 and 2009 to 2012 (Fig. 24).

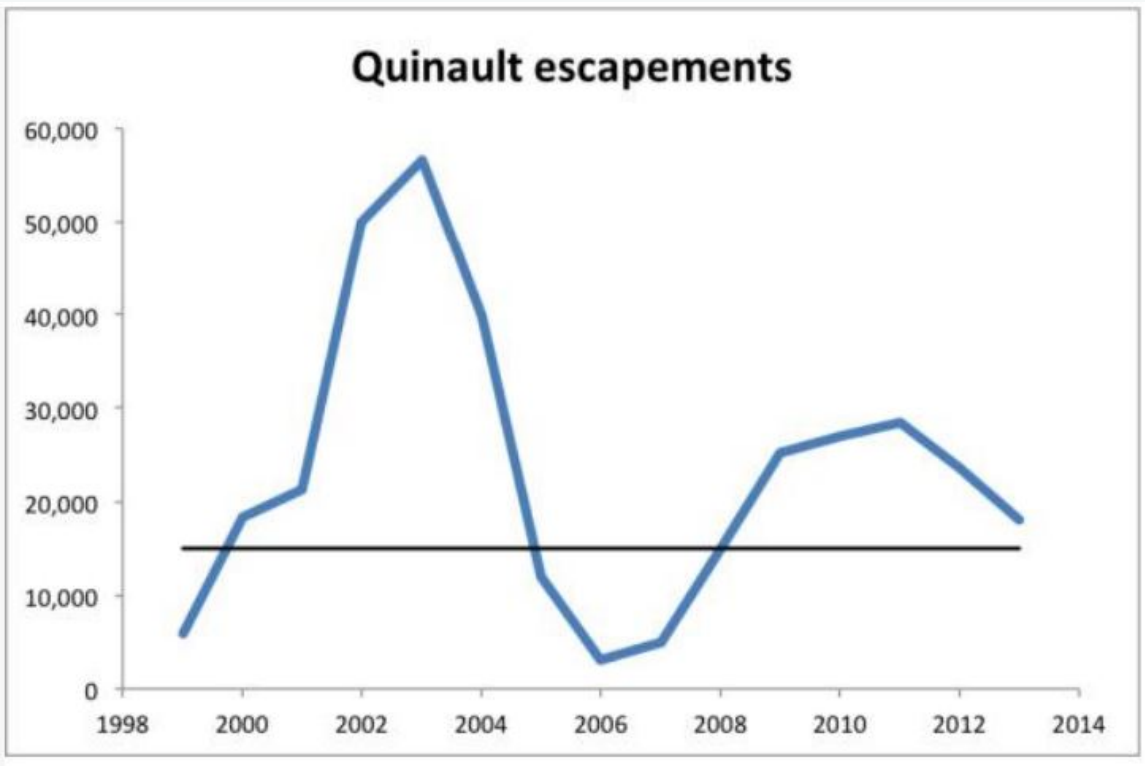


Figure 36: Quinault sockeye escapements (blue line) relative to the escapement target of 15,000 fish (black line).

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY

Low Concern

Major stocks caught in this fishery include Okanogan and Wenatchee sockeye. Under the US versus Oregon 2008–2017 Management Agreement, fishery exploitation rates on specific stocks are managed using harvest rate schedules. To help protect Snake River sockeye, tribal commercial fisheries are limited to harvesting 5% to 7% of the run, with the allowable harvest rate depending on sockeye run size, and non-tribal commercial fisheries are limited to harvesting 1% of the run (Joint Columbia River Management Staff 2014b). The 1% harvest allowance for non-tribal commercial fisheries is essentially incidental catch; there is no targeted non-tribal commercial fishery on Snake River sockeye. Escapement estimates do not indicate that stocks are declining. For example, Wenatchee River escapements have been cyclical and appear to be slightly increasing or at least stable since 2008 (Fig. 25). Thus, concern regarding fishing mortality is judged to be a "low" concern at this time.

Justification:

Under US versus Oregon, non-Indian and treaty Indian commercial fisheries for sockeye only occur when the escapement goal of 75,000 fish at Bonneville Dam has been achieved (Joint Columbia River Management Staff 2014b).

Escapements to the Wenatchee River have been cyclical and have met the management goal in only 53% of the past fifteen years (1999 to 2013). Nevertheless, escapements have been relatively high since 2008 (Fig. 25) (Joint Columbia River Management Staff 2014b). The Wenatchee stock has relatively little hatchery production, although there have been increasing releases of sockeye fry produced in Canada. Although the proportion of hatchery fish is low, estimated exploitation rates should reflect fishing mortality on the natural-origin stock. This assumption will need to be checked if hatchery releases increase, particularly if natural and hatchery-produced fish differ at all in run timing, body size at return, or other biological characteristics.

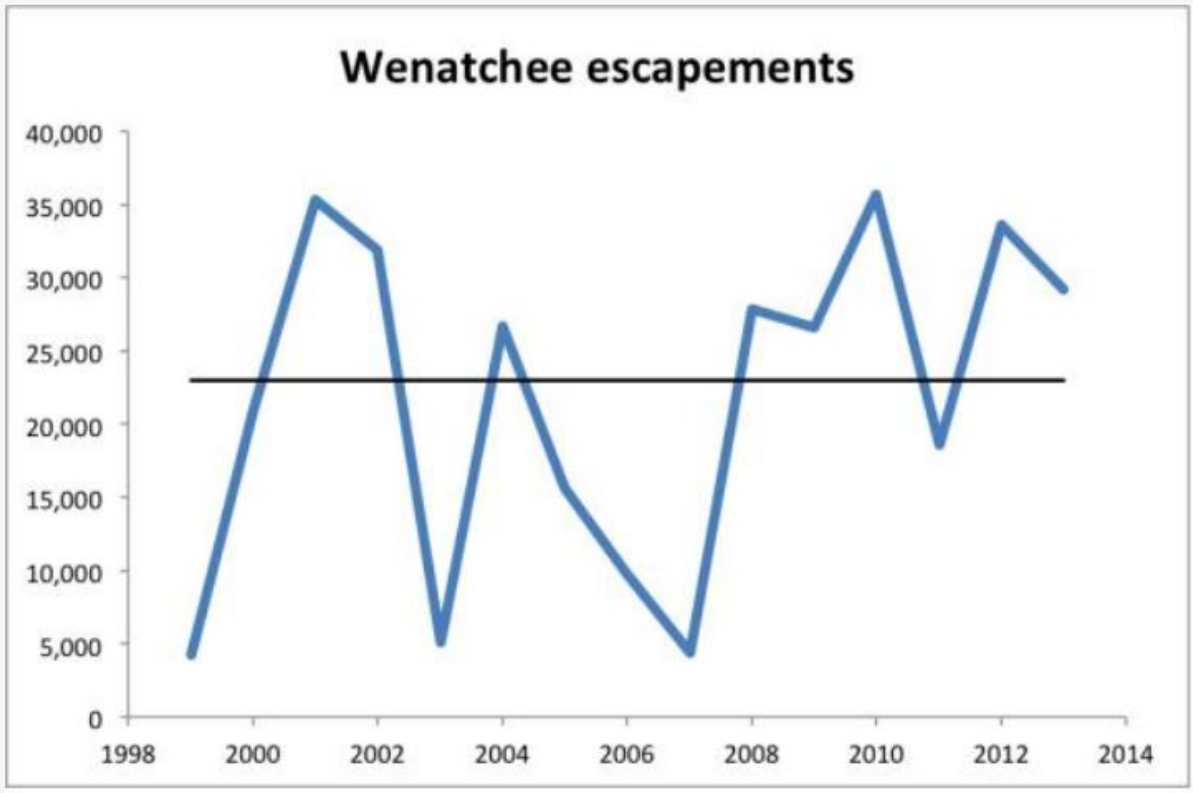


Figure 37 : Wenatchee sockeye escapements (blue line) relative to the escapement target of 23,000 fish (black line).

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

The Puget Sound sockeye salmon fishery primarily targets Fraser River sockeye salmon in British Columbia. Relatively small sockeye runs occur in Lake Washington and Baker Lake, but these runs often are not sufficient to allow a directed commercial harvest. Fraser sockeye salmon consists of many populations, but it is managed according to four migration timing groups; spawning escapements are monitored on about 18 populations. Fraser sockeye abundance is cyclic and productivity has been highly variable in recent years (Peterman et al. 2010). Harvest rates are adjusted in-season to reflect in-season estimates of abundance of each run timing group (Fraser River Panel 2012) (DFO 2013a). Spawning escapements of the timing groups have fluctuated about the escapement targets, which vary year-to-year (Fraser River Panel 2012). Over the past 20 years, total spawning escapement of sockeye salmon to the Fraser River has increased, whereas stock productivity has often declined (Connors et al. 2010). Some populations include artificial spawning channel sockeye, which are enumerated separately. Overall, Fraser sockeye is judged to have a "low" concern regarding fishing mortality because the run timing groups are typically (>50% of time) managed at sustainable harvest levels. See Criterion 2 for weak sockeye stocks.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Low Concern

The Puget Sound sockeye salmon fishery primarily targets Fraser River sockeye salmon in British Columbia. Relatively small sockeye runs occur in Lake Washington and Baker Lake, but these runs often are not sufficient to allow a directed commercial harvest. Fraser sockeye salmon consists of many populations, but it is managed according to four migration timing groups; spawning escapements are monitored in about 18 populations. Fraser sockeye abundance is cyclic and productivity has been highly variable in recent years (Peterman et al. 2010). Harvest rates are adjusted in-season to reflect in-season estimates of abundance of each run timing group (Fraser River Panel 2012) (DFO 2013a). Spawning escapements of the timing groups have fluctuated about the escapement targets, which vary year-to-year (Fraser River Panel 2012). Over the past 20 years, total spawning escapement of sockeye salmon to the Fraser River has increased, whereas stock productivity has often declined (Connors et al. 2010). Some populations include artificial spawning channel sockeye, which are enumerated separately. Overall, Fraser sockeye is judged to have a "low" concern regarding fishing mortality because the run timing groups are typically (>50% of time) managed at sustainable harvest levels. See Criterion 2 for weak sockeye stocks.

Criterion 2: Impacts on other species

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

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

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

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

Criterion 2 Summary

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

CHINOOK SALMON - OREGON/NORTHEAST PACIFIC - TROLLING LINES - UNITED STATES OF AMERICA - CHINOOK FISHERY - NORTH OF CAPE FALCON					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**
Species	**Inherent Vulnerability**	**Abundance**		**Fishing Mortality**	**Subscore**
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern		1.00:High Concern	Red (1.000)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern		2.33:Moderate Concern	Red (1.526)

CHINOOK SALMON - UNITED STATES OF AMERICA/COLUMBIA RIVER - DRIFT GILLNETS - CHINOOK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**		**Fishing Mortality**	**Subscore**
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern		2.33:Moderate Concern	Red (1.526)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern		2.33:Moderate Concern	Red (1.526)
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern		3.67:Low Concern	Red (1.916)
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern		3.67:Low Concern	Red (1.916)

Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)

CHINOOK SALMON - UNITED STATES OF AMERICA/KLAMATH RIVER - DRIFT GILLNETS - CHINOOK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	

CHINOOK SALMON - UNITED STATES OF AMERICA/NORTHEAST PACIFIC - TROLLING LINES - UNITED STATES OF AMERICA - CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)	

CHINOOK SALMON - UNITED STATES OF AMERICA/NORTHEAST PACIFIC - TROLLING LINES - UNITED STATES OF AMERICA - CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)	

CHINOOK SALMON - UNITED STATES OF AMERICA/NORTHEAST PACIFIC - TROLLING LINES - UNITED STATES OF AMERICA - CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)	

Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

CHINOOK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - DRIFT GILLNETS - UNITED STATES OF AMERICA - CHINOOK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)	
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)	
Pink salmon	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.000)	

CHINOOK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - PURSE SEINES - UNITED STATES OF AMERICA - CHINOOK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)	
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)	
Pink salmon	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.000)	

CHINOOK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - TROLLING LINES - UNITED STATES OF AMERICA - CHINOOK FISHERY					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)
Pink salmon	2.00:Medium	5.00:Very Low Concern	5.00:Very Low Concern	Green (5.000)

CHINOOK SALMON - WASHINGTON/NORTHEAST PACIFIC - DRIFT GILLNETS - UNITED STATES OF AMERICA - CHINOOK FISHERY

Subscore:	2.236	Discard Rate:	1.00	C2 Rate:	2.236

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

CHUM SALMON - UNITED STATES OF AMERICA/PUGET SOUND - DRIFT GILLNETS - UNITED STATES OF AMERICA - CHUM FISHERY

Subscore:	1.526	Discard Rate:	1.00	C2 Rate:	1.526

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)

CHUM SALMON - UNITED STATES OF AMERICA/PUGET SOUND - PURSE SEINES - UNITED STATES OF AMERICA - CHUM FISHERY

Subscore:	1.526	Discard Rate:	1.00	C2 Rate:	1.526

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)

Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)

CHUM SALMON - WASHINGTON/NORTHEAST PACIFIC - DRIFT GILLNETS - UNITED STATES OF AMERICA - CHUM FISHERY					
Subscore:	**2.236**	**Discard Rate:**	**1.00**	**C2 Rate:**	**2.236**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)	

COHO SALMON - OREGON/NORTHEAST PACIFIC - TROLLING LINES - UNITED STATES OF AMERICA - COHO FISHERY - NORTH OF CAPE FALCON					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)	
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	

COHO SALMON - UNITED STATES OF AMERICA/COLUMBIA RIVER - DRIFT GILLNETS - COHO FISHERY ABOVE BONNEVILLE DAM					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)	
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)	

COHO SALMON - UNITED STATES OF AMERICA/COLUMBIA RIVER - GILLNETS AND ENTANGLING NETS (UNSPECIFIED) - COHO FISHERY BELOW BONNEVILLE DAM					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Chum salmon / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

COHO SALMON - UNITED STATES OF AMERICA/PUGET SOUND - DRIFT GILLNETS - UNITED STATES OF AMERICA - COHO FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	3.67:Low Concern	Red (1.916)

COHO SALMON - UNITED STATES OF AMERICA/PUGET SOUND - PURSE SEINES - UNITED STATES OF AMERICA - COHO FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

COHO SALMON - UNITED STATES OF AMERICA/PUGET SOUND - TROLLING LINES - UNITED STATES OF AMERICA - COHO FISHERY					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)

Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Steelhead / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

COHO SALMON - WASHINGTON/NORTHEAST PACIFIC - DRIFT GILLNETS - UNITED STATES OF AMERICA - COHO FISHERY					
Subscore:	**2.236**	**Discard Rate:**	**1.00**	**C2 Rate:**	**2.236**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)	

PINK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - DRIFT GILLNETS - UNITED STATES OF AMERICA - PINK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	

PINK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - PURSE SEINES - UNITED STATES OF AMERICA - PINK FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**
Species	**Inherent Vulnerability**	**Abundance**	**Fishing Mortality**	**Subscore**	
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)	

PINK SALMON - UNITED STATES OF AMERICA/PUGET SOUND - TROLLING LINES - UNITED STATES OF AMERICA - PINK FISHERY					
Subscore:	**1.000**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.000**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	1.00:High Concern	Red (1.000)

SOCKEYE SALMON - UNITED STATES OF AMERICA/COLUMBIA RIVER - DRIFT GILLNETS - SOCKEYE FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	3.67:Low Concern	Red (1.916)

SOCKEYE SALMON - UNITED STATES OF AMERICA/PUGET SOUND - DRIFT GILLNETS - UNITED STATES OF AMERICA - SOCKEYE FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)

SOCKEYE SALMON - UNITED STATES OF AMERICA/PUGET SOUND - PURSE SEINES - UNITED STATES OF AMERICA - SOCKEYE FISHERY					
Subscore:	**1.526**	**Discard Rate:**	**1.00**	**C2 Rate:**	**1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Coho salmon / Minor stock	2.00:Medium	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)
Sockeye salmon / Minor stock	3.00:Low	1.00:Very High Concern	2.33:Moderate Concern	Red (1.526)

SOCKEYE SALMON - WASHINGTON/NORTHEAST PACIFIC - DRIFT GILLNETS - UNITED STATES OF AMERICA - SOCKEYE FISHERY					
Subscore:	**2.236**	**Discard Rate:**	**1.00**	**C2 Rate:**	**2.236**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Chinook salmon / Minor stock	2.00:Medium	1.00:Very High Concern	5.00:Very Low Concern	Yellow (2.236)

Summary

The stocks assessed under Criterion 2 were selected based on their depleted status (listed under ESA or determined to be "Threatened" or "Endangered" under COSEWIC) and their potential susceptibility to harvest within the main fisheries being assessed, based on gear type and/or run-timing. For example, Columbia River coho fisheries operate during the fall, so only ESA-listed stocks that migrate into the river at that time (fall Chinook, summer steelhead, chum) may be incidentally caught. Non-ESA listed salmon and non-salmon species were not assessed because they were typically not the most vulnerable species caught. In fisheries where multiple ESA-listed stocks were potentially captured, Criterion 2 was largely evaluated using the species that was judged to be most susceptible; this often was a conspecific ESA-listed stock.

Columbia River

Commercial gillnet fisheries in the mainstem Columbia River operate within a complex system that includes many salmon stocks, many of which are federally listed. Fisheries targeting Chinook salmon operate over much of the year and may encounter most salmon species, though ESA-listed Chinook and coho stocks are most susceptible to incidental harvest. Fisheries targeting coho salmon operate during the fall and may incidentally catch ESA-listed Chinook, coho, chum, and steelhead. Fisheries targeting sockeye salmon operate during the summer and may incidentally catch ESA-listed Chinook and sockeye. Other ESA-listed species found in Columbia River fishery management areas include the southern distinct population segments (DPSs) of green sturgeon and eulachon (Joint Columbia River Management Staff 2014a), but incidental harvests of these species should be minimal. Lower Columbia River white sturgeon are not ESA-listed and may be incidentally caught in some Chinook gillnet fisheries, but retention was prohibited in the 2014 season (Joint Columbia River Management Staff 2015). Gillnets occasionally capture aquatic birds, which may include the ESA-listed marbled murrelet. Anecdotally, bird bycatch rates are low (Profita 2012), although additional observer data would be useful for confirming bycatch rates (Wiedenfeld et al. 2012).

Klamath River

Coho salmon are caught incidentally in the Klamath tribal gillnet fishery targeting Chinook salmon. The primary ESA-listed coho stock that may be encountered in this area is Southern Oregon/Northern California Coast (SONCC) coho. The other ESA-listed species potentially caught in this fishery is the southern DPS of green sturgeon. However, the susceptibility of green sturgeon to the fishery is likely very low. Other ESA-listed stocks are unlikely to be encountered in the Klamath River fishery.

Puget Sound

Puget Sound coho, chum, and sockeye salmon fisheries harvest some Puget Sound ESA-listed Chinook salmon to the extent that these fisheries overlap in time and space with Chinook salmon. Very few Hood Canal summer chum, which are ESA-listed as "Threatened," are captured in chum salmon fisheries because their migration timing earlier and location is separate from most fisheries. Other species listed under ESA or determined to be "Threatened"/"Endangered" under COSEWIC that might be incidentally captured in Puget Sound salmon fisheries include Puget Sound steelhead, Ozette Lake sockeye salmon, Cultus sockeye salmon, Interior Fraser coho salmon, southern DPS of green sturgeon, bocaccio, canary rockfish, yelloweye rockfish, and marbled murrelet (NMFS 2014) (US FWS 2014). Natural Resources Consultants conducted bycatch research in some

Puget Sound gillnet and purse seine fisheries, and found that the susceptibility of these species to the fisheries is low.

Washington Inside Coast Fisheries
The ESA-listed Chinook and coho stocks encountered in these fisheries originate from the Lower Columbia River, Oregon coast, California coast, and Puget Sound (Kassler and Marshall 2004). As with Puget Sound, other ESA-listed species that might be incidentally captured include Ozette Lake sockeye salmon, southern DPS of green sturgeon, and marbled murrelet (NMFS 2014) (US FWS 2014). However, the susceptibility of these fish species to drift gillnets is very low. Anecdotally, bird bycatch rates are also low, although additional observer data would be useful for confirming bycatch rates (Wiedenfeld et al. 2012).

Pacific Fishery Management Council Ocean Fisheries (US/Mexico border to North of Cape Falcon)
PFMC ocean fisheries encounter ESA-listed stocks of Chinook and coho salmon, and the specific stocks that are incidentally caught vary by area. To help protect ESA-listed coho stocks, coho salmon cannot be retained in fisheries operating south of Cape Falcon. Bycatch of other ESA-listed species, such as sockeye, steelhead, and chum is likely to be very low because they are less susceptible to troll gear.

Criterion 2 Assessment

SCORING GUIDELINES

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

Factor 2.2 - Abundance
(same as Factor 1.2 above)

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

CHINOOK SALMON / MINOR STOCK

Factor 2.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for Chinook salmon is 68, which corresponds to high inherent vulnerability. However, the productivity-susceptibility analysis (PSA) suggests moderate vulnerability based on attributes including age at maturity, maximum size, reproductive strategy, and trophic level (see Table 2 for estimates used). We rated inherent vulnerability as "medium."

Justification:

The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Data used for the productivity susceptibility

analysis were obtained from Fishbase.org and are shown in Table 2.

Trait	Estimate	Score
Average at maturity (years)	4	3
Average maximum age (years)	8	3
Average maximum size (cm)	150	2
Average size at maturity (cm)	76.7	2
Reproductive strategy	demersal egg layer	2
Trophic level	4.4	1
Average score		2.17

Figure 38: Table of Chinook salmon trait estimates and scores used for determining inherent vulnerability using productivity and susceptibility analysis.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

Very High Concern

California Coastal (CC) Chinook is an ESA (Endangered Species Act)-listed stock landed in this fishery (PFMC 2014a). CC Chinook are listed as threatened (NOAA 2014), and thus conservation concern regarding abundance is "very high."

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

Very High Concern

Central Valley spring-run (CVS) Chinook, California Coastal (CC) Chinook, and Sacramento River winter-run (SRWC) Chinook are ESA (Endangered Species Act)-listed stocks landed in this fishery (PFMC 2011). CVS and CC Chinook are listed as "Threatened," and SRWC Chinook are listed as "Endangered" (NOAA 2014a). Conservation concern regarding abundance is therefore "very high."

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY

Very High Concern

There are five ESA (Endangered Species Act)-listed Chinook stocks and one COSEWIC-listed Chinook stock that occur in Columbia River fishery management areas. Some of these stocks do not overlap in run timing with Columbia River sockeye stocks, which migrate through the Lower Columbia River in June and July (Joint Columbia River Management Staff 2014b). Those that do overlap slightly in timing are fall stocks: Snake River fall, Lower Columbia River spring/fall, and Okanagan Chinook. All three are listed as "Threatened" (NOAA 2014a) (COSEWIC 2014). Since these stocks are federally listed, they are of "very high" conservation concern.

Justification:

The Upper Columbia River summer Chinook stock, which overlaps more substantially with Columbia River sockeye in run timing, is considered a healthy stock and is not ESA-listed (Joint Columbia River Management Staff 2014b).

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Very High Concern

Lower Columbia River natural tule Chinook and Snake River wild Chinook are listed as ESA (Endangered Species Act) stocks that are landed in these fisheries (PFMC 2014a). Both stocks are listed as "Threatened" (NOAA 2014a), and thus conservation concern regarding abundance is "very high."

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very High Concern

Although quantities are small, Washington coastal fisheries incidentally catch some ESA-listed stocks. A genetic analysis conducted on Chinook salmon sampled in the 2003 Willapa Bay summer fishery found that approximately 20% of the harvest was of Columbia Basin Chinook stocks, and 9% was of Puget Sound, Oregon Coast, and Northern California Chinook stocks (Kassler and Marshall 2004). ESA-listed stocks that may be caught therefore include California Coastal, Lower Columbia River natural, and Puget Sound Chinook. These stocks are listed as "Threatened," and thus conservation concern regarding abundance is "very high."

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

Very High Concern

California Coastal (CC) Chinook, Lower Columbia River (LCR) natural tule Chinook, and Snake River Wild (SRW) fall Chinook are ESA-listed stocks landed in this fishery (PFMC 2014a). All of these ESUs are listed as "Threatened" (NOAA 2014a), and thus conservation concern regarding abundance is "very high."

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Very High Concern

The Puget Sound troll fishery occurs in the Strait of Juan de Fuca. It is a relatively small fishery that targets Chinook and coho, many of which are headed to places other than Puget Sound, including the Columbia River (CDFO, NMFS, and WDFW 1988) (PFMC 2014a) (PSC 2012) (PSC 2013c). Puget Sound ESA-listed Chinook are scored under Criterion 1 in the troll fishery because they likely represent more than 5% of the overall catch of Chinook salmon given that many hatchery stocks are ESA-listed. Genetic data indicate that Columbia River Chinook are a dominant stock taken in this troll fishery although most of these Chinook are not ESA-listed (CDFO, NMFS, and WDFW 1988). Given the high presence of Columbia River Chinook, we assumed some ESA-listed Chinook from the Columbia River, such as Snake River fall Chinook and Lower Columbia River

natural tule Chinook (NOAA 2014a), may be taken in the troll fishery. Therefore, the conservation concern regarding abundance is "very high."

Justification:

ESA-listed species that might be incidentally captured in Puget Sound salmon fisheries in addition to Puget Sound Chinook include Puget Sound steelhead, Hood Canal summer chum, Ozette Lake sockeye salmon, southern DPS of green sturgeon, bocaccio, canary rockfish, yelloweye rockfish, and marbled murrelet (NMFS 2014) (US FWS 2014). The conservation concern for all of these species is "very high," but the susceptibility of the species to salmon trolling is negligible.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very High Concern

Puget Sound coho, chum, pink, and sockeye salmon fisheries harvest some Puget Sound ESA-listed Chinook salmon to the extent that these fisheries overlap in time and space with Chinook salmon. Some fisheries reduce Chinook impacts via live-release. This abundance factor receives a "very high" conservation concern because the gillnet fisheries take some ESA-listed Chinook salmon, whose status is "Threatened."

Justification:

ESA-listed species that might be incidentally captured in Puget Sound salmon fisheries in addition to Puget Sound Chinook include Puget Sound steelhead, Hood Canal summer chum, Ozette Lake sockeye salmon, southern DPS of green sturgeon, bocaccio, canary rockfish, yelloweye rockfish, and marbled murrelet (NMFS 2014) (US FWS 2014). The conservation concern for all of these species is "very high," but the susceptibility of these species to drift gillnets is "very low."

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Very High Concern

There are five ESA (Endangered Species Act)-listed Chinook stocks in the Columbia River fishery management areas. Upper Columbia spring Chinook are listed as "Endangered," while Snake River fall, Snake River spring/summer, Lower Columbia River spring/fall, and Upper Willamette spring Chinook are listed as "Threatened" (NOAA 2014a). Okanagan Chinook, which are listed as "Threatened" under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2014), may be encountered as well. Since these stocks are federally listed, they are of "very high" conservation concern.

Justification:

Three populations are monitored in the Upper Columbia spring Chinook evolutionarily significant unit: Wentachee River, Entiat River, and Methow River. Population abundances for natural-origin adults have been quite low in recent years (Fig. 26), but hatchery-produced fish contribute to abundances in natural spawning areas.

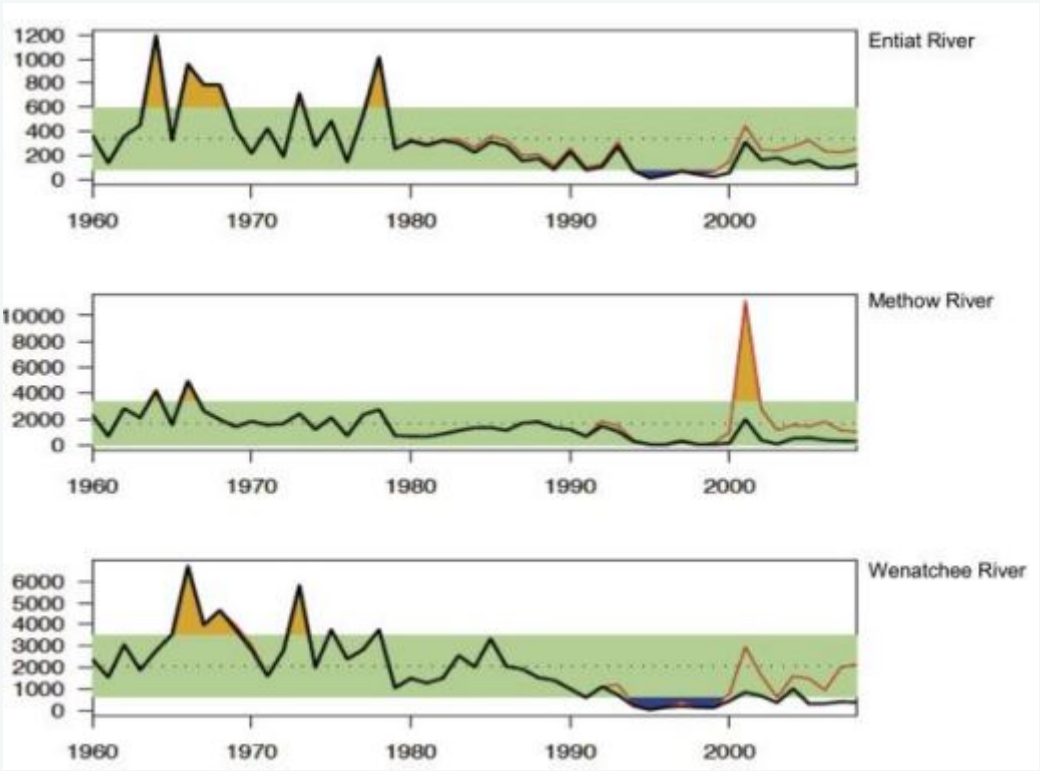


Figure 39: Estimated spawning abundances by year for the Upper Columbia River spring Chinook evolutionarily significant unit. The dark line indicates counts of natural-origin adults, and the orange line indicates counts of adults spawning in natural areas, including naturally spawning hatchery-origin fish. The dotted line is the long-term mean of the total adult counts, and the green shaded area indicates plus or minus one standard deviation around the mean. Figure from Ford et al. 2011.

Returns of Snake River fall Chinook have been stable and increasing, with an especially high return in 2013 (Joint Columbia River Management Staff 2014a). There is substantial hatchery supplementation of this stock as part of the conservation strategy, and the proportion of wild-origin fish has been below 40% from at least 2002 until 2008 (NOAA 2014c).

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Very High Concern

There are five ESA (Endangered Species Act)-listed Chinook stocks and one COSEWIC-listed Chinook stock that occur in Columbia River fishery management areas. Of these stocks, three may be caught in Columbia River coho gillnet fisheries: Snake River fall, Lower Columbia River spring/fall, and Okanagan Chinook. Since these stocks are identified as "Threatened," they are of "very high" conservation concern.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

High Concern

ESA (Endangered Species Act)-listed Chinook stocks caught in this fishery include California Coastal (CC) Chinook. Salmon fisheries in this area are managed using a weak stock approach, where total harvest is contained to meet management objectives for all stocks, including weak and sometimes ESA-listed stocks. For example, the CC Chinook ESA consultation standard requires a forecast ocean harvest rate on a proxy stock group (age-4 Klamath River fall Chinook) to be no greater than 16%. The forecast ocean harvest rate on age-4 KRF Chinook was 16% or less from 2001 to 2014, although the post-season harvest rates exceeded 16% in 6 of these 15 years (PFMC 2015a). CC Chinook continue to be at risk of extinction, presumably due to multiple factors including harvest and availability of suitable spawning habitat. Because depleted populations are subject to some fishing mortality, and management aimed at maintaining abundances may not be wholly effective, conservation concern was rated "high."

Justification:

Management for Chinook fisheries in this area is guided by the Pacific Fishery Management Council's Pacific Coast Salmon Fishery Management Plan and by Endangered Species Act consultation standards developed by the National Marine Fisheries Service. The constraining management objective in 2013 for this area was a marine exploitation rate limit of 16% on age-4 Klamath River Fall Chinook (KRFC) designed to limit exploitation of California Coastal Chinook. The projected 2013 coastwide ocean fishery exploitation rate on KRFC was 16% (PFMC 2014a).

The limited abundance data available for the California Coastal Chinook stock indicate that the population is still at risk of extinction, with temporal trends in abundance being unclear (NMFS 2011c)

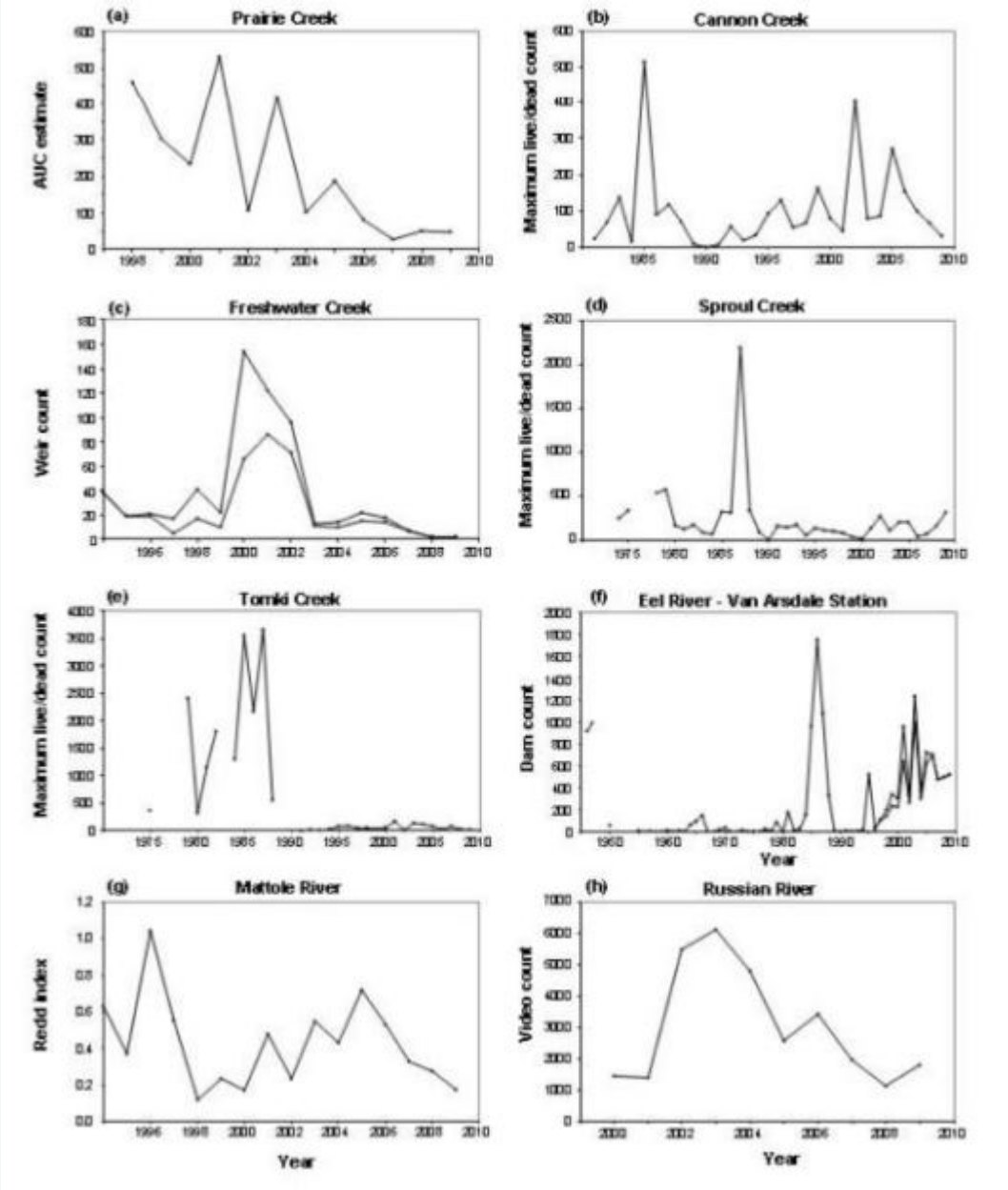


Figure 40: Chinook salmon population estimates, counts, and indices for populations in the California Coastal Chinook Salmon Evolutionarily Significant Unit. From Williams et al. 2011.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

High Concern

ESA (Endangered Species Act)-listed Chinook stocks caught in this fishery include Central Valley spring-run (CVS) Chinook, California Coastal (CC) Chinook, and Sacramento River winter-run (SRWC) Chinook. Salmon fisheries in this area are managed using a weak stock approach, where total harvest is contained to meet management objectives for all stocks, including weak and sometimes ESA-listed stocks. For example, ESA consultation standards require the forecast ocean harvest rate on a proxy stock group for CC Chinook (age-4 Klamath River fall Chinook) to be no greater than 16%, and a 2014 maximum forecast age-3 impact rate of 15.4% for SRWC Chinook in the area south of Point Arena (PFMC 2015b). The forecast ocean harvest rate on age-4 KRF Chinook was 16% or less from 2001 to 2014, although the post-season harvest rates exceeded 16% in 6 of these 15 years (PFMC 2015a). The population status of listed stocks has not yet improved, presumably due to multiple factors including harvest and availability of suitable spawning habitat. Additionally, ocean harvests of Chinook are substantial in this region, with over 150,000 fish landed each year since 2012 (PFMC 2014a). Because depleted populations are subject to some fishing mortality, and management aimed at maintaining abundances may not be wholly effective, conservation concern was rated "high."

Justification:

Management for Chinook fisheries in this area is guided by the Pacific Fishery Management Council's Pacific Coast Salmon Fishery Management Plan. The constraining management objectives in 2013 for this area were: 1) a marine exploitation rate limit of 16% on age-4 Klamath River Fall Chinook and 2) measures for limiting harvest of Sacramento River winter-run Chinook (SRWC). Objective 1 aims to limit harvest of California Coastal Chinook. Objective 2 includes an exploitation rate limit on age-3 SRWC salmon south of Point Arena based on escapement counts in previous years, minimum sizes for fish that can be caught, and a maximum range of fishery opening and closing dates (PFMC 2015a). These objectives were projected to be met in 2013 (PFMC 2014a).

Despite the presence of management measures, the status of Central Valley Spring-run (CVS) Chinook salmon has likely deteriorated since 2005, with some independent populations showing an increase in extinction risk (NMFS 2011a). Estimated escapements for Sacramento River winter-run (SRWC) Chinook showed a substantial decline of about 90% from 2005 to 2010 (Fig. 28) (NMFS 2011b).

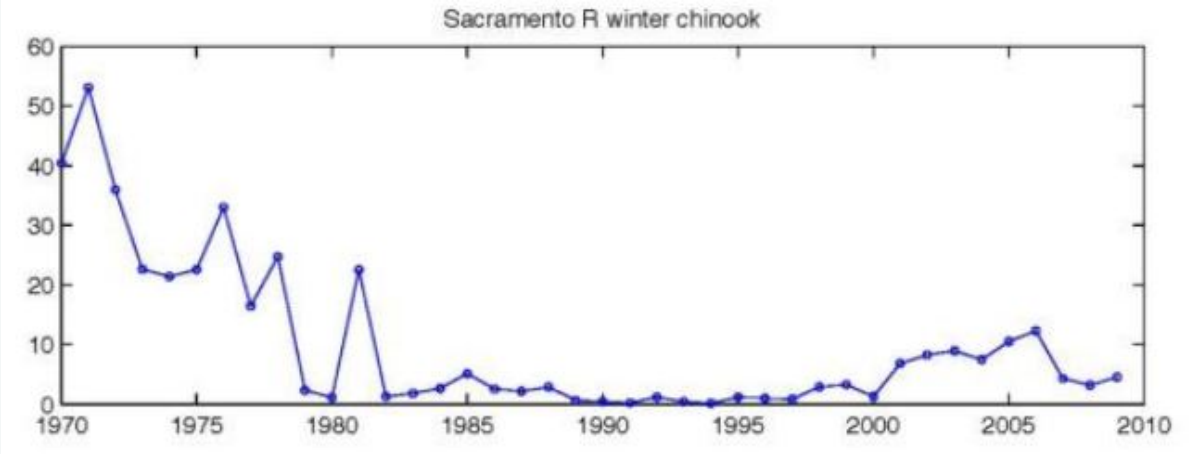


Figure 41: Escapement time series for the Sacramento River winter-run Chinook evolutionarily significant unit (ESU). Escapement counts are the average of counts at Red Bluff Dam and estimates from carcass surveys. From Williams et al. 2011.

There are limited escapement data for the California Coastal Chinook stock (NMFS 2011c). NMFS has drafted but not yet finalized a recovery plan for CVS and SRW Chinook.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Moderate Concern

Three threatened Chinook stocks may be caught in Columbia River coho and sockeye gillnet fisheries: Snake River fall, Lower Columbia River spring/fall, and Okanagan Chinook. To help protect these stocks from further depletion, non-Indian and treaty Indian fisheries are managed to meet harvest rate schedules provided in the US versus Oregon 2018–2027 Management Agreement. However, the population status of threatened stocks has not yet improved, because habitat and hydrosystem conditions have not yet improved sufficiently. Although many hatchery-released fish released in the Columbia Basin are marked, and marked fish are recorded at Bonneville Dam, hatchery- and natural-origin fish are managed together as composite stocks (i.e., they are managed as one stock). Because depleted populations are subject to some fishing mortality, but there is management aimed at maintaining abundances, conservation concern was rated "moderate."

Justification:

Data for Lower Columbia River fall Chinook index populations indicate that these stocks continue to have low abundances.

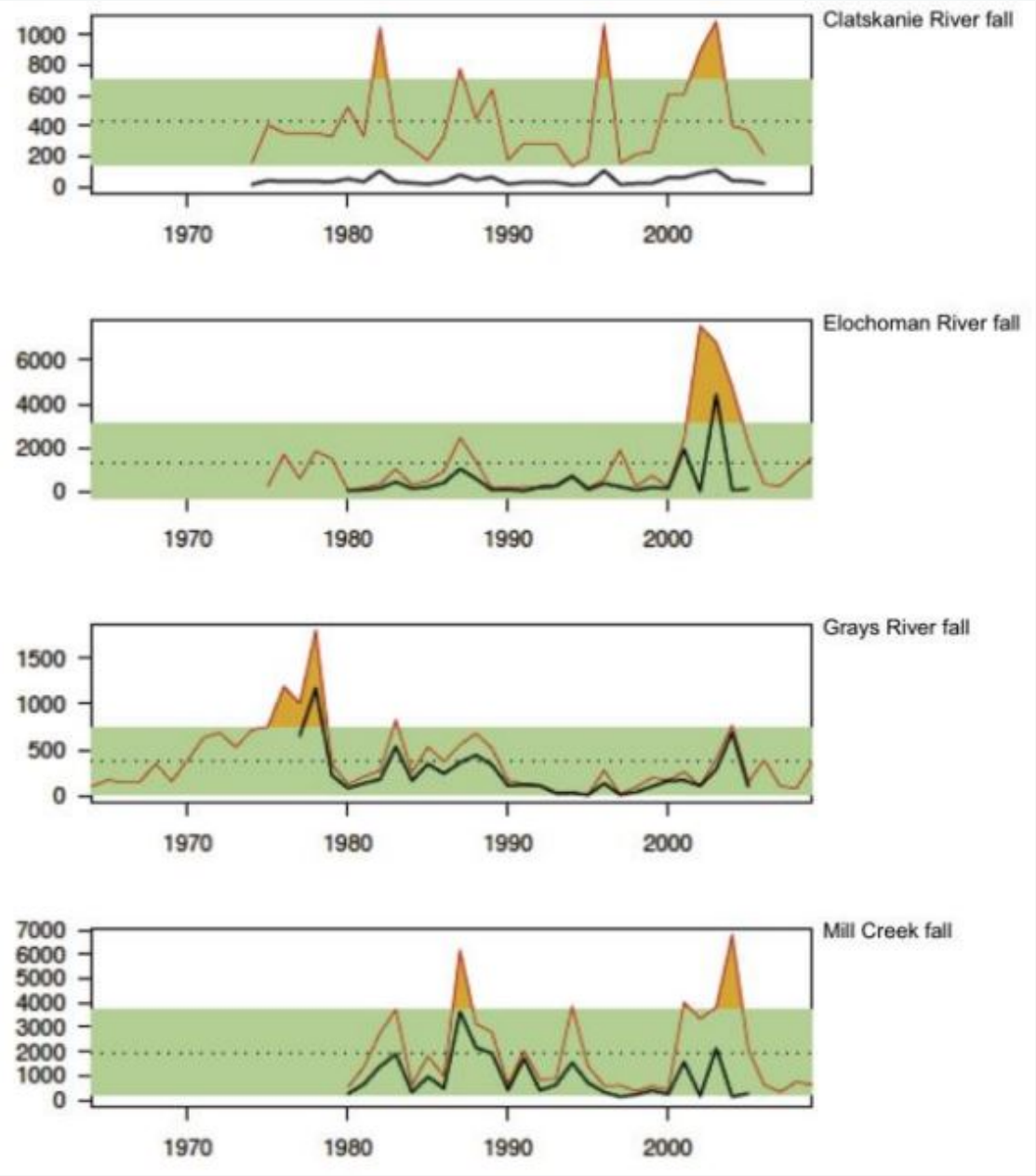


Figure 42: Estimated spawning abundances by year for the Chinook salmon coastal major population group in the Lower Columbia River evolutionarily significant unit. The dark line indicates counts of natural-origin adults, and the orange line indicates counts of adults spawning in natural areas, including naturally spawning hatchery-origin fish. The dotted line is the long-term mean of the total adult counts, and the green shaded area indicates plus or minus one standard deviation around the mean. Figure from Ford et al. 2011.

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

High Concern

ESA (Endangered Species Act)-listed Chinook stocks caught in this fishery include Lower Columbia River (LCR) natural tule Chinook and Snake River wild (SRW) Chinook. The Pacific Fishery Management Council implements ocean fishery regulations to reduce incidental harvest of ESA-listed stocks by restricting ocean harvest of associated indicator stocks. However, exploitation rates can still be substantial; for example, the combined marine and freshwater exploitation rate limit on LCR Chinook is 41%, with about 20% harvested by Council fisheries in 2013 (PFMC 2014a). The population status of listed stocks has not yet improved, presumably due to multiple factors including harvest and availability of suitable spawning habitat. Because depleted populations are subject to to some fishing mortality, and management aimed at maintaining abundances may not be wholly effective, conservation concern was rated "high."

Justification:

Management for Chinook fisheries in this area is guided by the Pacific Fishery Management Council's Pacific Coast Salmon Fishery Management Plan and by Endangered Species Act consultation standards devloped by the National Marine Fisheries Service. The primary management constraint in 2013 for this area was: 1) a combined marine and freshwater exploitation rate limit of 41% for Lower Columbia River (LRC) natural tule Chinook. Council area fisheries were projected to harvest 19.8% of LCR Chinook in 2013 (PFMC 2014a).

Nearly all LCR fall Chinook populations continue to be at risk of extinction (Fig. 29) (NMFS 2011e), and some populations are subjected to potential genetic and ecological impacts associated with large hatchery releases (NMFS 2012c).

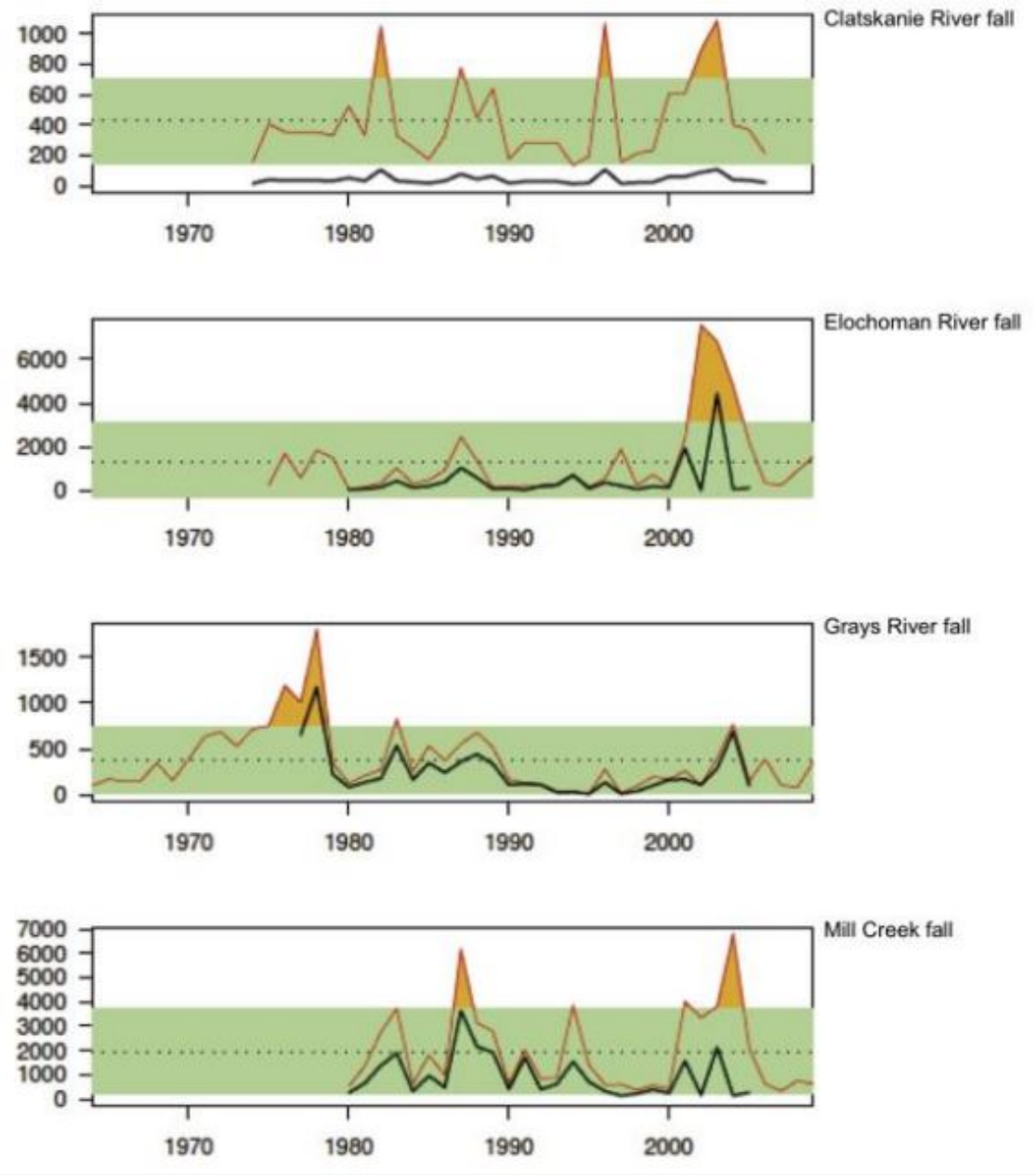


Figure 43: Estimated spawning abundances by year for the Chinook salmon coastal major population group in the Lower Columbia River evolutionarily significant unit. The dark line indicates counts of natural-origin adults, and the orange line indicates counts of adults spawning in natural areas, including naturally spawning hatchery-origin fish. The dotted line is the long-term mean of the total adult counts, and the green shaded area indicates plus or minus one standard deviation around the mean. Figure from Ford et al. 2011.

Numbers of natural-origin SRW Chinook have increased since the stock was listed, but the proportion of hatchery-origin adults has increased dramatically in recent years, making wild stock status somewhat uncertain (NMFS 2011d).

One concern related to exploitation rates is that hatchery stocks and ESA-listed wild stocks are harvested

together in this fishery. The productivity of wild stocks may be lower than that of the hatchery stocks (Winship et al. 2014), and if harvest rates do not account for these productivity differences, the wild stocks can be depleted more rapidly than the hatchery stocks.

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very Low Concern

Fishing mortality on ESA-listed stocks is probably negligible. Summer fisheries have the greatest likelihood of catching ESA-listed Chinook based on migration timing, and a genetic analysis of the 2003 Willapa Bay summer fishery found that 20% of the harvest was of Columbia Basin Chinook stocks, and 9% was of Puget Sound, Oregon Coast, and Northern California Chinook stocks (Kassler and Marshall 2004). In the only Columbia River commercial fishery that catches ESA-listed Lower Columbia River wild (LRW) Chinook, 5% of the 2013 catch was LRW Chinook (Joint Columbia River Management Staff 2014a). Thus, as an example, the catch of ESA-listed Columbia River Chinook may be on the order of 1% (20% x 5%) for Washington coastal summer fisheries. Additionally, the policy document for Grays Harbor Basin salmon management includes objectives for implementation of mark-selective fisheries that release unmarked (natural-origin) fish (WDFW 2014c), and exploitation rates on fall Chinook are limited to 5% when escapements to natural spawning areas are relatively low. Conservation concern regarding fishing mortality was rated "very low."

Justification:

Columbia River stock composition data were obtained from Table 19 in the 2014 Joint Columbia River Management Staff Report (Joint Columbia River Management Staff 2014a). The proportion of ESA-listed stocks was calculated as the LRW Chinook stock catch divided by the total catch for the September/October non-treaty commercial fishery, which was the only fishery that caught LRW Chinook.

Exploitation rates on Chinook stocks are estimated using the Chinook Fishery Regulation Assessment Model (FRAM), which uses data from fish that have been marked using coded wire tags.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

Moderate Concern

ESA-listed Chinook stocks caught in this fishery include California Coastal (CC) Chinook, Lower Columbia River (LCR) natural tule Chinook, and Snake River Wild (SRW) fall Chinook. Salmon fisheries in this area are managed using a weak stock approach, where total harvest is contained to meet management objectives for all stocks, including weak and sometimes ESA-listed stocks. For example, the CC Chinook ESA consultation standard requires a forecast ocean harvest rate on a proxy stock group (age-4 Klamath River fall Chinook) to be no greater than 16%, and there is a combined marine and freshwater exploitation rate limit of 41% for LCR Chinook. The forecast ocean harvest rate on age-4 KRF Chinook was 16% or less from 2001 to 2014, although the post-season harvest rates exceeded 16% in six of these fifteen years (PFMC 2015a). In 2014, a 41% total exploitation rate on LCR natural tules was projected (18% in PFMC-area fisheries) (PFMC 2015b). The ESA-listed stocks caught in this region have shown varying abundance trends, with some populations that

are stable but continuing to be at risk of extinction, and SRW escapements have been high in recent years. Because depleted populations are subject to some fishing mortality, but most stocks are not declining, conservation concern was rated "moderate."

Justification:

California Coastal (CC), Lower Columbia River (LCR) natural tule, and Snake River Wild (SRW) fall Chinook are all listed under the Endangered Species Act as "Threatened." The Pacific Fishery Management Council structured this fishery to meet the following objectives: 1) a combined marine and freshwater exploitation rate limit of 41% for LCR Chinook, 2) at least a 30% reduction in the total ocean age-3 and age-4 exploitation rate from the 1988 to 1993 average, and 3) an Individual Stock-Based Management index at or below 60% of the 1979 to 1982 base period average for select Chinook stocks. Objective 1 was the primary constraint for 2013 fisheries in this area, and Council area fisheries were projected to harvest 19.8% of LCR Chinook in 2013 (PFMC 2014a).

The limited abundance data available for the California Coastal Chinook stock indicate that the population is still at risk of extinction, with temporal trends in abundance being unclear (Fig. 27) (NMFS 2011c).

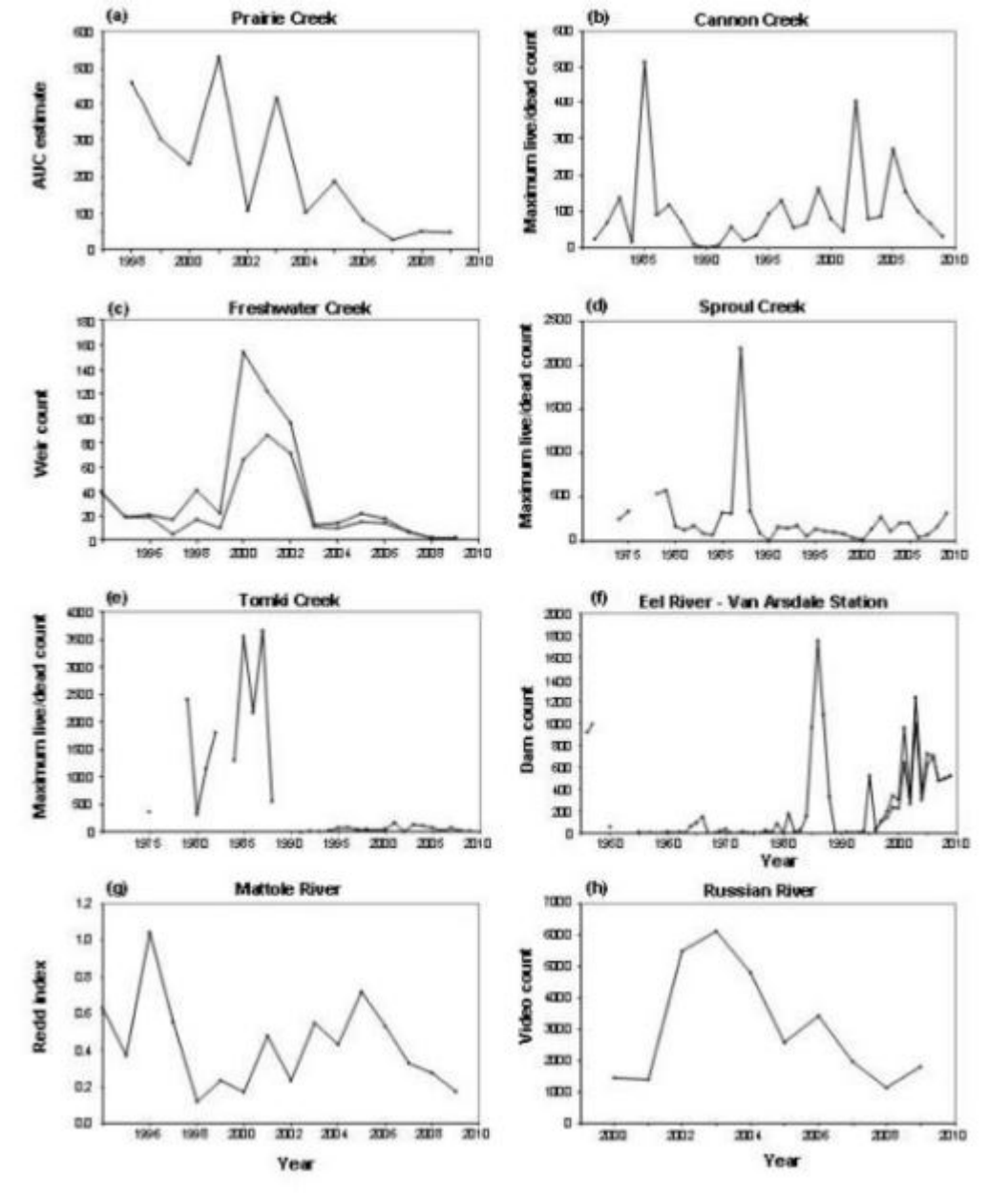


Figure 44: Chinook salmon population estimates, counts, and indices for populations in the California Coastal Chinook Salmon Evolutionarily Significant Unit. From Williams et al. 2011.

Numbers of Snake River Wild fall Chinook have increased since the stock was listed, but the proportion of hatchery-origin adults has increased dramatically in recent years, making wild stock status somewhat uncertain (NMFS 2011d). Nearly all LCR fall Chinook populations continue to be at risk of extinction (NMFS 2011e).

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

High Concern

The Puget Sound troll fishery is limited to the Strait of Juan de Fuca, and harvests are moderate to small. For example, in 2010, only 2,910 Chinook were harvested (WDFW and PSIT 2013). In recent years, annual harvests ranged from 400 to over 20,600 in the winter fishery, and from 100 to 4,500 in the spring/summer fishery.

Limited genetic data indicate Columbia River and Puget Sound Chinook salmon are the primary stocks taken in this fishery, which occurs over multiple seasons. Given that many Chinook returning to Puget Sound (including some hatchery stocks) and the Columbia River are ESA-listed, we assume a portion of the troll catch is on ESA Chinook, though we are not aware of specific estimates. Cumulative harvest rates on these ESA salmon in the fisheries is high, e.g. 56% for brood years 2002 to 2006 (Table 3) (Ford et al. 2011) (PSIT and WDFW 2013). Trends in catch versus predicted catch have been relatively constant (flat) over the past 6 years, indicating catch is meeting pre-season expectations. Long-term annual catch statistics for this fishery were not readily available in reports. However, there is no attempt to reduce mortality on natural fish by live-releasing umarked salmon, even though many Puget Sound populations are not meeting escapement goals for natural-origin fish. Although the NMFS Biological Opinion on the Paciific Salmon Treaty fisheries concludes that the fisheries are achieving recovery exploitation rates and that fisheries would not cause jeopardy to the Puget Sound Chinook ESU, the fisheries are still having a negative impact (NMFS 2008). Therefore, given high harvest rates on an ESA-listed stock and no attempt to live-release ESA salmon, fishing mortality is judged to have a "high" concern.

Justification:

	Mix Mat Fishery		Mature Fishery		Total AEQ ER	
BY	pop range	pop median	pop range	pop median	pop range	pop median
1982-1986	0.36-0.72	0.58	0.02-0.39	0.15	0.44-0.9	0.77
1987-1991	0.29-0.65	0.55	0.01-0.29	0.10	0.39-0.84	0.67
1992-1996	0.22-0.56	0.38	0-0.32	0.04	0.23-0.8	0.43
1997-2001	0.29-0.53	0.45	0.01-0.35	0.09	0.31-0.73	0.51
2002-2006	0.09-0.63	0.42	0.02-0.33	0.16	0.12-0.72	0.56
Trend	-0.12 - +0.02	-0.04	-0.03 - +0.01	-0.01	-0.15 - +0.02	-0.05

Figure 45: Median exploitation rates on 22 Puget Sound Chinook salmon populations (ESA-listed) in fisheries outside Puget Sound, inside Puget Sound, and all fisheries combined.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderate Concern

Puget Sound coho, chum, and sockeye salmon fisheries harvests some Puget Sound ESA-listed Chinook salmon to the extent that these fisheries overlap in time and space with Chinook salmon. Some gillnet fisheries reduce Chinook impacts via live-release after holding the fish in live boxes and by altering time and area of fisheries (WDFW 2013). Management assumes a catch and release mortality rate of 52% for gillnet-caught Chinook (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010). This fishing mortality factor receives a "moderate" conservation concern because the gillnet fisheries take some ESA-listed Chinook salmon, whose status is "Threatened," and natural origin abundance of Chinook has been relatively stable over the past 10 years (Ford et al. 2011).

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderate Concern

Purse seines in Puget Sound typically target the more abundant sockeye, pink and chum salmon rather than Chinook (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW 2013). The non-treaty purse seine fishery live-releases all Chinook salmon after recovery in live boxes in all areas prior to Oct 20, except for the directed fishery in 7B (near Nooksack R). A 33% morality rate is applied to the monitored release. Chinook are often retained in the Treaty fishery. This Factor is judged to be a "moderate" rather than "high" concern because some incidentally caught Chinook are live-released, seiners typically do not target Chinook except in local areas (7B) with high hatchery abundance, and Chinook abundance trends have been somewhat stable over the past 10 years (Ford et al. 2011).

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderate Concern

The five ESA (Endangered Species Act)-listed Chinook stocks that occur in Columbia River fishery management areas are: Upper Columbia spring, Snake River natural fall (SRW), Snake River spring/summer, Lower Columbia River spring/fall, and Upper Willamette spring Chinook. Okanagan Chinook, which are listed as "Threatened" under the Committee on the Status of Endangered Wildlife in Canada, may be encountered as well. Upper Columbia spring Chinook are the most poorly performing stock since they are listed as endangered (NOAA 2014a). To help protect these stocks from further depletion, non-treaty and treaty fisheries are managed to meet harvest rate schedules provided in the US v. Oregon 2008–2017 Management Agreement. The harvest rate limits were met in 2013 (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). However, the population status of listed stocks has not yet improved, because habitat and hydrosystem conditions have not yet improved sufficiently. Although many hatchery-released fish released in the Columbia Basin are marked, and marked fish are recorded at Bonneville Dam, hatchery- and natural-origin fish are managed together as composite stocks (i.e., they are managed as one stock). Because depleted populations are subject to some fishing mortality, but there is management aimed at maintaining abundances, conservation concern was rated "moderate."

Justification:

Upper Columbia River spring Chinook are harvested by treaty Indian fisheries as part of the ceremonies and subsistence (C&S) entitlement to 10,000 spring and summer Chinook, which does not include tributary

harvests. The majority of the entitlement is often taken in treaty Indian fisheries during the winter and spring management periods (January 1 through June 15). The harvest rate limit for spring Chinook is determined by either the Upper Columbia River spring/summer Chinook run size or the Snake River natural spring/summer Chinook run size, depending on whether the forecasted run size for the Snake River stock is more or less than 10% of the total Upper Columbia River run size (Joint Columbia River Management Staff 2014b).

Three populations are monitored in the Upper Columbia spring Chinook evolutionarily significant unit: Wentachee River, Entiat River, and Methow River. Population abundances for natural-origin adults have been quite low in recent years (Fig. 26), but hatchery-produced fish contribute to abundances in natural spawning areas (Ford et al. 2011).

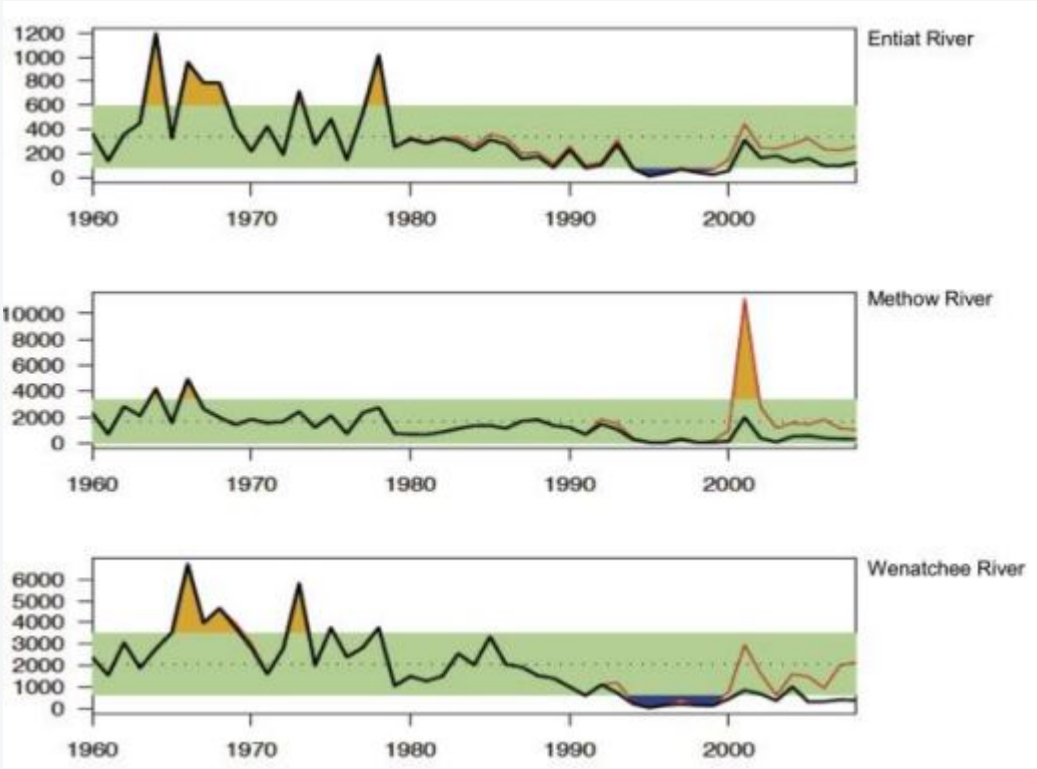


Figure 46: Estimated spawning abundances by year for the Upper Columbia River spring Chinook evolutionarily significant unit. The dark line indicates counts of natural-origin adults, and the orange line indicates counts of adults spawning in natural areas, including naturally spawning hatchery-origin fish. The dotted line is the long-term mean of the total adult counts, and the green shaded area indicates plus or minus one standard deviation around the mean. Figure from Ford et al. 2011.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

< 20%

The large majority of discards in the commercial troll fisheries are non-target salmon. Across all Pacific Fishery Management Council ocean commercial troll fisheries, the 2013 estimated bycatch mortality for Chinook salmon was 77,100 fish, and the catch was 500,100 fish (PFMC 2014b). For coho salmon, estimated bycatch mortality was 19,400 fish, and the catch was 54,200 fish (PFMC 2014b). The ratio of dead discards to landings across both species was therefore 17.4%.

Justification:

The total hook and release mortality rate used for both Chinook and coho in commercial troll fisheries is 26% (PFMC 2014a). Management also considers drop-off mortality for both Chinook and coho salmon as follows: 5% of total encounters south of Cape Falcon and 5% of legal encounters north of Cape Falcon (PFMC 2014b). These estimated drop-off mortality rates include predation on hooked fish. Projected and estimated bycatch mortality of salmon is reported for each management area each year (separated by fishery: Treaty Indian troll, Non-Indian commercial troll, and recreational). Some bycatch estimates are based on reported releases of fish.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

There are mark-selective commercial gillnet fisheries (releasing unmarked, wild-origin fish) for coho salmon in Grays Harbor and for Chinook salmon in Willapa Bay (PSC 2013a). In the 2012 Chinook fishery, there were an estimated 585 incidental mortalities and a total of of 29,232 fish landed (PSC 2013b). Washington coastal tribal fisheries retain all salmon caught. Thus, overall discard mortality was less than 20%.

Justification:

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in

area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

< 20%

Columbia River tangle net fisheries below Bonneville Dam are mark-selective (releasing unmarked, wild-origin fish), which utilize recovery boxes to allow fish to recover before being released. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

Factor 2.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for coho salmon is 53, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Coho salmon have "medium" vulnerability because they are widely distributed but occur in somewhat small and isolated populations.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

Very High Concern

ESA (Endangered Species Act)-listed coho salmon caught in this area include Lower Columbia River natural (LCN), Central California Coast (CCC), Southern Oregon/Northern California Coast (SONCC), and Oregon Coast Natural (OCN) coho. LCN, OCN, and SONCC coho are listed as "Threatened," while CCC coho are listed as "Endangered" (NOAA 2014a). Because these stocks are ESA-listed, conservation concern was rated "very high."

Justification:

The Oregon Coast Natural (OCN) coho evolutionarily significant unit includes salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco, and also coho salmon from the Cow Creek Hatchery Program. OCN escapements have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (PFMC 2014a). Central California Coast coho includes naturally spawned coho originating from rivers south of Punta Gorda, California to and including Aptos Creek, coho originating from tributaries to San Francisco Bay, and coho from three artificial propagation programs. Southern Oregon/Northern California Coast coho includes naturally spawned coho originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California, and coho from three artificial propagation programs. Lower Columbia River natural coho includes naturally spawned coho originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood rivers (inclusive), coho originating from the Willamette River and its tributaries below Willamette Falls, and coho from 21 artificial propagation programs.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

Very High Concern

ESA (Endangered Species Act)-listed coho salmon caught in this area include Central California Coast, Southern Oregon/Northern California Coast, and Oregon Coast Natural (OCN) coho. Oregon Coast Natural and Southern Oregon/Northern California Coast coho are listed as "Threatened," while Central California Coast coho are listed as "Endangered" (NOAA 2014a). Because these stocks are ESA-listed, conservation concern was rated "very high."

Justification:

The Oregon Coast Natural (OCN) coho evolutionarily significant unit includes salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco, and also coho salmon from the Cow Creek Hatchery Program. OCN escapements have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (PFMC 2014a). Central California Coast coho includes naturally spawned coho originating from rivers south of Punta Gorda, California to and including Aptos Creek, coho originating from tributaries to San Francisco Bay, and coho from three artificial propagation programs. Southern Oregon/Northern California Coast coho includes naturally spawned coho originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California, and coho from three artificial propagation programs.

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Very High Concern

ESA (Endangered Species Act)-listed coho salmon caught in this area include Lower Columbia River natural (LCN) and Oregon Coast Natural (OCN) coho. Both LCN and OCN coho are listed as "Threatened" (NOAA 2014a). Interior Fraser River coho, which are listed as "Endangered" under Canada's Species at Risk Act, may also be intercepted (PSC 2013c). Because these stocks are considered depleted, conservation concern was rated "very high."

Justification:

The Oregon Coast Natural (OCN) coho evolutionarily significant unit includes salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco, and also coho salmon from the Cow Creek Hatchery Program. OCN escapements have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (PFMC 2014a). Lower Columbia River natural coho includes naturally spawned coho originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood rivers (inclusive), coho originating from the Willamette River and its tributaries below Willamette Falls, and coho from 21 artificial propagation programs. Interior Fraser River coho spawn in the the Fraser River watershed in Canada. Based on reconstructed escapements for naturally produced fish, the short-term escapement target of 20,000 fish has been exceeded every year since 2008, and the long-term target of 40,000 was exceeded in 2012 and 2013 (CSAS 2014).

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Very High Concern

Coho salmon caught in this area are managed as a mixture of stocks termed the Oregon Production Index (OPI), which includes all Washington, Oregon, and California natural and hatchery stocks originating from streams south of Leadbetter Point, Washington. Some stocks produced north of Leadbetter point are intercepted also (PFMC 2011). The largest naturally produced coho stock is the Oregon Coast Natural (OCN) stock. OCN and two other stocks (Lower Columbia Natural coho and Southern Oregon/Northern California Coast coho) in the OPI area are all listed as "Threatened" under the Endangered Species Act (ESA) (NOAA 2014a). Because the major natural coho stocks are ESA-listed, conservation concern was rated "very high."

Justification:

The OCN coho evolutionarily significant unit includes salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco, and also coho salmon from the Cow Creek Hatchery Program. OCN escapements have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (PFMC 2014a). Southern Oregon/Northern California Coast coho includes naturally spawned coho originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California, and coho from three artificial propagation programs. Lower Columbia River natural coho includes naturally spawned coho originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood rivers (inclusive), coho originating from the Willamette River and its tributaries below Willamette Falls, and coho from 21 artificial propagation programs.

UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Very High Concern

Klamath River coho are part of the Southern Oregon/Northern California Coastal (SONCC) classified as

"Threatened" under the Endangered Species Act (ESA) (NOAA 2014a). Therefore the conservation concern was deemed “very high."

Justification:

Klamath River coho are part of the Southern Oregon/Northern California Coastal (SONCC) that was classified as "Threatened" under the ESA in 1997 (NOAA 2014b). Long-term data on SONCC coho abundance are scarce, but the available evidence from limited monitoring efforts indicates that populations continued to decline between 2005 and 2010 (NOAA 2011f). Coho salmon are released at two hatcheries in the Klamath Basin, but hatchery and wild components are managed together.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very High Concern

The Interior Fraser River population of coho salmon was determined to be "Endangered" by COSEWIC in 2002, and this status continues to the present ((COSEWIC 2014) (Decker et al. 2014)). Interior Fraser River coho are captured in Puget Sound salmon fisheries. Escapement of interior coho declined sharply from the late 1980s to mid-1990s; escapement has improved since 2010, and escapement during 2012 and 2013 appears to have exceeded the long-term objective (i.e., 20,000 spawners). Although there are some indications of increasing escapement, the abundance of Interior Fraser coho salmon is judged to be a "very high" conservation concern because it remains an endangered species.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Very High Concern

Wild coho populations were largely extirpated from Columbia River tributaries by the 1930s (Joint Columbia River Management Staff 2014a). The only remaining natural stock is Lower Columbia River coho, which is listed under the Endangered Species Act as "Threatened" (NOAA 2014a). The Lower Columbia River coho evolutionarily significant unit (ESU) includes both naturally spawned and hatchery produced fish, with the large majority being hatchery produced. Management does not differentiate between natural and hatchery-origin fish when determining whether escapement goals are met, but efforts are being made to monitor proportions of hatchery fish in some Columbia River tributaries. Because this stock is listed as "Threatened," conservation concern was deemed "very high."

Justification:

The Lower Columbia River coho ESU includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood Rivers (inclusive), and from the Willamette River and its tributaries below Willamette Falls. Coho produced in 21 artificial propagation

programs are included as well. Unmarked, naturally-produced coho have also been returning to the Columbia River system in increasing numbers since 2000, but they are of unknown origin (Joint Columbia River Management Staff 2014a).

One positive management development is that the Yakama Nation has re-introduced coho to the Yakima, Wenatchee, and Methow River basins (Bonneville Power Administration et al. 2012). These fish are not marked because they are attempting to rebuild the stocks, and some fisheries target marked fish.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER

Very Low Concern

ESA (Endangered Species Act)-listed coho stocks caught in this fishery include Central California Coast (CCC), Oregon Coast Natural (OCN), Southern Oregon/Northern California Coast (SONCC), and Lower Columbia River natural (LCN) coho. Commercial troll fisheries south of Cape Falcon have not been allowed to retain coho salmon since 1993, with the exception of limited fisheries in 2007 and 2009 that were not selective for marked hatchery fish (PFMC 2008b). However, some bycatch mortality occurs; in 2013, observed bycatch mortality from commercial troll fisheries south of Cape Falcon was 8,700 fish (PFMC 2014b). Estimated exploitation rates on OCN coho were under management-determined rate limits in 93% of the past fifteen years (1999 to 2013), and LCN coho exploitation rates were under limits in 78% of the years from 2005 to 2013 (PFMC 2014a). Ocean exploitation rates on CCC coho are not monitored but are thought to be comparable to exploitation rates on Rogue and Klamath River hatchery coho, which ranged from about 1 to 10% from 2000 to 2010 (NFMS 2011c). Because it is highly likely that fishing mortality is at or below a sustainable level that will maintain current population abundances, conservation concern regarding fishery mortality was deemed "very low."

Justification:

Post-season estimates of exploitation rates on Oregon Coast Natural coho are obtained from the Pacific Fishery Management Council's Fishery Regulation Assessment (FRAM) model. These estimates are for exploitation from all fisheries (commercial and recreational) and are based on estimated discard mortality (PFMC 2008).

Escapement data for Oregon Coast Natural coho suggests that spawner abundances have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (Fig. 30) (PFMC 2014a). Escapement counts include hatchery-origin salmon produced at Cow Creek Hatchery.

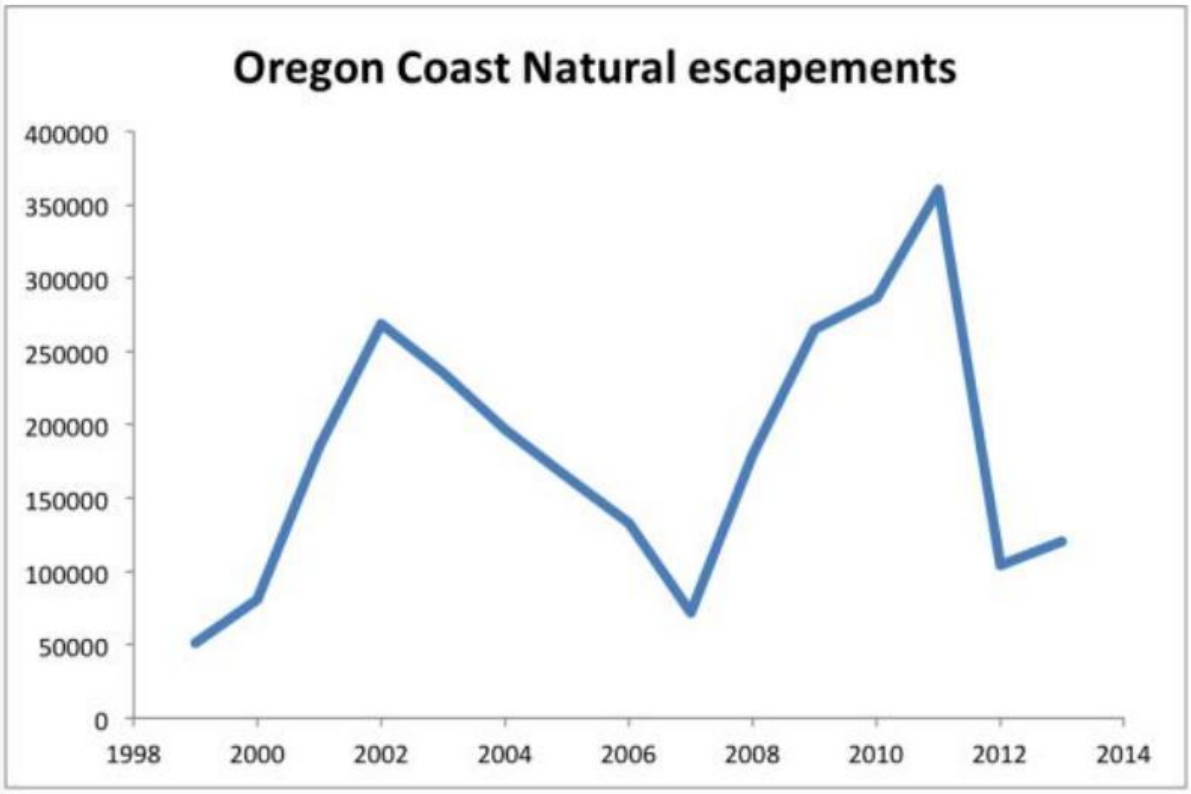


Figure 47 1: Oregon Coast Natural coho escapements (blue line). The escapement counts are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.

Very Low Concern

ESA (Endangered Species Act)-listed coho stocks caught in this fishery include Central California Coast (CCC), Oregon Coast Natural (OCN), and Southern Oregon/Northern California Coast (SONCC) coho. Commercial troll fisheries south of Cape Falcon have not been allowed to retain coho salmon since 1993, with the exception of limited fisheries in 2007 and 2009 that were not selective for marked hatchery fish (PFMC 2008b). In other words, coho retention is entirely prohibited in California ocean salmon fisheries, although some bycatch mortality occurs. In 2013, observed bycatch mortality from commercial troll fisheries south of Cape Falcon was 8,700 fish (PFMC 2014b). Estimated exploitation rates on OCN coho were under management-determined rate limits in 93% of the past fifteen years (1999-2013). Ocean exploitation rates on CCC coho are not monitored but are thought to be comparable to exploitation rates on Rogue and Klamath River hatchery coho, which ranged from about 1 to 10% from 2000 to 2010 (NFMS 2011c). Because coho retentian is prohibited in this area, it is highly likely that fishing mortality is at or below a sustainable level that will maintain current population abundances, and conservation concern regarding fishery mortality was deemed 'Very Low.'

Justification:

Postseason estimates of exploitation rates on Oregon Coast Natural coho are obtained from the Pacific Fishery Management Council's Fishery Regulation Assessment (FRAM) model. These estimates are for exploitation

from all fisheries (commercial and recreational) and are based on estimated discard mortality (PFMC 2008).

Escapement data for Oregon Coast Natural coho suggests that spawner abundances have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (Fig. 30)(PFMC 2014a). Escapement counts include hatchery-origin salmon produced at Cow Creek Hatchery.

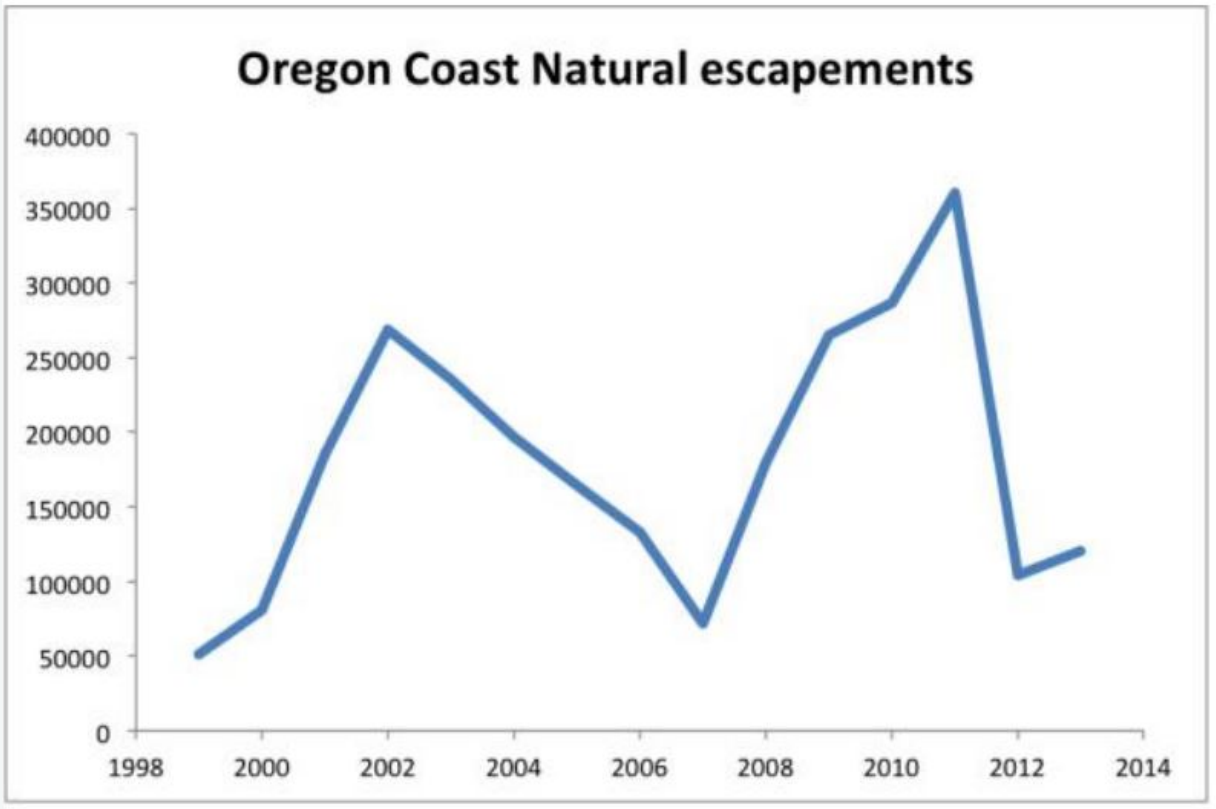


Figure 48 : Oregon Coast Natural coho escapements (blue line). The escapement counts are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Moderate Concern

ESA (Endangered Species Act)-listed coho stocks caught in this fishery include Lower Columbia River natural (LCN) and Oregon Coast Natural (OCN) coho. Interior Fraser River coho, which are listed as "Endangered" under Canada's Species at Risk Act, are also intercepted. Estimated exploitation rates on Oregon Coast natural coho were under management-determined rate limits in 93% of the past fifteen years (1999 to 2013), and Lower Columbia natural coho exploitation rates were under limits in 78% of the years from 2005 to 2013 (PFMC 2014a). The 2013 exploitation rate on Interior Fraser River coho from US fisheries was under the limit mandated by the Pacific Salmon Commission (PFMC 2014b). However, coho (potentially including natural-

origin fish from ESA-listed stocks) can be retained in ocean fisheries north of Cape Falcon, whereas fisheries south of Cape Falcon prohibit retention. Because depleted populations are subject to some fishing mortality, but there is management aimed at maintaining abundances, conservation concern was rated "moderate."

Justification:

Non-Indian commercial troll fisheries from Cape Falcon to the US/Canada border had an overall quota of 14,220 coho in 2013, and fishers were only allowed to retain coho with marks indicating that the fish originated from hatcheries. Treaty Indian fisheries north of Cape Falcon targeting all salmon species had a 2013 quota of 47,500 coho, and they were not restricted to retaining only marked coho (PFMC 2014a). Under the Pacific Salmon Treaty Southern Coho Management Plan for the United States (US) and Canada, US fisheries have been limited to a 10% exploitation rate on Interior Fraser coho. Interior Fraser coho include Upper Fraser and Thompson River coho.

Post-season estimates of exploitation rates on Oregon Coast Natural and Lower Columbia River natural coho are obtained from the Pacific Fishery Management Council's Fishery Regulation Assessment (FRAM) model. These estimates are for exploitation from all fisheries (commercial and recreational) and are based on estimated discard mortality (PFMC 2008).

Escapement data for Oregon Coast Natural coho suggests that spawner abundances have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (Fig. 30) (PFMC 2014a). Escapement counts include hatchery-origin salmon produced at Cow Creek Hatchery.

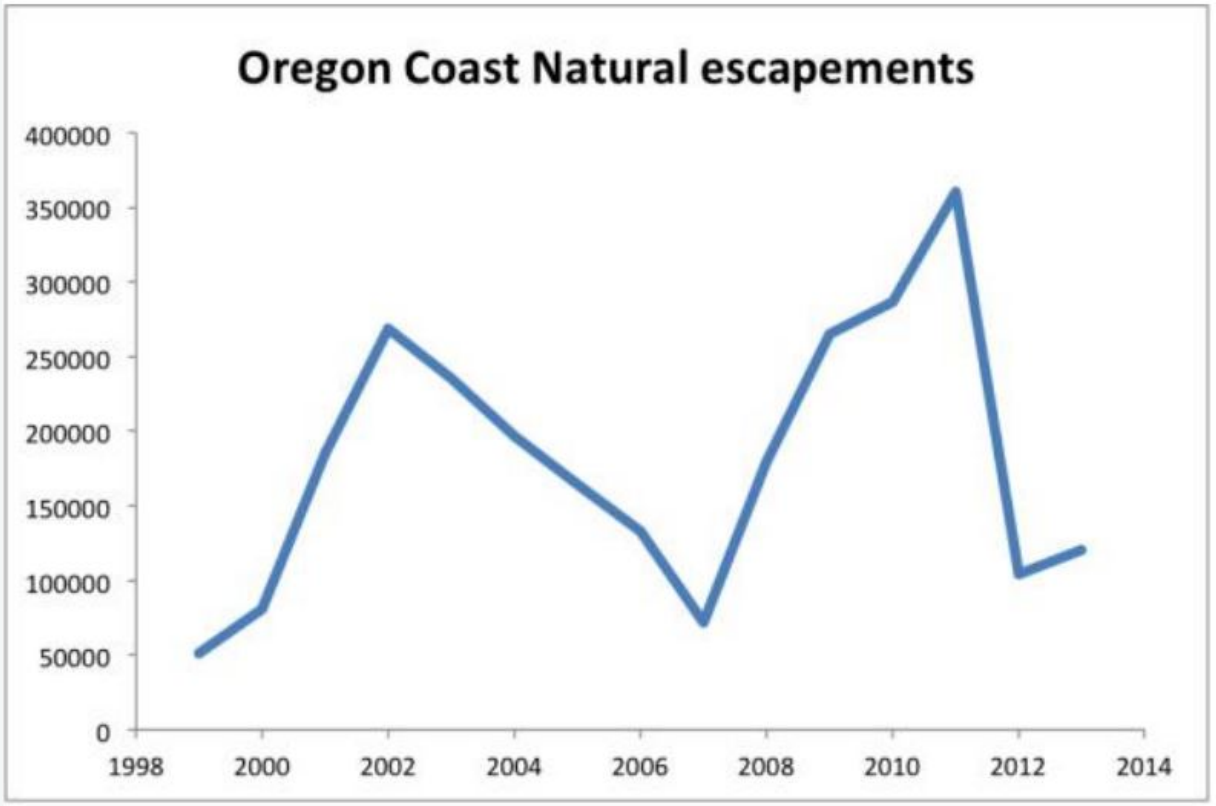


Figure 49 : Oregon Coast Natural coho escapements (blue line). The escapement counts are for fish spawning

in natural areas but may include both hatchery and natural-origin fish.

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Very Low Concern

ESA (Endangered Species Act)-listed coho stocks caught in this fishery include Oregon Coast Natural (OCN), Southern Oregon/Northern California Coast (SONCC), and Lower Columbia Natural (LCN) coho. Commercial troll fisheries south of Cape Falcon have not been allowed to retain coho salmon since 1993, with the exception of limited fisheries in 2007 and 2009 that were not selective for marked hatchery fish (PFMC 2008b). However, some bycatch mortality occurs. In 2013, observed bycatch mortality from commercial troll fisheries south of Cape Falcon was 8,700 fish (PFMC 2014b). Estimated exploitation rates on OCN coho were under management-determined rate limits in 93% of the past fifteen years (1999-2013), and LCN coho exploitation rates were under limits in 78% of the years from 2005 to 2013 (PFMC 2014a). Because it is highly likely that fishing mortality is at or below a sustainable level that will maintain current population abundances, conservation concern regarding fishery mortality was deemed 'Very Low.'

Justification:

Postseason estimates of exploitation rates on Oregon Coast Natural coho are obtained from the Pacific Fishery Management Council's Fishery Regulation Assessment (FRAM) model. These estimates are for exploitation from all fisheries (commercial and recreational) and are based on estimated discard mortality (PFMC 2008a).

Escapement data for Oregon Coast Natural coho suggests that spawner abundances have fluctuated over the past fifteen years (1999 to 2013), with relatively low counts in 2012 and 2013 (Fig. 30)(PFMC 2014a). Escapement counts include hatchery-origin salmon produced at Cow Creek Hatchery.

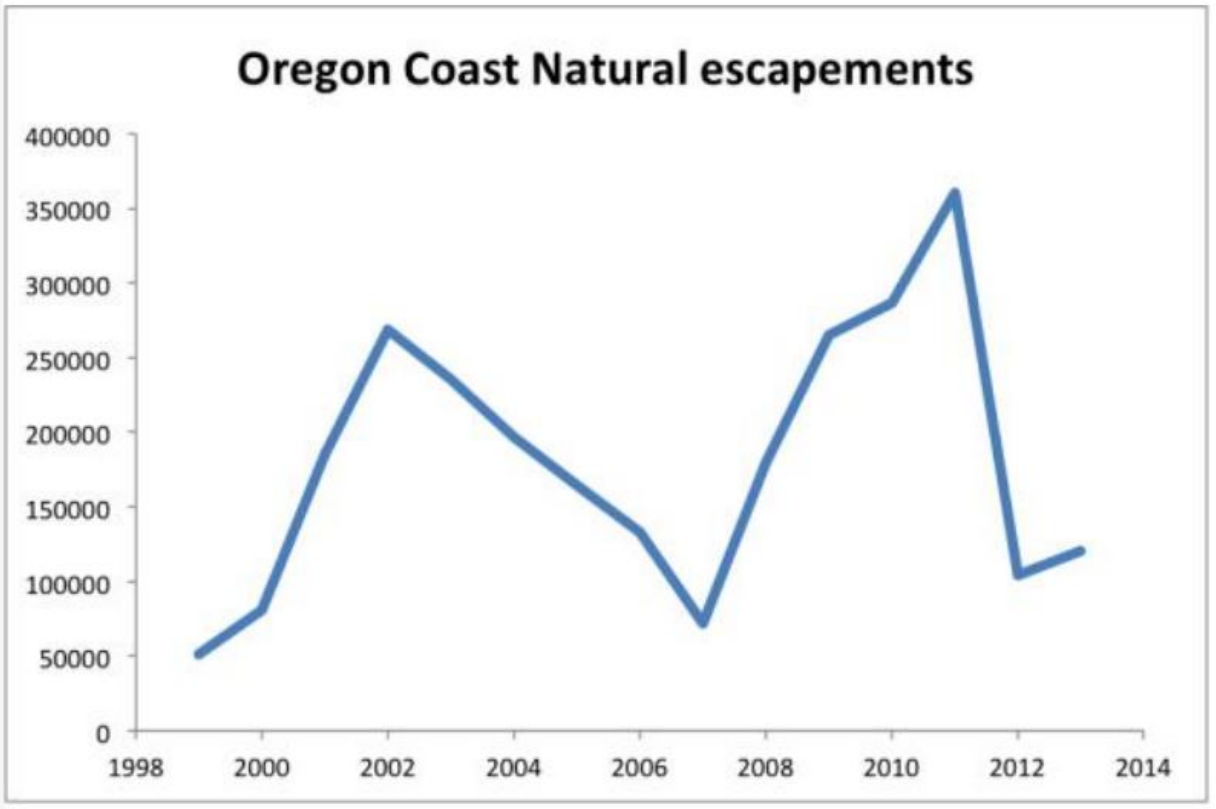


Figure 50: Oregon Coast Natural coho escapements (blue line). The escapement counts are for fish spawning in natural areas but may include both hatchery and natural-origin fish.

UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderate Concern

Coho salmon are caught incidentally in the Klamath tribal gillnet fishery targeting Chinook salmon. The primary ESA (Endangered Species Act)-listed coho stock that may be encountered in this area is Southern Oregon/Northern California Coast (SONCC) coho. Commercial fishers are prohibited from selling coho salmon, and regulations are designed to reduce incidental catches. Total fishing mortality (either retained for subsistence use, or catch and release mortality) on SONCC coho in the commercial fishery may be on the order of 5% based on reported Yurok fishery exploitation rates on Klamath coho. During the most recent SONCC status review, the available spawning information indicated that SONCC coho populations were declining (NOAA 2011f). Because the fishery contribution to mortality is unknown and the population is depleted, fishing mortality is considered a "moderate" conservation concern.

Justification:

Commercial fishers are prohibited from selling coho salmon and are required to physically attend the gear to allow for efficient release of non-target species. In addition, the number of days per week the fishery is open is reduced during the coho migration to reduce fishing impacts (Yurok Tribal Council 2013). Coho salmon may be retained for subsistence and ceremonial purposes. Total Yurok fishery harvest rates on Klamath coho averaged 4% from 1992 to 2005 and 5% from 2006 to 2009, but harvest rates for the other two Klamath basin tribal fisheries were not provided (NOAA 2011f). For the non-tribal commercial fishery, forecasted

exploitation rates on Rogue/Klamath coho are the best available measure of the ocean exploitation rate on Southern Oregon/Northern California Coast coho. The exploitation rate averaged 3% from 2000 to 2009. Despite the low harvest rates, available spawning information led the National Marine Fisheries Service to conclude that abundance of coho salmon had decreased for many populations in the ESU since the last status review (NOAA 2011f).

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderate Concern

Interior Fraser coho are taken as bycatch in Puget Sound salmon fisheries ((PSC 2013c) (Decker et al. 2014)). Modeled total exploitation rate averaged 11% during 2005 to 2009, of which 2.9% occurred in Canadian fisheries (i.e., within the goal of 3% or less) and 8.1% occurred in US fisheries. Exploitation occurs in fisheries along the Washington coast (troll) and the San Juan Islands (net). Fishing mortality on Interior Fraser coho salmon in Puget Sound fisheries is judged to be a "moderate" concern because the exploitation rate in Puget Sound has remained relatively stable over time, yet about 75% of total mortality occurs in the US versus BC fisheries.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Moderate Concern

The only major Columbia River coho stock is Lower Columbia River natural (LCN) coho, which is listed under the Endangered Species Act but harvested in fall Columbia gillnet fisheries. Lower Columbia River coho escapements do not appear to be declining, and estimated wild abundance was especially high in 2014 (see Fig. 19 in Detailed Rationale). Under the US versus Oregon 2008–2017 Management Agreement, fishery exploitation rates on specific stocks (including LCN coho) are managed using harvest rate schedules, where harvest limits are determined each year based on in-season monitoring of salmon abundances. For LCN coho these limits have ranged from 8 to 20%, and estimated exploitation rates on LCN coho did not exceed limits in 78% of the years from 2005 to 2013 (PFMC 2014a). Starting in 2015, a new harvest matrix that considers parameters of ocean survival and parental escapement has been used. The new matrix is designed to concentrate fishing in the 18 to 23% range while allowing for exploitation rates up to 30% when marine survival is very high; at the same time, exploitation rates are supposed to be lowered in years when levels of artificial juvenile seeding is low (< 30% of full seeding) (PFMC 2014f). This change may make harvest limits more responsive to stock status information, but the target exploitation rates do not appear more conservative than they have been since the ESA-listing of LCN coho. Additionally, fishing mortality is estimated on hatchery- and natural-origin fish combined, so there is some uncertainty regarding fishing mortality levels on the wild stock component. Conservation concern was rated "moderate" concern.

Justification:

Columbia River salmon fisheries are complex, spanning essentially all seasons (fall, summer, winter, spring), including multiple components (e.g., commercial and recreational, treaty and non-treaty), and catching both hatchery and non-hatchery stocks, many of which are listed under the Endangered Species Act. Hatcheries in the lower Columbia River mark the coho they produce. Columbia River treaty gillnet fisheries do not selectively harvest marked hatchery salmon, but Select Area commercial fisheries target hatchery-produced fish in off-channel areas, sometimes using tangle net gear and recovery boxes in more recent years (Joint Columbia River Management Staff 2015b).

The allowable exploitation rate on LCN coho is for ocean and non-tribal Columbia River fisheries (downstream of Bonneville Dam) combined. The allocation of non-Indian catch and ESA impacts between ocean and in-river fisheries is determined annually by the states and occurs during the Pacific Fishery Management Council and North of Falcon meetings (Joint Columbia River Management Staff 2015b).

According to run reconstructions conducted by the Oregon Production Index Technical Team, wild LCN coho abundances have been stable and showed a large increase in 2014 (Fig. 19) (ODFW 2015a). Exploitation rates on this stock are estimated using the Coho Fishery Regulation Assessment Model (FRAM), which uses data from fish that have been marked using coded wire tags.

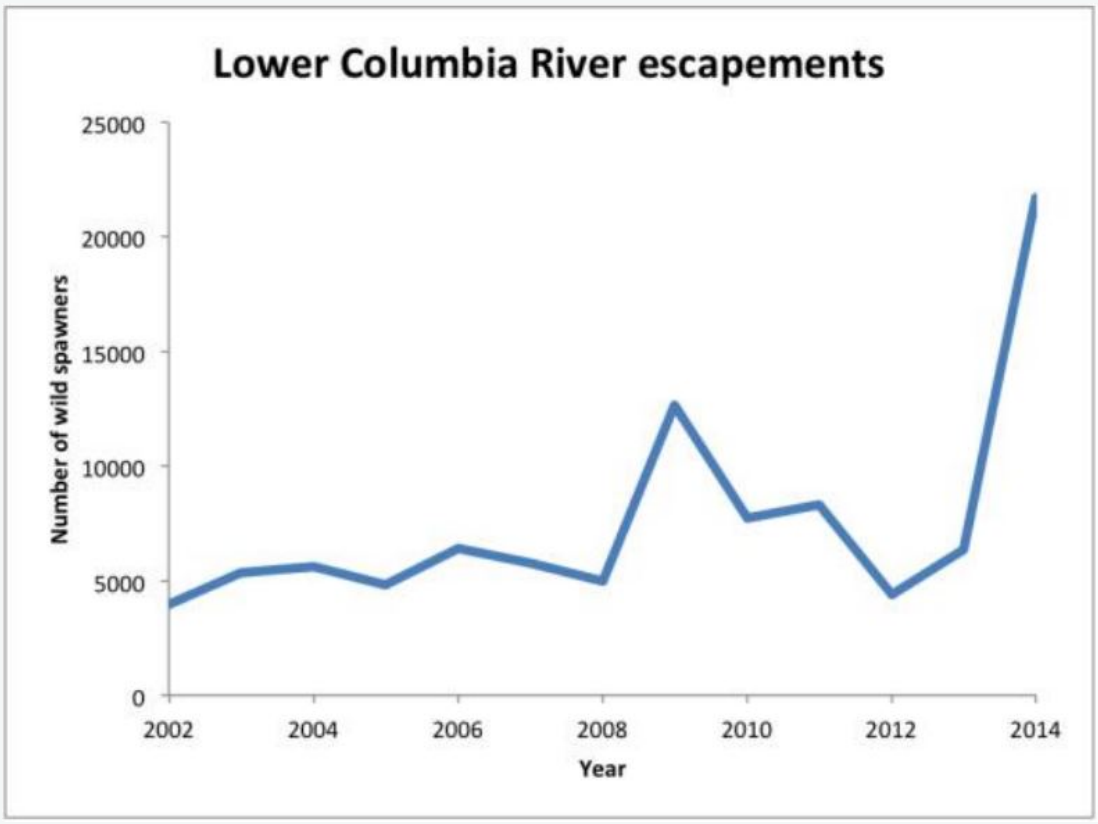


Figure 51: Estimated numbers of wild coho spawners (blue line) for the Oregon portion of the Lower Columbia River coho ESU. Data from Oregon Production Index Technical Team run reconstructions.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA/NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

< 20%

The large majority of discards in the commercial troll fisheries are non-target salmon. Across all Pacific Fishery Management Council ocean commercial troll fisheries, the 2013 estimated bycatch mortality for Chinook salmon was 77,100 fish, and the catch was 500,100 fish (PFMC 2014b). For coho salmon, estimated bycatch mortality was 19,400 fish, and the catch was 54,200 fish (PFMC 2014b). The ratio of dead discards to landings across both species was therefore 17.4%.

Justification:

The total hook and release mortality rate used for both Chinook and coho in commercial troll fisheries is 26% (PFMC 2014a). Management also considers drop-off mortality for both Chinook and coho salmon as follows: 5% of total encounters south of Cape Falcon and 5% of legal encounters north of Cape Falcon (PFMC 2014b). These estimated drop-off mortality rates include predation on hooked fish. Projected and estimated bycatch mortality of salmon is reported for each management area each year (separated by fishery: Treaty Indian troll, Non-Indian commercial troll, and recreational). Some bycatch estimates are based on reported releases of fish.

UNITED STATES OF AMERICA/KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

< 20%

Fish that are caught and not sold in the Klamath tribal fishery are typically retained for subsistence or ceremonial purposes. In 2004 an estimated 21,109 Chinook salmon, 1,289 coho salmon, 217 steelhead and 14 green sturgeon were harvested in the Klamath estuary where commercial fishing is allowed (Williams 2007). The harvest of non-Chinook species represented 6.8% of the total landings. The Klamath tribal fishery is considered a full-retention fishery so there is very little, if any, discard mortality.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

SOCKEYE SALMON / MINOR STOCK

Factor 2.1 - Inherent Vulnerability

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Low

The FishBase vulnerability score for sockeye salmon is 32, making inherent vulnerability "low." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Sockeye salmon have "low" vulnerability because they have high diversity in life history traits.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Very High Concern

The Snake River sockeye stock is extremely depleted and is listed as "Endangered" under the Endangered Species Act (NOAA 2014a). Because this stock is ESA-listed, conservation concern was rated "very high."

Justification:

Production of Snake River sockeye is maintained through a captive brood program, and most returning adults are progeny of this program. The Snake River stock was federally-listed as "Endangered" in November 1991.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very High Concern

Fraser sockeye salmon is the primary stock targeted by the Puget Sound sockeye fishery. Fraser sockeye salmon consists of many populations, but it is managed according to four migration timing groups; spawning escapements are monitored on about 18 populations. Although the major stocks have been relatively abundant (Fraser River Panel 2012), some smaller stocks have been depressed (CSAS 2013). For example, the Cultus population was classified as "Endangered" by COSEWIC (Committee on the Status of Endangered Wildlife in Canada), leading to actions to reduce harvest rates to some extent (FMP document). Cultus sockeye abundance and other small Fraser populations are judged to have a "very high" conservation concern regarding abundance. Very few, if any, Ozette Lake sockeye (listed under the Endangered Species Act as "Threatened") are likely to be captured by this fishery.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Low Concern

Snake River sockeye are an ESA-listed stock caught in this fishery. To help protect Snake River sockeye, tribal commercial fisheries are limited to harvesting 5 to 7% of the run, with the allowable harvest rate depending on sockeye run size, and non-tribal commercial fisheries are limited to harvesting 1% of the run (Joint Columbia River Management Staff 2014b). The 1% harvest allowance for non-tribal commercial fisheries is essentially incidental catch; there is no targeted non-tribal commercial fishery on Snake River sockeye. Abundances are monitored at Lower Granite Dam and appear to have increased since 2008, presumably due in part to hatchery supplementation. Because fishing mortality is probably at a sustainable level, conservation concern was rated "low."

Justification:

Adult returns are monitored at Lower Granite Dam on the lower Snake River, and data suggest that abundances have been relatively high since 2008 (Fig. 31) (NMFS 2011d).

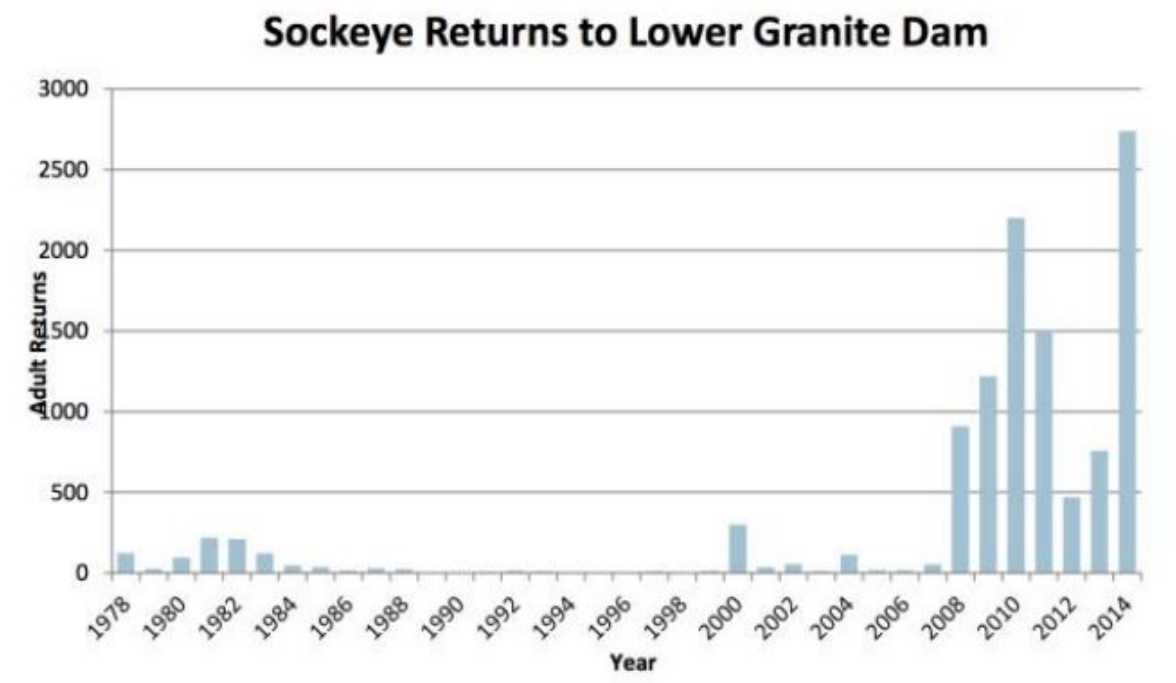


Figure 52: Returns of sockeye salmon to Lower Granite Dam in the Columbia River basin. Figure from www.salmonrecovery.gov.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Very Low Concern

Very few weak stock and ESA-listed sockeye are taken in the troll fishery, which is directed at coho and Chinook.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderate Concern

Cultus Lake sockeye and other small, depressed sockeye populations are harvested along with the more abundant Fraser sockeye populations in the Puget Sound sockeye fishery. These populations have declined even though total spawning escapement of sockeye salmon to the Fraser River has increased over the past 20 years (Connors et al. 2010) (CSAS 2013). Management is attempting to balance the need to conserve these populations while also allowing harvest of the abundant populations. Accordingly, the maximum allowable exploitation rate for Cultus Lake Sockeye is "the greater of a) the low abundance exploitation rate identified

for Late Run Sockeye, or b) the exploitation rate that is consistent with continued rebuilding of the population based on in-season information on returns and potential numbers of effective spawners" (DFO 2013a) (Fraser River Panel 2012). Management has taken some action to reduce harvests on Cultus sockeye, and fishing mortality is judged to have a "moderate" conservation concern. Very few, if any, Ozette Lake sockeye (ESA "Threatened") are likely to be captured by this fishery

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Moderate Concern

Cultus Lake sockeye and other small, depressed sockeye populations are harvested along with the more abundant Fraser sockeye populations in the Puget Sound sockeye fishery. These populations have declined even though total spawning escapement of sockeye salmon to the Fraser River has increased over the past 20 years (Connors et al. 2010) (CSAS 2013). Management is attempting to balance the need to conserve these populations while also allowing harvest of the abundant populations. Accordingly, the maximum allowable exploitation rate for Cultus Lake Sockeye is "the greater of a) the low abundance exploitation rate identified for Late Run Sockeye, or b) the exploitation rate that is consistent with continued rebuilding of the population based on in-season information on returns and potential numbers of effective spawners" (DFO 2013a) (Fraser River Panel 2012). Management has taken some action to reduce harvests on Cultus sockeye, and fishing mortality is judged to have a "moderate" conservation concern. Very few, if any, Ozette Lake sockeye (ESA "Threatened") are likely to be captured by this fishery.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

RAINBOW TROUT

Factor 2.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for steelhead salmon is 36, making inherent vulnerability "moderate." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005).

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS

Very High Concern

Suggest deleting. Steelhead information is listed under ESA-listed steelhead.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS

Low Concern

Suggest deleting. Have added a score for the sake of having a summary score for Columbia R. fisheries.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-

selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

CHUM SALMON

Factor 2.1 - Inherent Vulnerability

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for chum salmon is 49, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Chum salmon have "medium" vulnerability because although they are a relatively large salmon, they have the widest natural geographic distribution of all Pacific salmon species.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA

Very Low Concern

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA

Very Low Concern

Very few chum are taken in the troll fishery.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

Criterion 3: Management Effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*

Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Criterion 3 Summary

Region / Method	Harvest Strategy	Bycatch Strategy	Score
Oregon / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - North of Cape Falcon	3.000	3.000	Yellow (3.000)
Oregon / Northeast Pacific / Trolling lines / United States of America / Coho fishery - North of Cape Falcon	3.000	3.000	Yellow (3.000)
United States of America / Columbia River / Drift gillnets / Coho fishery above Bonneville Dam	3.000	3.000	Yellow (3.000)
United States of America / Columbia River / Drift gillnets	3.000	3.000	Yellow (3.000)
United States of America / Columbia River / Drift gillnets / Chinook fishery	3.000	3.000	Yellow (3.000)
United States of America / Columbia River / Drift gillnets / Sockeye fishery	3.000	3.000	Yellow (3.000)
United States of America / Columbia River / Gillnets and entangling nets (unspecified) / Coho fishery below Bonneville Dam	3.000	3.000	Yellow (3.000)
United States of America / Klamath River / Drift gillnets / Chinook fishery	3.000	3.000	Yellow (3.000)
United States of America / Northeast Pacific / Trolling lines / United States of America / Cape Falcon to Humbug Mt.	3.000	3.000	Yellow (3.000)
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Cape Falcon to Humbug Mt.	3.000	3.000	Yellow (3.000)
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Horse Mt. to U.S./Mexico Border	3.000	3.000	Yellow (3.000)

United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Humbug Mt. to Horse Mt.	3.000	3.000	Yellow (3.000)
United States of America / Northeast Pacific / Hand-operated pole-and-lines / United States of America / Cape Falcon to Humbug Mt.	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Drift gillnets / United States of America / Chinook fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Drift gillnets / United States of America / Chum fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Drift gillnets / United States of America / Coho fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Drift gillnets / United States of America / Pink fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Drift gillnets / United States of America / Sockeye fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Purse seines / United States of America / Chinook fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Purse seines / United States of America / Chum fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Purse seines / United States of America / Coho fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Purse seines / United States of America / Pink fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Purse seines / United States of America / Sockeye fishery	3.000	3.000	Yellow (3.000)
United States of America / Puget Sound / Trolling lines / United States of America / Chinook fishery	3.000	0.000	Yellow (3.000)
United States of America / Puget Sound / Trolling lines / United States of America / Coho fishery	3.000	0.000	Yellow (3.000)
United States of America / Puget Sound / Trolling lines / United States of America / Pink fishery	3.000	0.000	Yellow (3.000)
United States of America / Puget Sound / Hand-operated pole-and-lines / United States of America	3.000	0.000	Yellow (3.000)
United States of America / Puget Sound / Trolling lines / United States of America	3.000	0.000	Yellow (3.000)
Washington / Northeast Pacific / Drift gillnets / United States of America / Chinook fishery	3.000	3.000	Yellow (3.000)

Washington / Northeast Pacific / Drift gillnets / United States of America / Chum fishery	3.000	3.000	Yellow (3.000)
Washington / Northeast Pacific / Drift gillnets / United States of America / Coho fishery	3.000	3.000	Yellow (3.000)
Washington / Northeast Pacific / Drift gillnets / United States of America / Sockeye fishery	3.000	3.000	Yellow (3.000)

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - Harvest Strategy

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

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

Factor 3.1 Summary

FACTOR 3.1 - MANAGEMENT OF FISHING IMPACTS ON RETAINED SPECIES							
Region / Method	**Strategy**	**Recovery**	**Research**	**Advice**	**Enforce**	**Track**	**Inclusion**
Oregon / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - North of Cape Falcon	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
Oregon / Northeast Pacific / Trolling lines / United States of America / Coho fishery - North of Cape Falcon	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

United States of America / Columbia River / Drift gillnets / Coho fishery above Bonneville Dam	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Columbia River / Drift gillnets	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Columbia River / Drift gillnets / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Columbia River / Drift gillnets / Sockeye fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Columbia River / Gillnets and entangling nets (unspecified) / Coho fishery below Bonneville Dam	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Klamath River / Drift gillnets / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Cape Falcon to Humbug Mt.	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Cape Falcon to Humbug Mt.	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Horse Mt. to U.S./Mexico Border	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Humbug Mt. to Horse Mt.	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Northeast Pacific / Hand-operated pole-and-lines / United States of America / Cape Falcon to Humbug Mt.	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Chum fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Coho fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

United States of America / Puget Sound / Drift gillnets / United States of America / Pink fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Sockeye fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Purse seines / United States of America / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Purse seines / United States of America / Chum fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Purse seines / United States of America / Coho fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Purse seines / United States of America / Pink fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Purse seines / United States of America / Sockeye fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

United States of America / Puget Sound / Trolling lines / United States of America / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Trolling lines / United States of America / Coho fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Trolling lines / United States of America / Pink fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Hand-operated pole-and-lines / United States of America	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
United States of America / Puget Sound / Trolling lines / United States of America	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
Washington / Northeast Pacific / Drift gillnets / United States of America / Chinook fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
Washington / Northeast Pacific / Drift gillnets / United States of America / Chum fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
Washington / Northeast Pacific / Drift gillnets / United States of America / Coho fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

Washington / Northeast Pacific / Drift gillnets / United States of America / Sockeye fishery	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

Subfactor 3.1.1 – Management Strategy and Implementation

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

These ocean salmon fisheries are co-managed by the Pacific Fishery Management Council and federal and state agencies to meet objectives described in the Pacific Coast Salmon Fishery Management Plan. The plan includes escapement goals for some Chinook and coho indicator stocks, and escapement monitoring suggests that the goals have generally been met in the majority of the past fifteen years (PFMC 2014a). However, escapement counts typically do not distinguish between wild and hatchery-origin fish spawning in natural areas (PFMC 2014e). For depleted stocks that are listed under the Endangered Species Act, exploitation rate limits are set to help ensure that harvest does not impede population recovery (PFMC 2014e). Available data indicate that these limits are typically not exceeded. Co-managers respond to projected salmon abundances and use fishery time and area restrictions to meet management objectives, and in some cases they may use fishing quotas as well (PFMC 2014e).

The management strategy is judged to be "moderately effective" because a strategy exists along with objectives and monitoring, but hatchery-produced salmon often contribute to the achievement of escapement goals.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

Columbia River salmon fisheries are co-managed by the Columbia River treaty fishing tribes and the states of Washington and Oregon, who work together to ensure that harvest rate limits and sharing agreements between treaty and non-treaty fisheries are met. A restricted number of commercial fishing licenses are issued each year, and to meet harvest limits and escapement goals, co-managers adjust ocean and in-river fishery harvest openings and closures. Natural spawning escapement goals have been developed for many Columbia River Chinook and sockeye salmon stocks (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). Brood stock goals have been established for Chinook, sockeye and coho hatchery populations, and "Select Area" commercial fisheries have been established in lower river off-channel areas to target hatchery-produced coho and Chinook returning to release sites (Joint Columbia River Management Staff 2014a). Data provided by the Pacific Fishery Management Council and the Oregon and Washington Departments of Fish and Wildlife indicate that escapement goals have been typically met during the past 10 years, but escapement counts often include an unknown number of hatchery origin salmon spawning in the streams (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). This may be appropriate in cases where hatchery-produced fish are part of a stock recovery strategy, but in other cases, hatchery production is primarily aimed at supporting harvest, and inclusion of hatchery-produced fish in escapement counts may obscure estimation of wild fish abundance.

The management strategy is judged to be "moderately effective" because a generally appropriate strategy is in place, but escapement management is not always precautionary with regard to management of wild-origin fish.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

The Klamath inriver commercial salmon fishery is managed by Klamath tribal authorities. Total harvest limits on KRF Chinook are established each year through the PFMC process based on forecasted run strength and escapement requirements. Klamath River tribal fisheries are allocated 50% of the total harvest. The inriver commercial fishery occurs in the Klamath estuary and is limited to tribal members (Yurok Tribal Council 2013). Tribal authorities manage the fishery through the number of days fishing that is allowed or closed. Commercial sales are recorded on fish tickets which are turned into tribal authorities to monitor the harvest relative to the allocation. Escapement goals have been established for the main target stock (Klamath River fall Chinook), and this stock has generally met its escapement goal the majority of the past fifteen years. However, Klamath River spring Chinook stocks do not have escapement goals, and the Klamath River fall Chinook escapement goal does not distinguish between wild and hatchery-origin fish spawning in natural areas (PFMC 2011).

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Moderately Effective

Spawning escapement goals have been developed for Chinook, coho, chum, pink, and sockeye salmon in most of the major Puget Sound watersheds. The co-managers attempt to meet these goals by adjusting fishery harvests in commercial, tribal, and recreational fisheries. Fisheries management incorporates harvest information on salmon harvested outside Puget Sound. Data provided by the Pacific Fishery Management Council and Washington Department of Fish and Wildlife indicate that the escapement goals for most species and stocks have been met during the past 10 or more years, but escapement counts often include an unknown number of hatchery-origin salmon spawning in the streams (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW 2014b). However, escapement goals for sockeye are often not met even though harvests are small. Also, escapement goals for natural origin Chinook (excluding hatchery fish) have not been consistently met; escapement goals are more likely to be met when hatchery fish are counted against the goal. Escapements to hatcheries are monitored. The management strategy is judged to be "moderately effective" because there is a strategy along with objectives and monitoring, but hatchery salmon often contribute to the achievement of escapement goals.

Justification:

The Chinook Harvest Management Plan's objectives are to "*Ensure that fishery-related mortality will not impede rebuilding of natural Puget Sound Chinook salmon populations, consistent with the capacity of properly functioning habitat, to levels that will sustain fisheries, enable ecological functions, and are consistent with treaty-reserved fishing rights."* The Plan guides the implementation of fisheries in Washington while considering the total harvest impacts on Puget Sound Chinook of fisheries in Washington, Oregon, British Columbia, and Alaska.

The Plan sets fisheries exploitation rate (ER) ceilings as the principle mechanism for achieving spawning escapement levels that are consistent with current habitat function. Exploitation rate management was first

implemented in the late 1990s for Puget Sound Chinook (i.e., before the evolutionarily significant unit was listed), because the former harvest strategy, based on fixed escapement goals, was not adequately conservative, and was not consistently applicable across fisheries when the run sizes were lower than escapement goals. Fishery Regulation Assessment Model (FRAM) estimates of exploitation rate are more accurate than its projections of spawning escapement. The co-managers determined that exploitation rate management was more averse to risk than a fixed escapement goal management strategy, because estimates of exploitation rates were considered more reliable and more amenable to post-season assessment. When escapement is projected to be less than the Lower Abundance Threshold, fishing-related mortality is further constrained by implementing a lower, critical exploitation rate (CER) ceiling to increase escapement.

The management strategy has developed objectives for exploitation rates in order to meet Chinook spawning escapement thresholds. The strategy also recognizes the need to rebuild ESA-listed salmon, though it notes that rebuilding will take considerable time because habitat has been degraded. The management strategy recognizes a balance between conservation of natural-origin Chinook and providing harvest. However, NOAA Fisheries estimates that the recent total (all fisheries) exploitation rate is 42% and the exploitation rate in Puget Sound is 16%. The exploitation rate in Puget Sound in recent years (brood years 2002 to 2006) is higher than it has been since 1982. Escapement data indicate that natural spawners are often not meeting the lower or upper abundance thresholds.

Spawning escapement goals have been developed for coho, chum, pink, and sockeye salmon in most of the major Puget Sound watersheds. The co-managers attempt to meet these goals by adjusting fishery harvests in commercial, tribal, and recreational fisheries. Data provided by the PFMC and WDFW indicates that the spawning goals have been typically met during the past 10 or more years. However, for Lake Washington sockeye the goal is often not met even though harvests have been small. Escapements to hatcheries are monitored. However, in watersheds with hatcheries, the contribution of hatchery salmon to the natural salmon spawning counts is typically not monitored.

The management strategy is judged to be "moderately effective" because it does have a strategy along with objectives and monitoring. Spawning goals are typically achieved for chum, coho, and pink salmon but evidence indicates that the goals are not consistently achieved for natural origin Chinook.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Moderately Effective

Spawning escapement goals have been developed for Chinook, coho, chum, pink and sockeye salmon in most of the major Puget Sound watersheds. The co-managers attempt to meet these goals by adjusting fishery harvests in commercial, tribal and recreational fisheries. Fisheries management incorporates harvest information on salmon harvested outside Puget Sound. Data provided by the Pacific Fishery Management Council and Washington Department of Fish and Wildlife indicate that the escapement goals have been typically met during the past 10 or more years, but escapement counts often include an unknown number of hatchery-origin salmon spawning in the streams (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW 2014b). Escapement goals for sockeye are often not met even though harvests are small. Escapement goals for natural origin Chinook (excluding hatchery fish) have not been consistently met. Escapements to hatcheries are monitored. The management strategy is judged to be "moderately effective" because there is a strategy along with objectives and monitoring, but hatchery salmon often contribute to the achievement of escapement goals.

Justification:

The Chinook Harvest Management Plan's objectives are to *"Ensure that fishery-related mortality will not impede rebuilding of natural Puget Sound Chinook salmon populations, consistent with the capacity of properly functioning habitat, to levels that will sustain fisheries, enable ecological functions, and are consistent with treaty-reserved fishing rights."* The Plan guides the implementation of fisheries in Washington while considering the total harvest impacts on Puget Sound Chinook of fisheries in Washington, Oregon, British Columbia, and Alaska.

The Plan sets fisheries exploitation rate (ER) ceilings as the principle mechanism for achieving spawning escapement levels that are consistent with current habitat function. Exploitation rate management was first implemented in the late 1990s for Puget Sound Chinook (i.e., before the evolutionarily significant unit was listed), because the former harvest strategy, based on fixed escapement goals, was not adequately conservative, and was not consistently applicable across fisheries when the run sizes were lower than escapement goals. Fishery Regulation Assessment Model (FRAM) estimates of exploitation rate are more accurate than its projections of spawning escapement. The co-managers determined that exploitation rate management was more averse to risk than a fixed escapement goal management strategy, because estimates of exploitation rates were considered more reliable and more amenable to post-season assessment. When escapement is projected to be less than the Lower Abundance Threshold, fishing-related mortality is further constrained by implementing a lower, critical exploitation rate (CER) ceiling to increase escapement.

The management strategy has developed objectives for exploitation rates in order to meet Chinook spawning escapement thresholds. The strategy also recognizes the need to rebuild ESA-listed salmon, though it notes that rebuilding will take considerable time because habitat has been degraded. The management strategy recognizes a balance between conservation of natural-origin Chinook and providing harvest. However, NOAA Fisheries estimates that the recent total (all fisheries) exploitation rate is 42% and the exploitation rate in Puget Sound is 16%. The exploitation rate in Puget Sound in recent years (brood years 2002 to 2006) is higher than it has been since 1982. Escapement data indicate that natural spawners are often not meeting the lower or upper abundance thresholds.

Spawning escapement goals have been developed for coho, chum, pink, and sockeye salmon in most of the major Puget Sound watersheds. The co-managers attempt to meet these goals by adjusting fishery harvests in commercial, tribal and recreational fisheries. Data provided by the PFMC and WDFW indicates that the spawning goals have been typically met during the past 10 or more years. However, for Lake Washington sockeye the goal is often not met even though harvests have been small. Escapements to hatcheries are monitored. However, in watersheds with hatcheries, the contribution of hatchery salmon to the natural salmon spawning counts is typically not monitored.

The management strategy is judged to be "moderately effective" because it does have a strategy along with objectives and monitoring. Spawning goals are typically achieved for chum, coho and pink salmon but evidence indicates that the goals are not consistently achieved for natural origin Chinook.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Washington Coast inside fisheries are managed by the Washington Department of Fish and Wildlife and treaty Indian tribes to meet spawning escapement goals for Washington coastal Chinook and coho salmon stocks.

Escapement monitoring suggests that the goals have generally been met in the majority of the past fifteen years (PFMC 2014a). However, escapement counts typically do not distinguish between wild and hatchery-origin fish spawning in natural areas (PFMC 2014e). The policy document for Grays Harbor Basin salmon management includes objectives for focusing harvest on hatchery fish and reducing fishing mortality on natural stocks by implementing mark selective fisheries that release unmarked (natural-origin) fish (WDFW 2014c). In addition, exploitation rates on Chinook and coho are limited to 5% when escapements to natural spawning areas are relatively low. Managers use fishery time and area restrictions to meet management objectives.

The management strategy is judged to be "moderately effective" because a strategy exists along with objectives and monitoring, but hatchery-produced salmon often contribute to the achievement of escapement goals.

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.

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

A large component of fisheries management region is the ESA consultation standard for depleted stocks such as California coastal Chinook salmon. Thus, management strategies are in place to reduce fishery mortality on these stocks, and recovery plans have been developed for some ESA-listed stocks. Results thus far are mixed: one depleted stock had its "overfished" status removed in 2013 (NOAA 2014b), whereas few ESA-listed stocks have shown signs of recovery. Management has appropriate intentions and may be effective at reducing fishing mortality on depleted stocks, but recovery outcomes are uncertain, especially since factors other than ocean harvest (such as availability of quality habitat) may also affect escapement levels (O'Farrell et al. 2012a).

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

The co-managers and the National Marine Fisheries Service have developed strategies for recovering threatened or endangered salmon listed under the Endangered Species Act. These strategies involve harvest and hatchery management as well as factors beyond fisheries management such as habitat restoration. Significant progress in fisheries management has been made in the past 10 to 15 years, and harvest rates on listed species are often greatly reduced. Recovery is not yet evident in many depleted populations, but factors besides harvest, such as habitat availability and ocean conditions, also influence recovery. However, the recovery strategy is considered to be "moderately effective" because the needs for recovery of ESA-listed salmon are balanced with the need to provide harvest.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Southern Oregon/Northern California Coast (SONCC) coho salmon are caught and retained in this fishery although they may not be sold. Management strategies are in place to reduce fishery mortality on these stocks, and a recovery plan was adopted in 2014. Despite these efforts, SONCC coho populations have continued to decline due to overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices (NOAA 2011f). Although management has appropriate intentions and may be effective at reducing fishing mortality, other non-fishing factors are substantial contributors to making the SONCC recovery outcomes uncertain.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Moderately Effective

The co-managers and NOAA Fisheries have developed strategies for recovering Puget Sound Chinook salmon, Hood Canal summer chum, and Ozette Lake sockeye, and an initial planning document (outline) for the recovery of Puget Sound Steelhead has been developed (NMFS 2014c), all of which are listed as "Threatened" under the Endangered Species Act. These strategies involve many factors beyond fisheries management, e.g., habitat restoration, but they also involve strategies for harvest management and hatchery management. Significant progress in fisheries management has been made in the past 10 to 15 years. Harvest rates on listed species are often greatly reduced, e.g., Hood Canal summer chum, steelhead, and Ozette Lake sockeye. Nevertheless, the recovery strategy is considered to be only "moderately effective" because the needs of the ESA-listed salmon are sometimes balanced with the need to provide harvest.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Moderately Effective

The co-managers and NOAA Fisheries have developed strategies for recovering Puget Sound Chinook salmon, Hood Canal summer chum, Ozette Lake sockeye and Puget Sound steelhead (NMFS 2014c), all of which are listed as "Threatened" under the Endangered Species Act. These strategies involve harvest and hatchery management as well as factors beyond fisheries management such as habitat restoration. Significant progress in fisheries management has been made in the past 10 to 15 years. Harvest rates on listed species are often greatly reduced, e.g., Hood Canal summer chum, steelhead, Ozette Lake sockeye. Nevertheless, the recovery strategy is considered to be only "moderately effective" because the needs of the ESA-listed salmon are sometimes balanced with the need to provide harvest.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Some ESA-listed stocks are caught in this fishery, but management has implemented regulations that appear effective at limiting harvest of these stocks. Fishery openings and closures (in time and area) are designed to minimize encounters of ESA-listed stocks, and there are mark-selective fisheries (PSC 2013a). The population statuses of listed stocks remain uncertain, but recovery will take time and may be affected by factors other than ocean harvest, such as habitat quantity and quality (O'Farrell et al. 2012a).

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.

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

Fishery exploitation rates are estimated for some ESA (Endangered Species Act)-listed stocks to help ensure that fishery impacts do not impede population recovery. There is escapement monitoring for fish spawning in some natural areas, but in-season monitoring of escapements is not used for harvest management. In addition, escapement counts often do not differentiate between wild and hatchery-origin fish. These include some hatchery programs for endangered species or reintroduction of extirpated stocks that encourage hatchery-origin fish to spawn naturally to rebuild these populations. However in many of the hatchery programs, the intent is to increase or maintain the number of fish available for harvest. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on the natural-origin stock.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

Fisheries co-managers have made good strides in developing and implementing monitoring and evaluation programs for Columbia River salmon stocks. Escapements are monitored in-season at Bonneville Dam and estimated for numerous spawning and hatchery locations. Harvests are monitored in-season as well. Some salmon stocks (mostly hatchery fish) receive coded-wire-tags (CWT), acoustic tags or passive integrated transponder (PIT) tags that are used to evaluate stock-specific distribution, survival, and exploitation rate. Otoliths and scales may be used for age determination in addition to CWT. The majority (but not all) of hatchery Chinook and coho salmon are mass-marked with adipose fin clips that allow hatchery fish to be identified in harvests, dam monitoring sites, and spawning areas (Washington Fish and Wildlife Commission 2009). Estimated proportions of hatchery versus natural-origin fish on the spawning grounds have been monitored in recent years for many Columbia River tributaries, and parentage based tagging (PBT) methods for estimating pHOS are being developed and tested (Steele et al. 2014) (Cassinelli et al. 2013). However, pHOS monitoring is not yet fully implemented and integrated into management. For example, pHOS is generally not being monitored in catches. Research and monitoring was judged to be "moderately effective."

Justification:

Both the Oregon and Washington Departments of Fish and Wildlife have management plans and objectives for their hatcheries that consider hatchery impacts on wild fish. The specific objectives can vary by hatchery, but some describe an intent to enumerate wild-origin fish in tributaries (ODFW 2005). The WDFW Hatchery and Fishery Reform Policy describes an intent to use the principles and recommendations of the Hatchery Scientific Review Group, which include monitoring the proportion of returning hatchery fish that escape to natural spawning grounds and the reproductive contribution of hatchery fish spawning in the wild (Washington Fish and Wildlife Commission 2009).

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

There is escapement monitoring for naturally spawning stocks, and fishery exploitation rates are estimated for some ESA (Endangered Species Act)-listed stocks to help ensure that fishery impacts do not impede population recovery. Escapement monitoring is conducted in the Klamath and Trinity River mainstems and tributaries by tribal, federal and state agencies. This information is compiled by joint staff to estimate total natural (including hatchery-origin) escapements annually to measure management performance against the natural spawning escapement goal. There are some efforts to estimate hatchery contributions to select natural spawning areas. However, escapement counts and goals in general do not differentiate between wild and hatchery-origin fish spawning in natural areas. Klamath hatcheries release coho salmon listed as "Threatened" under ESA. However, the hatchery programs were implemented to mitigate for lost habitat (due to dams) and have not fully implemented integrated hatchery practices to minimize genetic and ecological impacts to natural stocks. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on the natural-origin stock. Therefore, this factor was deemed to be "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Moderately Effective

Fisheries managers have a "moderately effective" monitoring and evaluation program for Puget Sound salmon. Recovery plans have been developed for depleted stocks. Salmon spawning in streams are enumerated and counts are expanded using past tagging data to estimate total spawning abundance in the major watershed. Escapements to hatcheries are recorded. Harvests are monitored and recorded. Catch and release has been used to selectively harvest surplus hatchery salmon (adipose clipped), while also considering catch and release mortality of the unmarked salmon. Some Chinook and coho salmon (mostly hatchery fish) receive coded-wire-tags (CWT) that are used to evaluate stock-specific distribution, survival, and exploitation rate. Otoliths and scales may be used for age determination in addition to CWT. Estimated proportions of hatchery versus natural-origin Chinook on the spawning grounds have been developed in recent years in some of the watersheds. However, most salmon escapement counts include hatchery-origin spawners in the totals (see Criterion 1 for each species). The presence of numerous hatchery fish on the spawning grounds may mask the viability of the natural population and confound its status. Some hatchery programs, for endangered stocks or reintroduction of extirpated stocks, encourage hatchery-origin fish to spawn naturally to rebuild these populations. However in many of the hatchery programs, the intent is to increase or maintain the number of fish available for harvest. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on the natural-origin stock.

Justification:

Commercial, ceremonial, and subsistence, harvest, and test fisheries, in Washington catch areas 1 to 13, and associated subareas and freshwater areas, are recorded on sales receipts (=fish tickets) and compiled in a jointly maintained database. Catch is monitored in-season for all fisheries. Non-landed mortality of Chinook is significant for commercial troll, recreational hook-and-line fisheries. Regulations for these fisheries may require release of sub-adult Chinook, or all Chinook, during certain periods. Studies are conducted to estimate encounter rates and hooking mortality for these fisheries. Estimates of encounter rates will be derived from on-board observations, angler interviews at landing ports or marinas, and remote observation of some recreational fisheries, These findings are used to validate, or adjust, the encounter rates, and release mortality rates used in the FRAM = Drop-out mortality in gillnet fisheries is accounted as 3% or 2% of landed

catch in preterminal and terminal fisheries, respectively. Chinook non-retention regulations govern certain non-Treaty seine fisheries; WDFW monitors Chinook encounters in these fisheries. Sampling terminal-area fisheries to collect biological information about mature Chinook has been prioritized. Collection of scales, sex, and length data will supplement similar information collected from spawners to characterize the age and size composition of the local population.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Moderately Effective

Fisheries managers have a "moderately effective" monitoring and evaluation program for Puget Sound salmon. Recovery plans have been developed for depleted stocks. Salmon spawning in streams are enumerated and counts are expanded using past tagging data to estimate total spawning abundance in the major watershed. Escapements to hatcheries are recorded. Harvests are monitored and recorded. Catch and release has been used to selectively harvest surplus hatchery salmon (adipose clipped), while also considering catch and release mortality of the unmarked salmon. Some Chinook and coho salmon (mostly hatchery fish) receive coded-wire-tags (CWT) that are used to evaluate stock-specific distribution, survival, and exploitation rate. Otoliths and scales may be used for age determination in addition to CWT. Estimated proportions of hatchery versus natural-origin Chinook on the spawning grounds have been developed in recent years in some of the watersheds. However, most salmon escapement counts include hatchery-origin spawners in the totals (see Criterion 1 for each species). The presence of numerous hatchery fish on the spawning grounds may mask the viability of the natural population and confound its status.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Commercial catches for Washington Department of Fish and Wildlife (WDFW) marine fisheries are subject to dockside catch sampling at major ports. Commercial fishers in coastal marine areas have on-board observer coverage. Fishery exploitation rates are estimated for some ESA (Endangered Species Act)-listed stocks to help ensure that fishery impacts do not impede population recovery.

Escapements are monitored in-season in natural spawning areas, and if escapements appear especially low, WDFW can close a fishery by emergency rule. However, escapement counts do not differentiate between wild and hatchery-origin fish spawning in natural areas. With the exception of the Lake Ozette sockeye salmon (ESA "Threatened") hatchery, hatchery programs along the Washington Coast are intended primarily to increase the number of fish available to harvest. Failing to exclude hatchery-origin fish from the escapement counts inflates escapement numbers and can mask the impact of a high harvest rate on the natural-origin stock. Therefore, research/monitoring was deemed "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.

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Co-managers incorporate scientific information, such as forecasts, into management decisions when setting harvest limits, (e.g., (PFMC 2011) (WDFW and PSIT 2013b)). Escapement goals are often achieved, but this achievement is typically based on spawning of hatchery-origin salmon along with natural-origin salmon.

Scientific evidence indicates that intermixing of natural origin and hatchery origin salmon reduces reproductive success (Chilcote et al. 2013), indicating the need to reduce the proportion of hatchery origin fish in natural spawning areas. The goal for spawning salmon is not met every year and the proportion of spawners originating from hatcheries is sometimes higher than suggested by scientists. Co-managers balance the needs of fishers to harvest fish with that of achieving spawner abundance thresholds. However, they typically follow scientific advice when setting exploitation rates. Based on the information available this indicator is judged to be "moderately effective."

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS

Highly Effective

Co-managers incorporate scientific information, such as forecasts and in-season run size estimates, into management decisions when setting exploitation rates in Columbia River and in ocean fisheries that intercept Columbia River salmon (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). This process is part of a legal requirement under the US v. Oregon Management Agreement (United States v. Oregon 2008). There is no evidence that scientific advice is disregarded, or that managers are setting exploitation rates higher than recommended by fishery scientists 50% of the time. Therefore this indicator is judged to be "highly effective."

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Highly Effective

Co-managers incorporate scientific information, such as forecasts, into management decisions when setting exploitation rates in Puget Sound and in outside fisheries that intercept Puget Sound salmon (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010). Escapement goals are typically achieved, but this achievement is typically based on spawning of hatchery origin salmon along with natural origin salmon. Some watersheds do not achieve the goal for natural origin Chinook. Co-managers balance the needs of fishers to harvest fish with that of achieving spawner abundance thresholds. However, they typically follow scientific advice when setting exploitation rates. This indicator is judged to be "highly effective" because there is little evidence that managers are setting exploitation rates higher than recommended by fishery scientists 50% of the time.

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.

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

Enforcement is in place to monitor compliance with regulations. Landings are sampled daily during the fishing season, and fish tickets and fisher logbooks are submitted (PFMC 1997). Management measures are enforced by the National Oceanic and Atmospheric Administration Office of Law Enforcement, the US Coast Guard 11th District, and local enforcement agencies. However, due to the dispersed nature of the fishery over a large area with multiple ports of landing it is difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

State, Federal, and Tribal authorities are responsible for enforcement and monitoring of catch to meet goals and objectives of fisheries management. However, the complexity of the fishery involving multiple federal, state, and tribal jurisdictions and landing sites makes it difficult to maintain consistent enforcement effort across the entire fishery during all fishery openings. Therefore, although enforcement of management regulations is in place, the effectiveness of enforcement and monitoring is somewhat uncertain, and this indicator was judged to be "moderately effective."

Justification:

To obtain a "highly effective" score, demonstration of independent verification and adequate enforcement using appropriate methods is needed, and that level of evidence was not found. A report submitted to the Independent Scientific Review Panel mentioned some enforcement challenges for tribal fisheries, such as the large size of the enforcement area, lack of boats, suitable night patrols, and high-wave conditions, and the need for more public education about conservation (Independent Scientific Review Panel 2010). The biggest compliance issues for tribal fisheries are illegal nets and poaching of salmon, steelhead, and sturgeon (Independent Scientific Review Panel 2010).

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Enforcement is in place to monitor compliance with regulations. All fish harvested for commercial sale must be examined by the checkpoint clerk at the boat dock prior to leaving the river, and sales are reported on fish tickets that are submitted to tribal authorities (Yurok Tribal Council 2013). However, it is unclear whether the level of enforcement effort is sufficient to control illegal sales from non-commercial fisheries. This indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

State and Tribal authorities are responsible for enforcement and monitoring of catch to meet goals and objectives of fisheries management. However, the complexity of the fishery involving both state and tribal jurisdictions and multiple landing sites/points of sale make it difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Moderately Effective

Enforcement and monitoring of catch are in place to effectively meet goals and objectives of the fisheries management. Catch is required to be reported on sales slips in both treaty and non-treaty fisheries (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW and PSIT

2013b). However, the complexity of the fishery involving multiple federal, state and tribal jurisdictions and landing sites makes it difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

Justification:

Enforcement and monitoring of catch are in place to effectively meet goals and objectives of the fisheries management. Catch is required to be reported on sales slips in both treaty and non-treaty fisheries.

According to the Harvest Management Plan, *"Individual tribes promulgate and enforce regulations for fisheries in their usual and accustomed fishing areas, and WDFW promulgates and enforces non-Indian fishery regulations, consistent with the principles and procedures set forth in the PSSMP. To achieve conservation and sharing objectives all fisheries shall be regulated based on four fundamental elements: (1) acceptably accurate determinations of the appropriate exploitation rate, harvest rate, or numbers of fish available for harvest; (2) the ability to evaluate the effects of specific fishing regulations; (3) a means to monitor fishing activity in a sufficient, timely and accurate fashion; and (4) effective regulation of fisheries, and enforcement, to meet objectives for spawning escapement, harvest sharing, and fishery impacts."*

Non-treaty commercial and recreational fishery regulations are enforced by the WDFW Enforcement Program. The Enforcement Program's 137 general-authority commissioned fish police officers provide protection for the state's fish and wildlife habitats and species, prevent and manage human/wildlife contacts, and conduct outreach and education activities for both the citizens and resource users of Washington State. The mission and responsibilities of the Enforcement Program originate with statutes promulgated in several titles of the Revised Code of Washington (RCW) and Washington Administrative Code (WAC). Primary among these is RCW Title 77 - Fish and Wildlife, and Title 10 - Criminal Procedure. Commissioned Fish and Wildlife Officers (FWOs) stationed in six regions throughout the state work with a variety of state and federal agencies to enforce all fish and wildlife laws, general authority laws, and WDFW rules.

Each tribe exercises authority to enforce tribal fishing regulations, whether fisheries occur on or off their reservation. Enforcement officers of one tribal agency may be cross-deputized by another tribal agency, where those tribes fish in common areas. Some tribes have increased enforcement activity to reduce illegal fishing in some areas. Tribal and WDFW agencies coordinate enforcement for some fisheries. Prosecution of violations of tribal regulations occurs through tribal courts and governmental structures.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Moderately Effective

Enforcement and monitoring of catch are in place to effectively meet goals and objectives of the fisheries management. Catch is required to be reported on sales slips in both treaty and non-treaty fisheries (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW and PSIT 2013b).

Justification:

Enforcement and monitoring of catch are in place to effectively meet goals and objectives of the fisheries management. Catch is required to be reported on sales slips in both treaty and non-treaty fisheries.

According to the Harvest Management Plan, *"Individual tribes promulgate and enforce regulations for fisheries in their usual and accustomed fishing areas, and WDFW promulgates and enforces non-Indian fishery regulations, consistent with the principles and procedures set forth in the PSSMP. To achieve conservation and*

sharing objectives all fisheries shall be regulated based on four fundamental elements: (1) acceptably accurate determinations of the appropriate exploitation rate, harvest rate, or numbers of fish available for harvest; (2) the ability to evaluate the effects of specific fishing regulations; (3) a means to monitor fishing activity in a sufficient, timely and accurate fashion; and (4) effective regulation of fisheries, and enforcement, to meet objectives for spawning escapement, harvest sharing, and fishery impacts."

Non-treaty commercial and recreational fishery regulations are enforced by the WDFW Enforcement Program. The Enforcement Program's 137 general-authority commissioned fish police officers provide protection for the state's fish and wildlife habitats and species, prevent and manage human/wildlife contacts, and conduct outreach and education activities for both the citizens and resource users of Washington State. The mission and responsibilities of the Enforcement Program originate with statutes promulgated in several titles of the Revised Code of Washington (RCW) and Washington Administrative Code (WAC). Primary among these is RCW Title 77 - Fish and Wildlife, and Title 10 - Criminal Procedure. Commissioned Fish and Wildlife Officers (FWOs) stationed in six regions throughout the state work with a variety of state and federal agencies to enforce all fish and wildlife laws, general authority laws, and WDFW rules.

Each tribe exercises authority to enforce tribal fishing regulations, whether fisheries occur on or off their reservation. Enforcement officers of one tribal agency may be cross-deputized by another tribal agency, where those tribes fish in common areas. Some tribes have increased enforcement activity to reduce illegal fishing in some areas. Tribal and WDFW agencies coordinate enforcement for some fisheries. Prosecution of violations of tribal regulations occurs through tribal courts and governmental structures.

Commercial, ceremonial, and subsistence, harvest, and test fisheries, in Washington catch areas 1 to 13, and associated subareas and freshwater areas, are recorded on sales receipts (= fish tickets), and compiled in a jointly maintained database. Catch is monitored in-season for all fisheries. Non-landed mortality of Chinook is significant for commercial troll, recreational hook-and-line fisheries. Regulations for these fisheries may require release of sub-adult Chinook, or all Chinook, during certain periods. Studies are conducted to estimate encounter rates and hooking mortality for these fisheries. Estimates of encounter rates will be derived from on-board observations, angler interviews at landing ports or marinas, and remote observation of some recreational fisheries, These findings are used to validate, or adjust, the encounter rates and release mortality rates used in the FRAM = Drop-out mortality in gillnet fisheries is accounted as 3% or 2% of landed catch in preterminal and terminal fisheries, respectively. Chinook non-retention regulations govern certain non-Treaty seine fisheries; WDFW monitors Chinook encounters in these fisheries. Sampling terminal-area fisheries to collect biological information about mature Chinook has been prioritized. Collection of scales, sex, and length data will supplement similar information collected from spawners to characterize the age and size composition of the local population.

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.

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

Management has implemented measures to reduce fishery impacts on ESA-listed stocks, aiming to target abundant hatchery fish. These measures have been in place for many years, although the track record is somewhat uncertain and has had mixed results in terms of recovery of depleted stocks, largely because much salmon habitat remains degraded. Restoration of populations may take considerable time. There is no evidence that measures have maintained ecosystem integrity in the long-term.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

Numerous changes in harvest management were enacted following the ESA-listing of many Columbia River salmon stocks, to help enable population rebuilding. These management objectives have generally been met (Joint Columbia River Management Staff 2015b). However, it cannot be said that management measures have resulted in long-term maintenance of ecosystem integrity. Although harvest on ESA-listed stocks has been constrained, hatchery production has not, and the large numbers of hatchery fish in the river system may negatively affect wild populations. The management track record was rated "moderately effective."

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Management measures have been in place for many years, although the track record is somewhat uncertain and has had mixed results in terms of recovery of depleted stocks, largely because much salmon habitat remains degraded or blocked to anadromous migration. Factors that have contributed to the decline of SONCC stocks include: over-fishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices (NOAA 2011f). There is no evidence that measures have maintained ecosystem integrity in the long-term.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Moderately Effective

The management track record has been "moderately effective." Many changes in the management system were enacted after the ESA-listing of Puget Sound Chinook, Hood Canal summer chum, Puget Sound steelhead and Ozette Lake sockeye; therefore, the track record is somewhat recent. The intentions of fisheries management are to enable population rebuilding to the extent that reduced fishing will contribute to rebuilding. Escapement goals for non-listed populations are often met, but hatchery salmon are often used to supplement these populations.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Moderately Effective

The management track record has been "moderately effective." Many changes in the management system were enacted after the ESA-listing of Puget Sound Chinook, Hood Canal summer chum, Puget Sound steelhead and Ozette Lake sockeye, therefore the track record is somewhat recent. The intentions of fisheries management are to enable population rebuilding to the extent that reduced fishing will contribute to rebuilding. Escapement goals for non-listed populations are often met, but hatchery salmon are often used to supplement these populations.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Management has implemented measures to reduce fishery impacts on ESA-listed stocks, aiming to target abundant hatchery and naturally-produced stocks through strategic fishery openings and closures and implementing mark selective fisheries that release non-marked (wild) fish. There are indications that Washington coastal fisheries catch minimal numbers of fish from ESA-listed stocks (Kassler and Marshall 2004). However, there is not sufficient evidence to determine whether management measures have resulted in long-term maintenance of ecosystem integrity. Thus the management track record was rated "moderately effective."

Subfactor 3.1.7 – Stakeholder Inclusion

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Highly Effective

Fishery management practices are described in publicly available reports, and stakeholder input has been sought for recovery plans (NMFS 2009).

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Highly Effective

Management is transparent, and the inclusion of stakeholders in the management process is judged to be "highly effective." Annual planning of Columbia River fisheries proceeds concurrently with that of ocean fisheries, from February through early April each year, in the Pacific Fishery Management Council forum. This offers the public access to salmon status information and opportunity to interact with the co-managers in developing annual fishing regimes. Conservation concerns for any management unit are identified early in the process.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Highly Effective

The Klamath Fishery is managed in coordination with the Pacific Fishery Management Council. Fishery management practices are described in publicly available reports, and stakeholder input has been sought for recovery plans (NMFS 2014b).

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Highly Effective

Management is transparent and the inclusion of stakeholders in the management process is judged to be "highly effective." Annual planning of Puget Sound fisheries proceeds concurrently with that of coastal fisheries, from February through early April each year, in the Pacific Fishery Management Council and North of Cape Falcon (NOF) forums (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW and PSIT 2013b). These offer the public, particularly commercial and recreational fishing interest groups, access to salmon status information and opportunity to interact with the co-managers in developing annual fishing regimes. Conservation concerns for any management unit are identified early in the process. Meeting schedules are posted on the Washington Department of Fish and Wildlife web page (http://wdfw.wa.gov/fishing/northfalcon/).

Justification:

Abundance forecasts are developed for Puget Sound, Washington coastal, and Columbia River Chinook management units in advance of the management planning process. Preliminary abundance forecasts for Canadian Chinook stocks, and expected catch ceilings in Alaska and British Columbia, are obtained through the Pacific Salmon Commission or directly from Canada Department of Fisheries and Oceans. The Pacific Fishery Management Council's annual planning process begins in March by establishing a range of allowable catches for each coastal fishery. An initial harvest regime for Puget Sound fishing is evaluated. Recreational fisheries

are initially set at levels similar to the previous year's regime. Incidental Chinook harvest in pre-terminal net fisheries is projected from recent-year catch data, and the anticipated scope of fisheries for other species in the upcoming year. Terminal area net fisheries in Chinook management periods are scaled to harvest surplus production and achieve natural and/or hatchery escapement objectives. The fishery regimes for pre-terminal and terminal net fisheries directed at other salmon species are initially set to meet management objectives for those species.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Highly Effective

Management is transparent and the inclusion of stakeholders in the management process is judged to be "highly effective." Annual planning of Puget Sound fisheries proceeds concurrently with that of coastal fisheries, from February through early-April each year, in the Pacific Fishery Management Council and North of Cape Falcon (NOF) forums (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW and PSIT 2013b). These offer the public, particularly commercial and recreational fishing interest groups, access to salmon status information and opportunity to interact with the co-managers in developing annual fishing regimes. Conservation concerns for any management unit are identified early in the process. Meeting schedules are posted on the Washington Department of Fish and Wildlife web page (http://wdfw.wa.gov/fishing/northfalcon/).

Justification:

Abundance forecasts are developed for Puget Sound, Washington coastal, and Columbia River Chinook management units in advance of the management planning process. Preliminary abundance forecasts for Canadian Chinook stocks, and expected catch ceilings in Alaska and British Columbia, are obtained through the Pacific Salmon Commission or directly from Canada Department of Fisheries and Oceans. The Pacific Fishery Management Council's annual planning process begins in March by establishing a range of allowable catches for each coastal fishery. An initial harvest regime for Puget Sound fishing is evaluated. Recreational fisheries are initially set at levels similar to the previous year's regime. Incidental Chinook harvest in pre-terminal net fisheries is projected from recent-year catch data, and the anticipated scope of fisheries for other species in the upcoming year. Terminal area net fisheries in Chinook management periods are scaled to harvest surplus production and achieve natural and / or hatchery escapement objectives. The fishery regimes for pre-terminal and terminal net fisheries directed at other salmon species are initially set to meet management objectives for those species.

The Fishery Regulation Assessment Model (FRAM) is configured to simulate this initial regulation set for all Washington fisheries, based on forecast abundance of all contributing Chinook management units. Spawning escapement for each population and exploitation rates, projected by model runs, are then examined for compliance with management objectives for each Puget Sound Chinook management unit and their component populations. The initial model runs reveal conservation concerns for any management units in critical status (i.e., where escapement falls short of the low abundance thresholds), and a more general

perspective on the achievement of management objectives for all other management units. In accordance with the preceding rules that control harvest levels, regulations governing directed and incidental Chinook harvest impacts are adjusted, through negotiation among the co-managers, then modeled, to develop a fishery regime that addresses the conservation concerns for weak stocks, ensures that exploitation rate ceilings are not exceeded and/or escapement objectives are achieved for all management units.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Highly Effective

Fishery management practices are described in publicly available reports, and stakeholder input is actively sought. For example, meetings were held to encourage public involvement in the development of the Grays Harbor salmon management policy (WDFW 2014).

Factor 3.2 - Bycatch Strategy

SCORING GUIDELINES

Four subfactors are evaluated: Management Strategy and Implementation, Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.' Unless reason exists to rate Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations differently, these rating are the same as in 3.1.

- *5 (Very Low Concern)—Rated as 'highly effective' for all four subfactors considered*
- *4 (Low Concern)—Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*
- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy rated 'ineffective.'*
- *0 (Critical)—No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substatntially impacted by the fishery*

FACTOR 3.2 - BYCATCH STRATEGY

Region / Method	All Kept	Critical	Strategy	Research	Advice	Enforce
Oregon / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - North of Cape Falcon	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
Oregon / Northeast Pacific / Trolling lines / United States of America / Coho fishery - North of Cape Falcon	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective

United States of America / Columbia River / Drift gillnets / Coho fishery above Bonneville Dam	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Columbia River / Drift gillnets	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Columbia River / Drift gillnets / Chinook fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Columbia River / Drift gillnets / Sockeye fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Columbia River / Gillnets and entangling nets (unspecified) / Coho fishery below Bonneville Dam	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Klamath River / Drift gillnets / Chinook fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Cape Falcon to Humbug Mt.	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Cape Falcon to Humbug Mt.	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Horse Mt. to U.S./Mexico Border	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Humbug Mt. to Horse Mt.	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Northeast Pacific / Hand-operated pole-and-lines / United States of America / Cape Falcon to Humbug Mt.	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Chinook fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Chum fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Coho fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective

United States of America / Puget Sound / Drift gillnets / United States of America / Pink fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Drift gillnets / United States of America / Sockeye fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Purse seines / United States of America / Chinook fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Purse seines / United States of America / Chum fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Purse seines / United States of America / Coho fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Purse seines / United States of America / Pink fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Purse seines / United States of America / Sockeye fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
United States of America / Puget Sound / Trolling lines / United States of America / Chinook fishery	Yes	All Species Retained				
United States of America / Puget Sound / Trolling lines / United States of America / Coho fishery	Yes	All Species Retained				
United States of America / Puget Sound / Trolling lines / United States of America / Pink fishery	Yes	All Species Retained				
United States of America / Puget Sound / Hand-operated pole-and-lines / United States of America	Yes	All Species Retained				
United States of America / Puget Sound / Trolling lines / United States of America	Yes	All Species Retained				
Washington / Northeast Pacific / Drift gillnets / United States of America / Chinook fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
Washington / Northeast Pacific / Drift gillnets / United States of America / Chum fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective

Washington / Northeast Pacific / Drift gillnets / United States of America / Coho fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective
Washington / Northeast Pacific / Drift gillnets / United States of America / Sockeye fishery	No	No	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective

Subfactor 3.2.2 – Management Strategy and Implementation

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON

Moderately Effective

Coho salmon are a bycatch species in this area, because the fishery encounters stocks listed under the Endangered Species Act or Committee on the Status of Endangered Wildlife in Canada (e.g., Lower Columbia natural, Oregon Coast natural, and Interior Fraser coho). Coho salmon are retained in Pacific Fishery Management Council ocean troll fisheries operating north of Cape Falcon (essentially Washington state), except in May and June (PFMC 2014a). In 2013, about 43% of Chinook landings in Washington (in fish numbers) were caught from July through September (PFMC 2014a), suggesting that a substantial portion of the Chinook fishery retains coho. In contrast, troll fisheries south of Cape Falcon are always required to release coho to reduce harvest impacts on listed stocks. Management generally meets exploitation rate limits on listed stocks (PFMC 2014a), but this strategy is considered "moderately effective" or precautionary.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

Bycatch of ESA-listed Columbia River salmon and steelhead stocks is allowed under a 2008 Biological Opinion issued by NMFS (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). The co-managers attempt to keep fishery impact rates on ESA-listed stocks within allowable limits in commercial, tribal, and recreational fisheries, and they have generally been successful (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). However, salmon from ESA-listed stocks are being retained in some fisheries, so bycatch is not minimized to the greatest extent possible. This suggests a "moderately effective," rather than "highly effective," bycatch strategy.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Bycatch reduction techniques are used but are of unknown or uncertain effectiveness. For example, fishing effort is reduced during the migration timing of ESA-listed coho salmon. These fish cannot be sold but may be retained for subsistence or ceremonial purposes. Southern Oregon/Northern California Coast coho populations have continued to decline despite efforts to reduce incidental harvests.

UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

ESA-listed stocks may be caught as bycatch species in US West Coast salmon fisheries. To protect ESA-listed coho stocks, retention of coho caught off the California coast has been prohibited since 1993 (NMFS 1999), and fisheries south of Cape Falcon have not targeted coho except in 2007 and 2009. The bycatch strategy for coho is therefore precautionary, but Chinook are retained, even though fish from ESA-listed stocks may occasionally be caught. Co-managers have generally been successful at using seasonal fishery closures to maintain exploitation rates on ESA-listed stocks within specified limits (PFMC 2014a). The bycatch strategy is considered "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

The management system has a strategy to reduce by catch of seabirds, such as the marbled murrelet, and salmon species at specific times and locations (WDFW 2013). For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A. Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release,

salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. The bycatch strategy is not considered to be highly effective because, for example, it is impractical to live-release all ESA-listed salmonids with a high degree of success. Instead the bycatch strategy for the gillnet fishery is judged to be "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Purse seiners must brail salmon and live release Chinook, coho, and/or chum salmon in specific locations and time periods. A live box must be used to revive the released salmon. Management monitors bycatch and applies a mortality factor to fish that are released (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW & PSTIT 2013) (WDFW 2013). The strategy is deemed to be "moderately effective," rather than "highly effective," because the bycatch species often involve ESA-listed species.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Bycatch in Washington coastal inside fisheries primarily consists of ESA-listed salmon stocks from other regions, such as the Columbia River. None of the local Washington Coast Chinook and coho salmon stocks is ESA-listed. To better target these local stocks, managers use strategic fishery openings and closures and have implemented mark-selective fisheries in some areas (K. Hughes, personal communication). Some ESA-listed salmon may be encountered (Kassler and Marshall 2004), but actual catches of ESA-listed salmon are probably minimal. Additional monitoring would help confirm whether this is the case, especially for coho salmon. This indicator was judged to be "moderately effective."

Justification:

Across the US West Coast, co-managers attempt to keep fishery impact rates on ESA-listed stocks within allowable limits in commercial, tribal and recreational fisheries, and they have generally been successful (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b).

Subfactor 3.2.3 – Scientific Research and Monitoring

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

There are insufficient data to estimate bycatch rates for some ESA (Endangered Speces Act)-listed coho salmon stocks in Chinook salmon fisheries. Exploitation rates on other stocks, such as Rogue and Klamath River hatchery coho, are used as a proxy (NMFS 2012b). However, it is unclear if these stocks are representative of the ESA-listed stocks and sufficient for monitoring their stock status. In addition, most salmon escapement counts include hatchery-origin spawners in the totals (see Criterion 1 for each species). The presence of numerous hatchery fish on the spawning grounds may mask the viability of the natural population and confound its status. As a result, research and monitoring was judged to be "moderately effective."

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

Co-managers are required to evaluate commercial fishery impacts on ESA-listed species and stocks caught as bycatch (Joint Columbia River Management Staff 2014a). To accomplish this, data are collected from fish tickets, creel surveys, and biological sampling. In addition, genetic stock identification and parentage based tagging are starting to be used for estimating stock abundances and proportions of hatchery-origin fish for Chinook salmon and steelhead (Hess et al. 2014) (Steele et al. 2014). Research and monitoring programs have made good strides, but until marking of hatchery salmon is more complete, via either physical or parentage based tagging, there will be some gaps in monitoring coverage. Bycatch research was deemed "moderately effective."

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Tribal fishery monitoring is in place to estimate bycatch of coho salmon, but indices of natural coho escapements are very limited. Thus, the effect of the fishery impacts on coho salmon are not well quantified. As a result, scientific research and monitoring were rated "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

There has been some research on the effectiveness of live boxes and catch and release survival of salmon captured by gillnets (Baker, M.R., et al. 2013). One pink salmon fishery requires on-board observers. Estimates of salmon caught and live released are not regularly reported. Research and monitoring of bycatch is judged to be "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Purse seiners must brail salmon and live release Chinook, coho, and/or chum salmon in specific locations and time periods. A live box must be used to revive the released salmon. There is some monitoring of bycatch and management applies a mortality factor, based on some research, to fish estimated to be released (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW & PSTIT 2013) (WDFW 2013). Research is deemed to be "moderately effective."

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

Exploitation rates on Lower Columbia River natural coho salmon, a bycatch species listed under the Endangered Species Act, are regularly estimated and monitored with the goal of staying within rate limits. However, salmon escapement counts include hatchery-origin spawners in the totals (see Criterion 1 for each species). The presence of numerous hatchery fish on the spawning grounds may mask the viability of the

natural population and confound its status. As a result, research and monitoring was judged to be "moderately effective."

Subfactor 3.2.4 – Management Record of Following Scientific Advice

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Highly Effective

Management generally follows scientific advice on bycatch species, and status reviews are conducted every five years for ESA-listed stocks (NOAA 2014a).

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Highly Effective

Co-managers incorporate scientific information, such as forecasts, into management decisions when setting exploitation rates in Columbia River and in ocean fisheries that intercept Columbia River salmon (PFMC 2014a) (Joint Columbia River Management Staff 2014a) (Joint Columbia River Management Staff 2014b). There is no evidence that scientific advice is disregarded. Therefore this indicator is judged to be "highly effective."

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Highly Effective

Management generally follows scientific advice, and there is no evidence that scientific advice is disregarded.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Highly Effective

The management system has implemented bycatch reduction in specific times and areas and is judged to be "highly effective" in its use of scientific information (WDFW 2013). For example, live releases of some salmon species are required at certain times and in specific areas. Released salmon must be revived in live boxes. Estimates of bycatch mortlity are considered in management.

UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Highly Effective

The management system has implemented bycatch reduction in specific times and areas and is judged to be "highly effective" in its use of scientific information (WDFW 2013). For example, purse seiners are required to live release all Chinook salmon prior to Oct 20 in nearly all areas. Chinook must be revived in live boxes. Estimates of bycatch mortality are considered in management.

Subfactor 3.2.5 – Enforcement of Management Regulations

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Moderately Effective

Enforcement is in place to monitor compliance with regulations. Landings are sampled daily during the fishing season, and fish tickets and fisher logbooks are submitted (PFMC 1997). Management measures are enforced by the National Oceanic and Atmospheric Administration Office of Law Enforcement, the US Coast Guard 11th District, and local enforcement agencies. However, due to the dispersed nature of the fishery over a large area with multiple ports of landing, it is difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Moderately Effective

State, Federal, and Tribal authorities are responsible for enforcement and monitoring of catch to meet goals and objectives of fisheries management. However, the complexity of the fishery involving multiple federal, state, and tribal jurisdictions and landing sites makes it difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Moderately Effective

Enforcement is in place to monitor compliance with regulations. Special regulations in place to reduce impacts to ESA-listed coho salmon include closing the fishery two days per week during the fall coho migration, and prohibition on the sale of coho salmon (Yurok Tribal Council 2013). However, it is unclear whether the level of

enforcement effort is sufficient to control illegal sales of coho salmon. This indicator was judged to be "moderately effective."

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

The management system has a record of enforcement that is judged to be "moderately effective." For example, fishers must be able to demonstrate that their live box meets specific criteria when examined in the field by officials (WDFW 2013). However, the complexity of the fishery involving multiple federal, state, and tribal jurisdictions and landing sites makes it difficult to maintain consistent enforcement effort across the fishery. Therefore the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Moderately Effective

State and Tribal authorities are responsible for enforcement and monitoring of catch to meet goals and objectives of fisheries management. However, the complexity of the fishery involving both state and tribal jurisdictions and multiple landing sites/points of sale make it difficult to maintain consistent enforcement effort across the fishery. Therefore, the effectiveness of enforcement and monitoring is uncertain and this indicator was judged to be "moderately effective."

Criterion 4: Impacts on the habitat and ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.

The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management score. The Criterion 2 rating is determined as follows:

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

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
Oregon / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - North of Cape Falcon	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
Oregon / Northeast Pacific / Trolling lines / United States of America / Coho fishery - North of Cape Falcon	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Columbia River / Drift gillnets / Coho fishery above Bonneville Dam	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Columbia River / Drift gillnets	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Columbia River / Drift gillnets / Chinook fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Columbia River / Drift gillnets / Sockeye fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Columbia River / Gillnets and entangling nets (unspecified) / Coho fishery below Bonneville Dam	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Klamath River / Drift gillnets / Chinook fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)

United States of America / Northeast Pacific / Trolling lines / United States of America / Cape Falcon to Humbug Mt.	5.00: None	0.00: Not Applicable	3.00: Moderate Concern	Green (3.873)
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Cape Falcon to Humbug Mt.	5.00: None	0.00: Not Applicable	3.00: Moderate Concern	Green (3.873)
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Horse Mt. to U.S./Mexico Border	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Northeast Pacific / Trolling lines / United States of America / Chinook fishery - Humbug Mt. to Horse Mt.	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Northeast Pacific / Hand-operated pole-and-lines / United States of America / Cape Falcon to Humbug Mt.	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Puget Sound / Drift gillnets / United States of America / Chinook fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Drift gillnets / United States of America / Chum fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Drift gillnets / United States of America / Coho fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Drift gillnets / United States of America / Pink fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Drift gillnets / United States of America / Sockeye fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Purse seines / United States of America / Chinook fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Purse seines / United States of America / Chum fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Purse seines / United States of America / Coho fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)

United States of America / Puget Sound / Purse seines / United States of America / Pink fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Purse seines / United States of America / Sockeye fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
United States of America / Puget Sound / Trolling lines / United States of America / Chinook fishery	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Puget Sound / Trolling lines / United States of America / Coho fishery	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Puget Sound / Trolling lines / United States of America / Pink fishery	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Puget Sound / Hand-operated pole-and-lines / United States of America	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
United States of America / Puget Sound / Trolling lines / United States of America	5.00: None	0.00: Not Applicable	2.00: High Concern	Yellow (3.162)
Washington / Northeast Pacific / Drift gillnets / United States of America / Chinook fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
Washington / Northeast Pacific / Drift gillnets / United States of America / Chum fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
Washington / Northeast Pacific / Drift gillnets / United States of America / Coho fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)
Washington / Northeast Pacific / Drift gillnets / United States of America / Sockeye fishery	4.00: Very Low Concern	0.25: Minimal Mitigation	2.00: High Concern	Yellow (2.915)

Criterion 4 Assessment

SCORING GUIDELINES

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

- *5 (None) - Fishing gear does not contact the bottom*
- *4 (Very Low) - Vertical line gear*
- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*

- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl) Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

Factor 4.2 - Mitigation of Gear Impacts

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.*
- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats*

Factor 4.3 - Ecosystem-Based Fisheries Management

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators)*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

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

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

None

Salmon troll fishers may fish near the bottom, especially for Chinook salmon, but they attempt to avoid touching the bottom with gear because it could become lost. Based on the low frequency at which gear contacts the seabed, and the low impact level of any contact that does occur, the habitat impact of salmon troll gear is judged to be negligible.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Very Low Concern

Floating gillnets and tangle nets are used which rarely touch the bottom. Therefore, the impacts on substrate are considered "very low" concern.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Very Low Concern

Floating gillnets are used which rarely touch the bottom. In addition, the fishery occurs in the estuary which is primarily sand substrate. Therefore, the impacts on substrate are considered "very low" concern.

UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

None

Salmon troll fishers may fish near the bottom, especially for Chinook salmon, but they attempt to avoid touching the bottom with gear because it could become lost. Based on the low frequency at which gear contacts the seabed, and the low impact level of any contact that does occur, the habitat impact of salmon troll gear is judged to be negligible.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very Low Concern

Gillnets in the Puget Sound salmon fisheries are surface nets that rarely touch bottom substrate. Therefore, gillnets are judged to have "very low" concern regarding impacts to the substrate.

Justification:

Salmon gillnets are sometimes lost and not easily recovered by fishermen, but this issue is not addressed by this Factor. Lost gillnets may continue to catch salmon, birds, and other species (Gilardi et al. 2010) (Good et al. 2010). Although fishermen have incentives to retrieve lost nets, evidence shows that lost nets accumulate over time and they continue to fish. In Puget Sound, where there is an ongoing program to retrieve lost nets, this issue has a "low" concern (Gilardi et al. 2010) (Good et al. 2010).

UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very Low Concern

Purse seines are often fished in relatively deep water and typically do not touch the bottom. Seines are rarely lost and when they are, they do not continue to fish to the extent that gillnets do. This factor is scored "very low" concern.

UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

None

Salmon troll fishers may fish near the bottom, but they attempt to avoid touching the bottom with gear because it could become lost. There is no evidence of a habitat effect due to troll gear. Salmon troll gear is judged to have no conservation concern.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Very Low Concern

Floating gillnets are used which rarely touch the bottom. Therefore, gillnets are judged to have "very low" concern regarding impacts to the substrate.

Justification:

Salmon gillnets are sometimes lost and not easily recovered by fishers, but this issue is not addressed by this factor. Lost gillnets may continue to catch salmon, birds, and other species (Gilardi et al. 2010) (Good et al. 2010). Although fishers have incentives to retrieve lost nets, evidence shows that lost nets accumulate over time and continue to fish. The Washington Department of Fish and Wildlife has an ongoing program to retrieve lost nets, so this issue has a "low" concern (Gilardi et al. 2010) (Good et al. 2010).

Factor 4.2 - Mitigation of Gear Impacts

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

Not Applicable

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Minimal Mitigation

Efforts are underway to change the spatial footprint of commercial fishing in the lower river, but it is unclear whether this will reduce the overall footprint or just change it from the Columbia River mainstem to off-channel locations. Mitigation of gear impacts was judged to be minimal because fishing effort is effectively controlled but not reduced.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

Minimal Mitigation

Commercial fishing is limited to the Klamath River estuary, where effort is effectively controlled but not reduced.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Minimal Mitigation

Gillnets have minimal contact wwith the substrate, and mitigation of this effect is minimal. Fishing effort is controlled but not reduced to limit habitat impacts.

Justification:

Salmon gillnets may be lost by fishermen and may continue to catch salmon and other species. Gillnets are tagged and registered as a means to link nets to the fishermen. Significant effort has been made in recent years to remove derelict gillnets (Gilardi et al. 2010) (Good et al. 2010).

UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Minimal Mitigation

Purse seines have minimal contact wwith the substrate, and mitigation of this effect is minimal. Fishing effort is controlled but not reduced to limit habitat impacts.

UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

Not Applicable

Troll gear has minimal contact with the substrate, and mitigation of this effect is not applicable.

WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

Minimal Mitigation

Commercial fishing effort in this area is effectively controlled but is not being reduced. Efforts are being made to remove derelict gillnets, which are primarily a bycatch concern but may also impact habitat.

Justification:

Salmon gillnets may be lost by fishers and may continue to catch salmon and other species via ghost fishing. Gillnets are tagged and registered as a means to link nets to the fishers. Significant effort has been made in recent years to remove derelict gillnets, particularly in Puget Sound (Gilardi et al. 2010) (Good et al. 2010). Derelict gillnets have also been removed from Grays Harbor and the Quinault area.

Factor 4.3 - Ecosystem-Based Fisheries Management

OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - NORTH OF CAPE FALCON
OREGON / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY - NORTH OF CAPE FALCON
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
WASHINGTON / NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on wild salmon from hatchery practices. The concern stems primarily from genetic and ecological issues (e.g., (Naish et al. 2007)). Managers are aware of these issues and are attempting to investigate and mitigate the problems. For example, the Hatchery Scientific Review Group (HSRG) has assessed individual populations and made hatchery-specific recommendations for improving practices and minimizing negative impacts on wild stocks, and some (but not all) recommendations are being implemented. There are no easy solutions given the desire to support fisheries with large numbers of hatchery salmon. This factor is ranked as a "high" concern.

Justification:

Several scientific review groups have reviewed hatcheries and their impacts on West Coast salmon stocks (CHSRG 2012b) (HSRG 2014). They suggest that management policies and strategies have not been completely effective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:

- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.

- Lack of protocols to prevent in-breeding.
- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.
- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, DRIFT GILLNETS, SOCKEYE FISHERY
UNITED STATES OF AMERICA / COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators such as bears and birds (Helfield and Naiman 2006). They are also an important food source for predators in the ocean such as marine mammals, sharks, and piscivorous fish. For example, abundance of the Southern Resident killer whale population (currently listed as "Endangered") strongly depends on availability of Chinook salmon (Ford et al. 2010b). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning.

Another major concern is negative impacts on wild salmon from hatchery practices, primarily stemming from genetic and ecological issues (e.g., (Naish et al. 2007)). Managers are aware of these issues and are attempting to investigate and mitigate the problems. For example, the Hatchery Scientific Review Group (HSRG) has assessed individual populations and made hatchery-specific recommendations for improving practices and minimizing negative impacts on wild stocks, and some (but not all) recommendations are being implemented. There are no easy solutions given the desire to support fisheries with large numbers of hatchery salmon. Based on designation of these species as "exceptional" and concerns that there can be serious negative impacts from hatchery supplementation in some areas, this factor was scored as a “high” concern.

Justification:

Several scientific review groups have reviewed hatcheries and their impacts on West Coast salmon stocks (CHSRG 2012b) (HSRG 2014). They suggest that management policies and strategies have not been completely effective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:
- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.
- Lack of protocols to prevent in-breeding.
- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.
- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / KLAMATH RIVER, DRIFT GILLNETS, CHINOOK FISHERY

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on ecosystems from hatchery practices. For example, productivity of wild salmon may decrease as the numbers of hatchery-produced juveniles in the system increase (Buhle et al. 2009). The California Hatchery Scientific Review Group (CHSRG) has made hatchery-specific recommendations for improving practices and minimizing negative impacts on wild stocks, and some but not all recommendations are being implemented. The evidence of negative hatchery impacts result in "high" concern for this factor.

Justification:

The California Hatchery Scientific Review Group has conducted scientific reviews of Iron Gate and Trinity River hatcheries and their impacts on Klamath salmon stocks (CHSRG 2012c) (CHSRG 2012d). They suggest that management policies and strategies have been ineffective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:

- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.
- Lack of protocols to prevent in-breeding.
- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.
- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - CAPE FALCON TO HUMBUG MT.

Moderate Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on wild salmon from hatchery practices. The concern stems primarily from genetic and ecological issues (e.g., (Naish et al. 2007)). Managers are aware of these issues, and the Hatchery Scientific Review Group (HSRG) has assessed individual populations and made hatchery-specific recommendations for improving practices and minimizing negative impacts on wild stocks.

On the Oregon coast, hatchery releases of coho salmon were scaled back extensively in the 1990s in an effort to protect wild populations (Buhle et al. 2009). This is a major step for mitigating negative impacts from hatchery supplementation on wild salmon ecosystems that has not been implemented in the other fisheries

assessed in this report. Thus this factor was ranked as a "moderate" concern.

Justification:

Several scientific review groups have reviewed hatcheries and their impacts on West Coast salmon stocks (CHSRG 2012b) (HSRG 2014). They suggest that management policies and strategies have not been completely effective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:

- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.
- Lack of protocols to prevent in-breeding.
- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.
- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HORSE MT. TO U.S./MEXICO BORDER
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY - HUMBUG MT. TO HORSE MT.
UNITED STATES OF AMERICA / NORTHEAST PACIFIC, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA, CAPE FALCON TO HUMBUG MT.

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on ecosystems from hatchery practices. For example, productivity of wild salmon may decrease as the numbers of hatchery-produced juveniles in the system increase (Buhle et al. 2009). The California Hatchery Scientific Review Group (CHSRG) has made hatchery-specific recommendations for improving practices and minimizing negative impacts on wild stocks, but not all recommendations are being implemented. The evidence of negative hatchery impacts result in "high" concern for this factor.

Justification:

The CHSRG has conducted scientific reviews of Iron Gate and Trinity River hatcheries and their impacts on Klamath salmon stocks (CHSRG 2012c) (CHSRG 2012d). They suggest that management policies and strategies have been ineffective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:

- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.
- Lack of protocols to prevent in-breeding.

- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.
- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, SOCKEYE FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on wild salmon from hatchery practices. The concern stems primarily from genetic and ecological issues (e.g., (Naish et al. 2007)). Co-managers are aware of these issues and they are attempting to investigate and mitigate the problems (WDFW and PSIT 2014), but there are no easy solutions given the desire to support fisheries with large numbers of hatchery salmon. This factor is ranked as a “high” concern.

Justification:

Several scientific review groups have reviewed hatcheries and their impacts on West Coast salmon stocks (CHSRG 2012b) (HSRG 2014). They suggest that management policies and strategies have not been completely effective in preventing negative hatchery impacts on the freshwater ecosystem. Examples of problems with hatchery programs are listed below:
- Hatchery broodstocks not representative of naturally spawning, locally adapted populations.
- Cross breeding of different run-types in the hatchery broodstock.
- Failure to include representative age-classes in the hatchery broodstock.
- Lack of protocols to prevent in-breeding.
- Releasing juveniles in locations away from the hatchery (such as the estuary) that increase stray rates.

- Excessive numbers of hatchery-origin fish in natural spawning areas.
- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

UNITED STATES OF AMERICA / PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA / PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA

High Concern

Salmon are considered a species of exceptional importance because they are a keystone species in freshwater systems, providing an annual pulse of marine-derived nutrients and food for predators (Helfield and Naiman 2006). Research on ecosystem and food web impacts of salmon harvest is being conducted, although fishery management does not have explicit policies for protecting ecosystem functioning. However, a large concern is negative impacts on wild salmon from hatchery practices. The concern stems primarily from genetic and ecological issues (e.g., (Naish et al. 2007)). Co-managers are aware of these issues and they are attempting to investigate and mitigate the problems (WDFW and PSIT 2014) but there are no easy solutions, given the desire to support fisheries with large numbers of hatchery salmon. This factor is ranked as a "high" concern.

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- Lack of formal health policy for hatchery operations.
- Inadequate monitoring and evaluation programs.

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Appendix A: Extra By Catch Species

CHUM SALMON / MINOR STOCK

Factor 2.1 - Inherent Vulnerability

WASHINGTON/NORTHEAST PACIFIC, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/PUGET SOUND, HAND-OPERATED POLE-AND-LINES, UNITED STATES OF AMERICA
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for chum salmon is 49, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Chum salmon have "medium" vulnerability because although they are a relatively large salmon, they have the widest natural geographic distribution of all Pacific salmon species.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

Very High Concern

Hood Canal summer chum salmon have undergone a significant decline in abundance, leading to listing as "Threatened" species under the Endangered Species Act. This ESU includes summer chum in the Strait of Juan de Fuca. Hood Canal summer chum have increased from less than 1,000 spawners in the early 1990s to 10,000 to 60,000 in the early 2000s, and to 7,000 to 30,000 during 2009 to 2012 (WDFW 2014b). Abundance has improved, in part, from conservation hatchery efforts, i.e., hatchery propagation specifically designed to

improve summer chum status rather than to provide some harvest (WDFW 2013) (WDFW 2014b) (WDFW and Point No Point Treaty Tribes 2000). The abundance of Hood Canal summer chum is judged to have a "very high" conservation concern, since it remains listed as "Threatened" under ESA.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Very High Concern

Columbia River chum salmon are listed as a "Threatened" stock under the Endangered Species Act. Thus, concern regarding population status is "very high."

Justification:

Most chum salmon production occurs in the Grays River in Washington, smaller tributaries downstream from Bonneville Dam, and some specific locations within the mainstem Columbia River (Joint Columbia River Management Staff 2014a). Returns are primarily from natural production, but four hatchery enhancement programs contribute to the chum population. Chum salmon return to the lower Columbia River from early October through mid-December, so bycatch likely occurs only during late fall and winter fisheries. Historically, chum salmon abundance has been monitored as number of fish per mile, but the reporting metric was switched to spawner estimates starting in 2013.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

Low Concern

The fisheries management goal for ESA-listed summer chum in Puget Sound is to keep fishing mortality to less than 10%. During 2003 to 2012, fishing mortality of Hood Canal summer chum averaged 9% per year, whereas the fishing mortality of Strait of Juan de Fuca summer chum was less than 1% (WDFW 2013) (WDFW 2014b). As noted previously, abundance of summer chum has increased over time. Based on improved abundance and low harvest rates on summer chum, fishing mortality is judged to have a "low" conservation concern.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

Low Concern

The fisheries management goal for ESA-listed summer chum in Puget Sound is to keep fishing mortality to less than 10%. During 2003 to 2012, fishing mortality of Hood Canal summer chum averaged 9% per year whereas the fishing mortality of Strait of Juan de Fuca summer chum was less than 1% (WDFW 2013) (WDFW 2014b). As noted previously, abundance of summer chum has increased over time. Based on improved abundance and low harvest rates on summer chum, fishing mortality is judged to have a "low" conservation concern.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Low Concern

Columbia River chum are listed as "Threatened" under the Endangered Species Act. Columbia River non-treaty commercial fisheries are limited to a 5% harvest rate on this stock, and in 2013 the exploitation rate was 1.9% (Joint Columbia River Management Staff 2014a). Treaty commercial fisheries do not impact this stock, and the 2008 NMFS Biological Opinion suggested that overall harvest of Columbia River chum is negligible (NMFS 2008). Available escapement data suggest that chum escapements have been low, but somewhat cyclical, peaking in 2002–2004 and again in 2011–2012 (Joint Columbia River Management Staff 2014a). Conservation concern was rated "low" because fishing mortality is probably at a sustainable level, and the stock appears stable.

Justification:

Chum salmon return to the lower Columbia River from early October through mid-December, so bycatch likely occurs only during late fall and winter fisheries. Reported catches suggest that almost no chum are caught in fall fisheries, when coho and the majority of Chinook are harvested (Joint Columbia River Management Staff 2014a).

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHUM FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHUM FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

< 20%

Columbia River tangle net fisheries below Bonneville Dam are mark-selective (releasing unmarked, wild-origin fish), which utilize recovery boxes to allow fish to recover before being released. Estimated incidental

mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

PINK SALMON

Factor 2.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Medium

The FishBase vulnerability score for pink salmon is 37, making inherent vulnerability "medium." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005). Pink salmon have medium to low vulnerability because this species matures quickly and has a relatively small body size. They have homogenous life history characteristics and are widely distributed.

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Very Low Concern

Pink salmon return to Puget Sound primarily in odd-numbered years owing to their two-year life cycle. They are the most abundant salmon species in Puget Sound with annual abundances up to 10 million salmon in recent years (PFMC 2014a). Hatchery pink salmon production is very small, typically less than 1% of the total. Spawning escapement goals have been established for most but not all the areas. The goals have been met or exceeded 75% of the past fifteen years. Given the high abundance (Fig. 23) and lack of hatchery fish on the spawning grounds, the abundance of Puget Sound pink salmon is judged to have a "very low" conservation concern.

Justification:

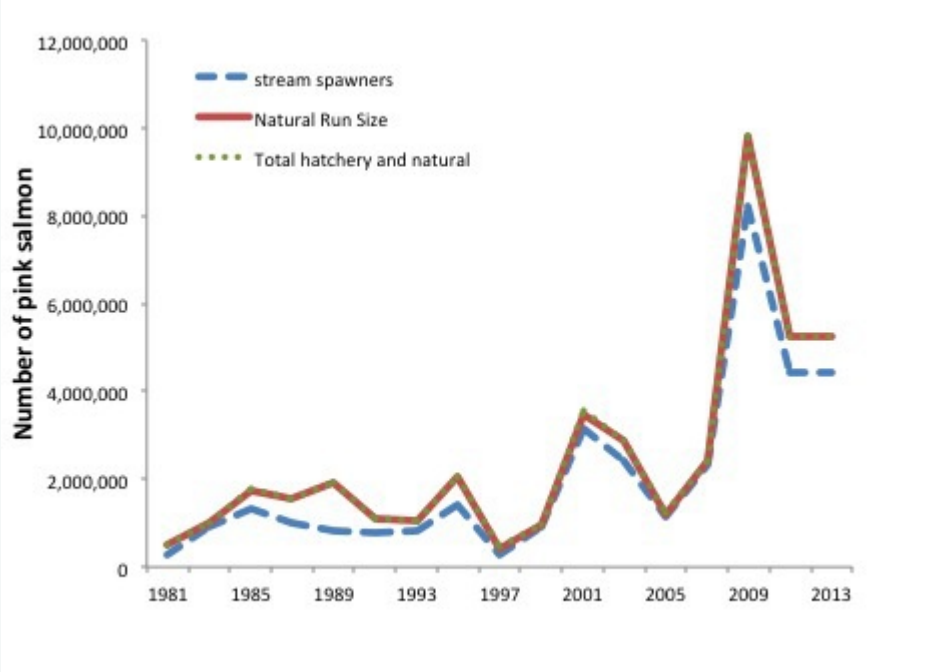


Figure 53: Abundance of pink salmon returning to Puget Sound, 1981-2013. Only odd years are shown because very few return in even years.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, PINK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, PINK FISHERY

Very Low Concern

Pink salmon are the most abundant salmon species in Puget Sound with annual abundances up to 10 million salmon in recent years(PFMC 2014a). Hatchery pink salmon production is very small, typically less than 1% of the total. Abundance has been increasing during the past 10 or more years. Given the high abundance and lack of hatchery fish on the spawning grounds, fishing mortality of Puget Sound pink salmon is judged to have a "very low" conservation concern.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%.

The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

STEELHEAD / MINOR STOCK

Factor 2.1 - Inherent Vulnerability

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Medium

The FishBase vulnerability score for steelhead salmon is 36, making inherent vulnerability "moderate." The FishBase score is based on life history traits and ecological characteristics including maximum length, age at first maturity, and geographic range (Cheung et al. 2005).

Factor 2.2 - Abundance

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY

Very High Concern

From 1985 to 2009, Puget Sound winter-run steelhead abundance has shown a widespread declining trend over much of the Distinct Population Segment (DPS). During 2005 to 2009, abundance was low throughout the DPS; seven of 15 monitored populations had geometric mean annual abundances of less than 250 steelhead and only three populations had geometric means that exceeded 500 steelhead (Ford et al. 2011). Puget Sound steelhead, which might be incidentally captured in Puget Sound salmon fisheries, were listed as "Threatened"

under the Endangered Species Act in May 2007. Therefore, the conservation concern was rated "very high."

Justification:

ESA-listed species that might be incidentally captured in Puget Sound salmon fisheries in addition to Puget Sound Chinook and steelhead include Hood Canal summer chum, Ozette Lake sockeye salmon, southern DPS of green sturgeon, bocaccio, canary rockfish, yelloweye rockfish, and marbled murrelet (NMFS 2014) (US FWS 2014). The conservation concern for all of these species is "very high," but the susceptibility of the species to salmon fishing is relatively low.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Very High Concern

Five steelhead evolutionarily significant units (ESUs) associated with the Columbia River are listed under the Endangered Species Act: Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, and Snake River basin steelhead. All five ESUs are listed as "Threatened," and thus conservation concern regarding population status is "very high." The status of these ESUs was last reviewed in 2011, and signs of recovery were not reported.

Factor 2.3 - Fishing Mortality

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY

Very Low Concern

Puget Sound steelhead are impacted in terminal tribal gillnet fisheries and in recreational fisheries (Ford et al. 2011), but relatively few steelhead are taken in the purse seine fisheries (non treaty fisheries cannot sell steelhead). We provide information on the gillnet fishery for reference. In tribal gillnet fisheries, most fishery impacts occur in fisheries directed at salmon and hatchery steelhead. Gillnet exploitation rates on natural steelhead in recent years have been stable and generally less than 5% in Puget Sound. This includes tribal fisheries that target hatchery steelhead. In Hood Canal fisheries, the gillnet harvest rate on steelhead averaged less than 2.6% during 2002 to 2012 (Point No Point Tribes 2013). The conservation concern related to purse seine and troll fishing mortality on steelhead during fisheries targeting salmon is judged to be "very low" because it is probable that fishing mortality is sufficiently low to allow the population to maintain itself or rebuild once other issues such as habitat are addressed.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

Low Concern

Puget Sound steelhead are impacted in terminal tribal gillnet fisheries and in recreational fisheries (Ford et al.

2011). In tribal net fisheries, most fishery impacts occur in fisheries directed at salmon and hatchery steelhead. Exploitation rates on natural steelhead in recent years have been stable and generally less than 5% in Puget Sound. In Hood Canal fisheries, the harvest rate on steelhead averaged less than 2.6% during 2002 to 2012 (Point No Point Tribes 2013). The conservation concern related to fishing mortality on steelhead during fisheries targeting salmon is judged to be "low" because it is probable that fishing mortality is sufficiently low to allow the population to maintain itself or rebuild once other issues such as habitat are addressed. The concern is not ranked as "very low" because there is some uncertainty in steelhead catch in gillnets and because the impact in gillnet fisheries is likely somewhat higher than that in purse seine and troll fisheries, which are judged to have "very low" concern.

Justification:

Puget Sound steelhead are impacted in terminal tribal gillnet fisheries and in recreational fisheries (Ford et al. 2011). Steelhead fisheries are directed at hatchery stocks, but some harvest of natural-origin steelhead occurs as incidental to hatchery directed fisheries. Winter-run hatchery steelhead production is primarily of Chambers Creek (southern Puget Sound) stock, which has been selected for earlier run timing than natural stocks to minimize fishery interactions. Hatchery production of summer steelhead is primarily of Skamania River (a lower Columbia River tributary) stock, which has been selected for earlier spawn timing than natural summer steelhead to minimize interactions on the spawning grounds. In recreational fisheries, retention of wild steelhead is prohibited, so all harvest impacts occur as the result of release mortality and non-compliance. In tribal net fisheries, most fishery impacts occur in fisheries directed at salmon and hatchery steelhead. Most Puget Sound streams have insufficient catch and escapement data to calculate exploitation rates for natural steelhead. Populations with sufficient data include the Skagit, Green, Nisqually, Puyallup, and Snohomish rivers. Exploitation rates differ widely among the different rivers, but all have declined since the 1970s and 1980s. Exploitation rates on natural steelhead in recent years have been stable and generally less than 5%. In Hood Canal fisheries, the harvest rate on steelhead averaged less than 2.6% during 2002 to 2012 (Point No Point Tribes 2013).

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

Low Concern

Five Columbia River steelhead evolutionarily significant units (ESUs) are listed under the Endangered Species Act: Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, and Snake River basin steelhead. These ESUs include both winter- and summer-run steelhead. Wild (unmarked) steelhead are released in non-Indian fisheries conducted during the winter season, because all winter-run steelhead are listed under the ESA (Joint Columbia River Management Staff 2014b). The fishery impact rate limit on winter steelhead is 2% per year. There are also minimum net mesh size restrictions to reduce incidental capture of steelhead, and incidental mortality is estimated (Joint Columbia River Management Staff 2014b). However, some tribal fisheries may retain wild steelhead, and steelhead may be caught in commercial fisheries for spring Chinook.

Abundance estimates, which are categorized by run type, suggest that wild steelhead numbers in the Columbia River are stable. The abundance of wild winter steelhead was high from 2001 to 2004 and has since been stable at a lower level (Fig. 32) (Joint Columbia River Management Staff 2014b). Escapement estimates for wild summer steelhead appear cyclical, with abundances peaking in 2001 and 2009 (Fig. 33) (Joint Columbia River Management Staff 2014b). Because fishing mortality is probably at a sustainable level, and population trends are stable, conservation concern was rated "low."

Justification:

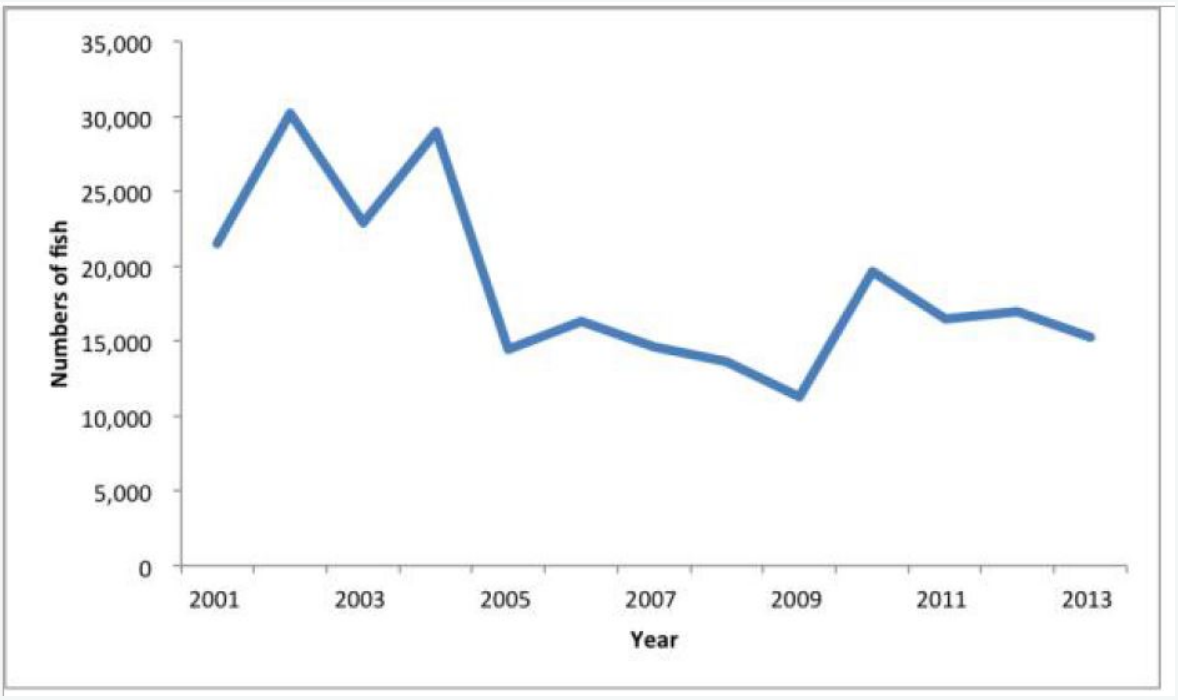


Figure 54: Estimated returns of wild Columbia River winter steelhead over time. Data from Table 11 in the 2014 Joint Columbia River Management Staff Report (Joint Columbia River Management Staff 2014b).

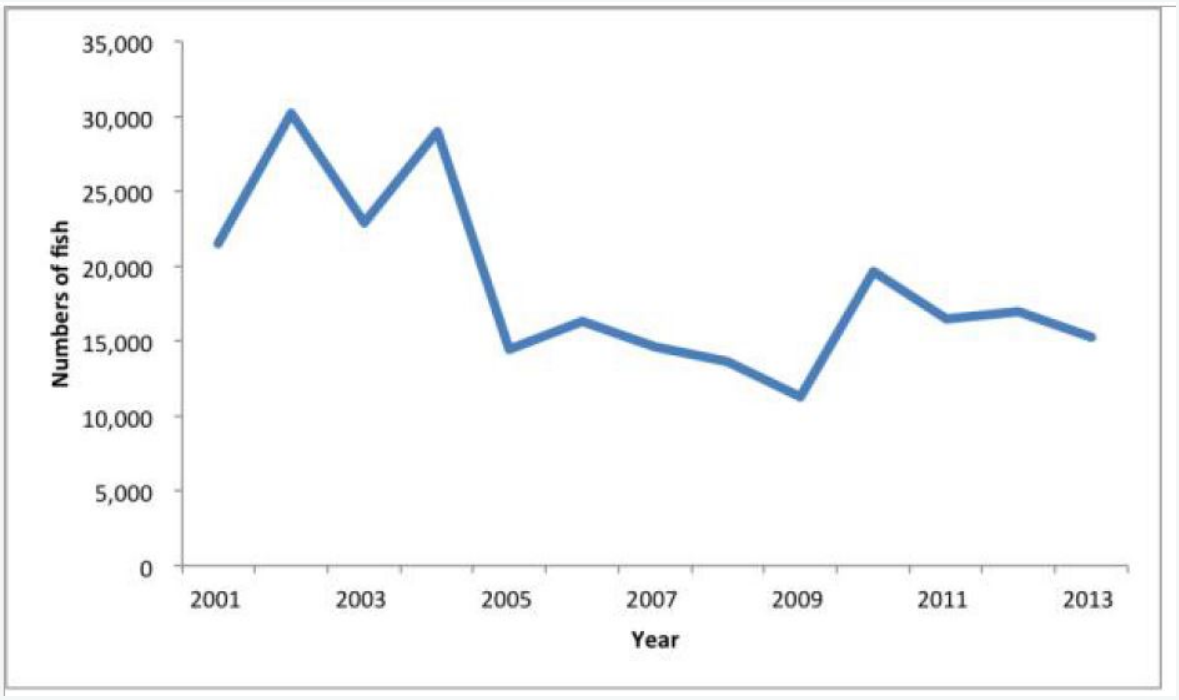


Figure 55: Estimated numbers of wild Columbia River summer steelhead passing Bonneville Dam each year. Data from Table 12 in the Joint Columbia River Management Staff Report (Joint Columbia River Management Staff 2014b).

The two basic run types of steelhead are winter- and summer-run. Upper Columbia River and Snake River

steelhead are generally classified as summer-run. Middle Columbia River steelhead are predominantly summer-run, but winter-run fish are found in two tributaries (Klickitat River and Fifteenmile Creek). The Lower Columbia River and Upper Willamette River steelhead ESUs include both summer- and winter-run fish.

UNITED STATES OF AMERICA/COLUMBIA RIVER, GILLNETS AND ENTANGLING NETS (UNSPECIFIED), COHO FISHERY BELOW BONNEVILLE DAM

Very Low Concern

Five Columbia River steelhead evolutionarily significant units (ESUs) are listed under the Endangered Species Act: Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, and Snake River basin steelhead. These ESUs include both winter- and summer-run steelhead. Wild (unmarked) steelhead are released in non-treaty fisheries conducted during the winter season, because all winter-run steelhead are listed under the ESA (Joint Columbia River Management Staff 2014b). The fishery impact rate limit on winter steelhead is 2% per year. There are also minimum net mesh size restrictions to reduce incidental capture of steelhead, and incidental mortality is estimated (Joint Columbia River Management Staff 2014b).

Abundance estimates, which are categorized by run type, suggest that wild steelhead numbers in the Columbia River are stable. The abundance of wild winter steelhead was high from 2001 to 2004 and has since been stable at a lower level (Fig. 32) (Joint Columbia River Management Staff 2014b). Escapement estimates for wild summer steelhead appear cyclical, with abundances peaking in 2001 and 2009 (Fig. 33) (Joint Columbia River Management Staff 2014b). Because wild (unmarked) fish must be returned in non-treaty fisheries below Bonneville Dam (zones 1 to 5) and therefore fishing mortality is likely minimized to the extent possible, fishing mortality is considered a "very low" concern.

Factor 2.4 - Discard Rate

UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, TROLLING LINES, UNITED STATES OF AMERICA, COHO FISHERY

< 20%

The Puget Sound troll fishery (Strait of Juan de Fuca) typically retains all salmon species while targeting Chinook or coho salmon. However, during some periods and locations, chum or coho salmon must be released (WDFW and NWIFC 2015). Overall, although discard data are not readily available, discards likely represent much less than 20% of the total catch.

UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, DRIFT GILLNETS, UNITED STATES OF AMERICA, COHO FISHERY

< 20%

The great majority of fish captured by gillnet are retained; therefore, the discard rate is considerably less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the ESA-listed marbled murrelet, and some salmon species at specific times and locations. For example, a seabird strip is used in gillnets during sockeye fisheries in Area 7/7A (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife. 2010.) (WDFW and PSIT 2013) (WDFW 2013). Some salmon species must be released from gillnets in specific locations and time periods, e.g., Chinook and coho in area 7/7A and Chinook and chum in

area 12A. Gillnet fisheries using this strategy are typically limited to short duration sets (60 or 90 minutes). Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, CHINOOK FISHERY
UNITED STATES OF AMERICA/PUGET SOUND, PURSE SEINES, UNITED STATES OF AMERICA, COHO FISHERY

< 20%

The great majority of fish captured by purse seine are retained, therefore the discard rate is less than 20%. The management system has a strategy to reduce bycatch of seabirds, such as the marbled murrelet, and specific salmon species at specific times and locations (Puget Sound Indian Tribes and the Washington Department of Fish and Wildlife 2010) (WDFW 2013). For example, a seabird strip is used in seines during sockeye and pink salmon fisheries. Some salmon species must be released from seines in specific locations and time periods. Seines are often required to use brailers as a means to reduce injury. Prior to release, salmon must be revived in functional live-boxes. In some areas, on-board observers are required to monitor bycatch. Catch and release mortality is estimated and considered in the management of the fishery.

UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, CHINOOK FISHERY
UNITED STATES OF AMERICA/COLUMBIA RIVER, DRIFT GILLNETS, COHO FISHERY ABOVE BONNEVILLE DAM

< 20%

Most Columbia River gillnet fisheries are not mark-selective (releasing unmarked, wild-origin fish), so the majority of fish are retained. There are some exceptions, such as commercial spring Chinook tangle net fisheries that are required to release unmarked spring Chinook. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

A study by the Independent Fisheries Science Panel estimated Chinook release mortality rates for gillnets and tangle nets in Grays Harbor and Willapa Bay. Assuming 90% compliance with fishery regulations, which would be consistent with observer data and testimonies from commercial fishermen, estimated rates were 31% for tangle nets, 56% for small mesh gillnets, and 62% for large mesh gillnets (IFSP 2014). These rates did not include drop-off mortality.

Appendix B: Review Schedule

This report was updated in July 2019 with the addition of a new rating for Coho salmon caught downstream of Bonneville Dam on the Columbia River. This new rating was created based on new data provided to Seafood Watch by Washington Department of Fish and Wildlife which demonstrated that the fisheries in the mainstem of the Columbia River downstream of Bonneville Dam, and in 'select area' fisheries off the mainstem, targeted hatchery-origin fish and had minimal impact on the Endangered coho stocks present in the Columbia River. The new rating considers coho caught in these fisheries to be a Good Alternative. The fisheries upstream of the Bonneville Dam remain an Avoid due to potential impacts on Endangered and Threatened runs of coho and other salmon species.

< 20%

Columbia River tangle net fisheries below Bonneville Dam are mark-selective (releasing unmarked, wild-origin fish), which utilize recovery boxes to allow fish to recover before being released. Estimated incidental mortality in 2012 Columbia River fisheries was 13,672 fish, and 245,140 fish were landed (PSC 2013b), making the overall discard rate less than 20%.

Justification:

The Willamette River spring Chinook Fishery Management Evaluation Plan requires release of unmarked spring Chinook to minimize fishery impacts on this ESA-listed, threatened stock. Thus a non-treaty, mark-selective spring Chinook commercial fishery using tangle nets was implemented starting in 2001 (Joint Columbia River Management Staff 2014a). The tangle net fishery had live-capture fishing regulations such as a 3.75-inch maximum mesh size and 30-minute maximum soak time. Preliminary data from the 2014 non-treaty Columbia River spring Chinook fishery indicated that 5,751 fish were handled, 3,557 fish were harvested, and 2,194 fish were released (R. Roler, personal communication). Treaty fisheries in the Columbia River are not mark-selective.

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