Public Comment Draft

Puget Sound Chinook Salmon

Washington Department of Fish and Wildlife

September 20, 2021

Cover Photos:

Top: Governor's Salmon Recovery Office

Second Row, Left: R. Blomker, WDFW

Second Row, Right: J. McMillan

Executive Summary

Chinook Salmon are the king of the Pacific salmon. Prized for their large size and strength, flavor and nutritional value, they are an icon of Pacific Northwest culture. The largest of the Pacific salmon, they were once common throughout the Puget Sound region, with as many as 690,000 returning from early summer through late fall. Dwindling returns, habitat degradation, historically high fishery harvest rates, and other factors resulted in the listing of Puget Sound Chinook salmon as a threatened species under the Endangered Species Act (ESA) in 1999.

Despite the ESA-listing and the subsequent development of a recovery plan, the status of Puget Sound Chinook Salmon is of increasing concern. The 2020 State of Salmon report categorized Puget Sound Chinook Salmon as "In Crisis" due to the gap between the number of spawners and recovery goals, the slow progress in closing that gap, and the limited likelihood of progress in the near future.

"Puget Sound Chinook Salmon are in trouble, but recovery is still possible—if we take bold and meaningful action now."

Kelly Susewind, Director

The Washington Department of Fish and Wildlife (WDFW) is now investing staff and resources in an expanded effort to conserve and rebuild Puget Sound Chinook Salmon runs. These efforts include support for improvements in habitat protection to ensure that Chinook Salmon have the clean, productive, pollutant-free river and estuarine waters essential for their survival. We are working with our recovery partners to increase funding for habitat restoration and minimize impediments to accelerated implementation of habitat restoration projects. We are also working with the tribal co-managers to develop and submit to the National Marine Fisheries Service (NMFS) a long-term fishery plan.

In this document we have compiled and summarized information that we believe will help inform our efforts to conserve and rebuild Puget Sound Chinook Salmon runs and develop the long-term fishery plan. We have focused on habitat protection and restoration because of its fundamental importance to the rebuilding of Puget Sound Chinook Salmon runs. Habitat degradation and climate change are the most important factors reducing the productivity and survival of Puget Sound Chinook Salmon. We have also included substantial information on fisheries because of the current effort to develop a long-term fishery management plan. Although we recognize the importance of hatchery programs, much of the essential information for that topic was presented and discussed during the recently completed, extensive public process that resulted in adoption by the Fish and Wildlife Commission of a new policy regarding hatchery programs.

We are asking for your assistance to review this document and provide your suggestions and comments on the following:

1) Are we missing important information? If so, what additional information would be important to include, and where might we find that information?
2) Are there errors in the information that we have summarized? If so, please identify those errors and the source of more accurate information.
3) Are there new approaches to the management of recreational and nontreaty commercial fisheries that WDFW should consider as we develop and implement the long-term fishery plan?

We look forward to receiving your comments, updating the document, and using this information to help us develop and implement with our partners improved strategies to conserve and rebuild Puget Sound Chinook Salmon runs.

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List of Abbreviations

ACL	annual catch limit
AEQ	adult equivalent
APA	Administrative Procedure Act
BA	Biological Assessment
BIA	Bureau of Indian Affairs
BiOp	Biological Opinion
BMP	best management practices
BRT	Biological Review Team
CEQ	Council of Environmental Quality
CERC	critical exploitation rate ceiling
CFR	Code of Federal Regulations
CWT	coded-wire tag
DIP	demographically independent population
DOI	U.S. Department of the Interior
DPS	distinct population segment
EA	Environmental Assessment
EEZ	exclusive economic zone (from 3-200 miles from shore)
EFH	essential fish habitat
EIS	Environmental Impact Statement
ER	exploitation rate
ERC	exploitation rate ceiling
ERD	NMFS' s evaluation and recommended determination (on a RMP)
ESA	Endangered Species Act ESU evolutionarily significant unit
FAB	Fisheries Advisory Board
FMCS	Federal Mediation and Conciliation Service
FMEP	fishery management and evaluation plan
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FRAM	Fishery Regulation Assessment Model
FWS	U.S. Fish & Wildlife Service
HCSMP	Hood Canal Salmon Management Plan
HGMP	Hatchery and Genetic Management Plan
HOR	hatchery origin recruit
HR	harvest rate
HSRG	Hatchery Scientific Review Group

ITS	incidental take statement
JDF	Strait of Juan de Fuca (also SJF)
LAT	low abundance threshold
LOAF	list of agreed fisheries
MPG	major population group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSF	mark selective fishery
MSH	maximum sustainable harvest
MSY	maximum sustainable yield
MU	management unit
MUP	Management Unit Profile (also Management Unit Status Profile)
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NOF	North of Falcon
NOR	natural origin recruit
NWFS	Northwest Fisheries Science Center
NWIFC	Northwest Indian Fisheries Commission
OY	optimum yield
PBF	physical and biological features
PCE	primary constituent element(s)
PDO	Pacific Decadal Oscillation
PFMC	Pacific Fishery Management Council
PSC	Pacific Salmon Commission
PSSMP	Puget Sound Salmon Management Plan
PST	Pacific Salmon Treaty
PSTIT	Puget Sound Treaty Indian Tribes
PSTRT	Puget Sound Technical Recovery Team
PT	pre-terminal
PTSUS	pre-terminal Southern U.S.
PVA	population viability assessment
RAP	risk assessment procedure
RCA	rockfish conservation area
RER	rebuilding exploitation rate
RM&E	research monitoring and evaluation
RMP	Resource Management Plan
ROD	record of decision

RPA	reasonable and prudent alternative
R/S	returns-per-spawner (also recruits-per-spawner)
RSMP	Regional Salmon Management Plan
SAR	smolt-to-adult return
SASSI	Salmon and Steelhead Stock Inventory
SJF	Strait of Juan de Fuca (also JDF)
SRKW	southern resident killer whale
SSC	Scientific and Statistical Committee
SSRA	Salmon Spawning & Recovery Alliance
STT	Salmon Technical Team
SUS	Southern United States
TAC	total allowable catch
TAMM	Terminal Area Management Module
TRT	Technical Recovery Team
U&A	usual and accustomed fishing grounds and stations
UMT	upper management threshold
VSP	viable salmonid population
WDFW	Washington Department of Fish and Wildlife

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Chapter 1. Introduction

Key Points:

1) Dwindling returns, habitat degradation, historically high fishery harvest rates, and other factors resulted in the listing of Puget Sound Chinook Salmon as a threatened species in 1999.
2) The 2020 State of Salmon report categorized Puget Sound Chinook Salmon as "In Crisis" due to the gap between the number of spawners and recovery goals, the slow progress in closing that gap, and the limited likelihood of progress in the near future.
3) WDFW is investing in expanded efforts to conserve and rebuild Puget Sound Chinook Salmon runs. These efforts include support for improvements in habitat protection and accelerating habitat restoration.
4) WDFW is also working with the tribal co-managers to develop a long-term fishery plan that is intended to not impede rebuilding of Puget Sound Chinook Salmon while providing some fishing opportunities.
5) We have compiled information to inform our efforts to conserve and rebuild Puget Sound Chinook Salmon, develop the long-term fishery plan, and manage fisheries, and are asking for your assistance in determining if the information is accurate and complete.

"To be from the Northwest is to know salmon and orca as part of our landscape and our shared heritage – and we must dedicate ourselves to their protection."

Governor Jay Inslee
August 5, 2021

Photo: John McMillan

1.1. King of Pacific Salmon

Chinook Salmon are the king of the Pacific salmon. Prized for their large size and strength, flavor and nutritional value, they are an icon of Pacific Northwest culture. The largest of the Pacific salmon, they were once common throughout the Puget Sound region, with as many as 690,000 returning from early summer through late fall (Myers et al. 1998).

Dwindling returns, habitat degradation, historically high fishery harvest rates, and other factors resulted in the listing of Puget Sound Chinook Salmon as a threatened species under the Endangered Species Act (ESA) in 1999 (64 FR 14308; March 24, 1999). As a result, any action that would harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect (collectively referred to as "take") an ESA-protected Puget Sound Chinook Salmon is now prohibited.

Despite the ESA-listing and the subsequent development of a recovery plan (NMFS 2006), the status of Puget Sound Chinook Salmon is of increasing concern. Every two years the Governor's Salmon Recovery Office assesses the status of ESA-listed salmonids in Washington State (see 2020 State of Salmon). The 2020 State of Salmon report categorized Puget Sound Chinook Salmon as "In Crisis" due to the gap between the number of spawners and recovery goals, the slow progress in closing that gap, and the limited likelihood of progress in the near future.

The Washington Department of Fish and Wildlife (WDFW) is investing staff and resources in an expanded effort to conserve and rebuild Puget Sound Chinook Salmon runs. These efforts include support for improvements in habitat protection to ensure that Chinook Salmon have the clean, productive, pollutant-free river and estuarine waters essential for their survival. We are working with our recovery partners to increase funding for habitat restoration and minimize impediments to accelerated implementation of habitat restoration projects.

WDFW is also working with the tribal co-managers to develop and submit to the National Marine Fisheries Service (NMFS) a long-term fishery plan. The fundamental intent of the plan is to not impede rebuilding of Puget Sound Chinook Salmon, enable harvest of strong, productive stocks of Chinook Salmon and other salmon species, and minimize fishery-related mortalities of weak or critically depressed Chinook Salmon stocks. As with the 2010 fishery plan approved by NMFS (PSIT and WDFW 2010), we anticipate that providing adequate conservation of weak stocks will necessitate foregoing the harvest of stronger stocks.

One way to secure ESA coverage for a fishery is through the submission and implementation of a fishery Resource Management Plan (RMP) that NMFS concludes meets criteria identified in federal rules. These criteria include a requirement that implementation of the plan "will not appreciably reduce the likelihood of survival and recovery" of Puget Sound Chinook Salmon. WDFW and the co-manager tribes are now working on a RMP that is intended to meet those criteria, provide certainty on management objectives, and result in long-term ESA coverage.

1.2. Our Request for Your Help

In this document we have compiled and summarized information that we believe will help inform our efforts to conserve and rebuild Puget Sound Chinook Salmon runs and develop the fishery RMP. The rebuilding of Puget Sound Chinook Salmon and the development of the fishery RMP are challenging tasks that require consideration of diverse factors. These factors include WDFW's authorizing environment (Chapter 2), treaties between the United States and the tribes and associated federal court orders (Chapter 3), stressors and habitat protection (Chapter 4), the Puget Sound Chinook Recovery Plan (Chapter 5), coastwide fishery management forums (Chapter 6), Puget Sound fisheries (Chapter 7), requirements for ESA-coverage (Chapter 8), watershed specific information on habitat and Chinook Salmon (Chapters 8-13), and Southern Resident Killer Whales (SRKWs) (Chapter 14).

Admittedly there is substantially more information available on the vast topic of salmon conservation and recovery than we have been able to collect and summarize in this document. We have focused on habitat because of its fundamental importance to the rebuilding of Puget Sound Chinook Salmon runs. Habitat degradation and climate change are the most important factors reducing the productivity and survival of Puget Sound Chinook Salmon. We have also included substantial information on fisheries because of the current effort to develop a long-term fishery management plan. Although we recognize the importance of hatchery programs, much of the essential information for that topic was presented and discussed

during the recently completed, extensive public process that resulted in adoption by the Fish and Wildlife Commission of a new policy regarding hatchery programs (the policy and related information can be found at WDFW Hatchery Policy). Information on specific hatchery programs can be found in the biological opinions and other documents associated with securing ESA-coverage for hatchery programs (e.g., Duwamish-Green Hatchery EIS) or on the WDFW webpage (WDFW Hatcheries).

We are asking for your assistance to review this document and provide your suggestions and comments on the following:

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We look forward to receiving your comments, updating the document, and using this information to help us develop and implement with our partners improved strategies to conserve and rebuild Puget Sound Chinook Salmon runs.

Chapter 2. WDFW Authorizing Environment

Key Points:

1) Puget Sound salmon fisheries are co-managed with the treaty tribes.
2) WDFW's primary state mandate is to "preserve, protect, and perpetuate" the fish and wildlife resources of Washington.
3) The Fish and Wildlife Commission has provided policy guidance that includes:
   a. Fisheries will be managed to meet or exceed ESA, recovery, and conservation goals; and harvest management measures will protect and promote the long-term well-being of the commercial and recreational fisheries.
   b. The Puget Sound harvest management objectives for Chinook and Coho stocks, in priority order, are to: (i) provided meaningful recreational fishing opportunities; and (ii) identify and provide opportunities for commercial harvest.
   c. Selective fishing methods and gears that maximize fishing opportunity and minimize impacts on depressed stocks will be utilized to the fullest extent possible taking into consideration legal constraints on implementation and budgetary limits associated with required sampling, monitoring and enforcement programs.

"The commission, director, and the department shall preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish in state waters and offshore waters."

RCW 77.04.012

"Fisheries will be managed to meet or exceed ESA, recovery, and conservation goals"

North of Falcon Policy

Photo Source: Bellevue Stream Team

2.1. WDFW Mandate

Puget Sound salmon fisheries are co-managed with the treaty tribes[1] to address international obligations, federal court orders, federal statutes and rules, state statutes and rules, and other legal obligations. We focus in this section on the state authorizing environment while Chapter 3 addresses co-management with the treaty tribes.

WDFW is comprised of a Fish and Wildlife Commission (Commission or FWC) appointed by the Governor with the advice and consent of the Washington State Senate (RCW 77.04.030). The FWC appoints the Director of WDFW. Given this

[1] We use the phrase "treaty tribes" to identify those Pacific Northwest tribes that have treaty-reserved fishing rights in off-reservation waters described in *United States v. Washington* or *United States v. Oregon*. See Chapter 3 for additional discussion.

structure, the Department is not a formal part of the Governor's Executive Cabinet, but has frequent contact with the Governor's Office, often working through policy representatives in the Governor's Policy Office.

WDFW's agency mandate is set forth in statute (RCW 77.04.012):

> "Wildlife, fish, and shellfish are the property of the state. The commission, director, and the department shall preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish in state waters and offshore waters.
>
> The department shall conserve the wildlife and food fish, game fish, and shellfish resources in a manner that does not impair the resource. In a manner consistent with this goal, the department shall seek to maintain the economic well-being and stability of the fishing industry in the state. The department shall promote orderly fisheries and shall enhance and improve recreational and commercial fishing in this state.
>
> The commission may authorize the taking of wildlife, food fish, game fish, and shellfish only at times or places, or in manners or quantities, as in the judgment of the commission does not impair the supply of these resources.
>
> The commission shall attempt to maximize the public recreational game fishing and hunting opportunities of all citizens, including juvenile, disabled, and senior citizens."

In short, the agency's primary priority is the conservation of fish and wildlife within Washington State. Secondarily, we work to provide access to these resources, including the establishment of fishing and hunting seasons.

2.2. Commission Fishery Policy Guidance

The Commission's North of Falcon policy (NOF Policy) provides guidance on several topics relevant to the management of Puget Sound Chinook fisheries. These include the following:

- When considering management issues, Department staff will ensure that decisions are made consistent with: the Department's statutory authority; *U.S. v. Washington*; *U.S. v. Oregon*; the Endangered Species Act; the Puget Sound Chinook Harvest Management Plan; the Pacific Salmon Treaty; the Pacific Fishery Management Council's Framework Salmon Management Plan; pertinent state/tribal agreements; and the applicable Fish and Wildlife Commission policies.
- Salmon and steelhead will be managed to recovery and to assure sustainability in a way that is science-based, well-documented, transparent, well-communicated, and accountable.
- Fisheries will be managed to meet or exceed ESA, recovery, and conservation goals; and harvest management measures will protect and promote the long-term well-being of the commercial and recreational fisheries.
- On a statewide basis, fishing opportunities will be provided when they can be directed at healthy wild and hatchery stocks.
- Selective fishing methods and gears that maximize fishing opportunity and minimize impacts on depressed stocks will be utilized to the fullest extent possible taking into consideration legal constraints on implementation and budgetary limits associated with required sampling, monitoring and enforcement programs.

- When managing sport fisheries, meaningful recreational fishing opportunities will be distributed equitably across fishing areas and reflect the diverse interests of fishers, including retention and catch and release fisheries.
- The Puget Sound harvest management objectives for chinook and coho stocks, in priority order, are to: (1) provided meaningful recreational fishing opportunities; and (2) identify and provide opportunities for commercial harvest. When managing sport fisheries in this region, recreational opportunities will be distributed equitably across fishing areas, considering factors such as: the uniqueness of each area; the availability of opportunities for various species in each area throughout the season; the desire to provide high levels of total recreational opportunity; and the biological impacts.
- Monitoring, sampling and enforcement programs will be provided to account for species and population impacts of all fisheries.
- The Department will manage fisheries to minimize mortalities on non-target species (e.g. rockfish, sea birds, etc.). Management regimes will include strategies to limit seabird mortalities consistent with the federal Migratory Bird Treaty Act.
- The Department will work with the National Marine Fisheries Service to refine tools to assess the effects of fisheries on available prey for SRKW [Southern Resident Killer Whales], and will plan fisheries to ensure that they provide proper protection to SRKW from reduction to prey availability or from fishery vessel traffic, consistent with the Endangered Species Act.

2.3. Commission Pinniped Predation Policy Statement

The Fish and Wildlife Commission has issued a policy statement regarding pinniped predation on ESA-listed salmon (see Pinniped Policy Position). This statement, in its entirety, is provided below.

> "Based on the information on record at this time, and until such time as there is a more equitable balance between the population abundance status of pinniped species and ESA-listed wild salmon populations in the State of Washington, the Washington Fish and Wildlife Commission advocates for authorization of greater flexibility in the management of pinniped populations in Federal and State legislation, towards a goal of significantly reducing pinniped predation on salmon. Further, the Commission tasks the Director with expeditious and efficient implementation of any flexibility forthcoming from successful passage of such legislation.
>
> This policy position applies to the Columbia River, coastal river basins, and Puget Sound including the Strait of Juan de Fuca. Flexibility in management activity should include a priority to actively discourage pinniped residence in areas of salmon predation, including effective harassment and lethal removal, both done in a humane manner that discourages residence and predation behavior."

2.4. Delegation of Authority for Tribal Agreements

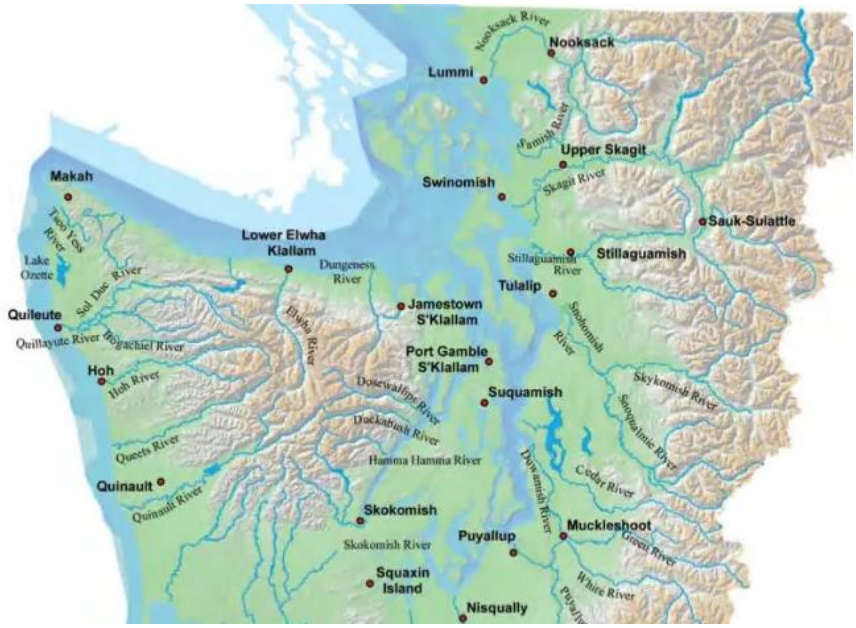
The Commission has delegated authority to the Director to enter into agreements with the tribes after appropriate consultation with the Commission (Smith 2018):

> "2. Treaty Indian Tribal Agreements. The Director shall have the authority to enter into co-management agreements with recognized treaty or executive order Indian tribes, including such agreements required under *U.S. v. Washington* (e.g. the Puget Sound Chinook Management Plan), and *U.S. v. Oregon*. The Director shall consult with the Commission on decisions that may have significant implications for the Department. The Director shall annually report to the Commission on issues associated with co-management agreements."

Chapter 3. Co-Management with Treaty Tribes

Key Points:

1) The fishing rights reserved by the Stevens Treaties entitle the treaty tribes to harvest up to half of the harvestable number of salmon returning to or passing through the tribes' usual and accustomed fishing places.
2) Overlapping tribal and state jurisdictions and authorities create a co-management relationship for WDFW and the treaty tribes.
3) To minimize potential conflict, and to promote effective and efficient management of fisheries resources that are subject to both state and tribal management, WDFW and the tribes have developed a cooperative management approach to exercise their respective authorities and to achieve shared conservation objectives.



3.1. U.S. v. Washington

In 1854-1855, territorial Governor Isaac Stevens negotiated five treaties with the tribes in what is now western Washington to obtain land for homesteaders. Through the treaties of Medicine Creek, Neah Bay, Olympia, Point Elliott and Point No Point, their lands were ceded to the United States in exchange for Reservations - land where they could live - and a guarantee that their ability to hunt and fish in off-reservation usual and accustomed areas (U&As, unique to each tribe, but in some cases overlapping) would continue. Under the U.S. Constitution, these treaties are defined as the "supreme law of the land," and supersede state law in the event of a conflict. Seventeen tribes have usual and accustomed fishing place within the Puget Sound region, and three additional tribes have U&As on the Washington Coast.

Following these treaties, the State of Washington entered the Union of states and asserted the authority to manage fisheries under state statutes. Eventually that led to conflict as the State

"The right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the Territory…"

Treaty of Point Elliott, 1855

The Boldt decision "recognized us as natural resource co-managers with the state of Washington and recognized our right to half the harvestable fish"

Billy Frank, Jr.

Map Source: NWIFC

attempted to limit and regulate tribal harvest, alongside non-tribal harvest, for various social objectives. In 1969 (*U.S. v. Oregon* – Judge Belloni) and then again in 1972 (*U.S. v. Washington* – Judge Boldt), the United States sued on behalf of the Tribes to secure their Treaty-reserved fishing rights. In Judge Boldt's initial ruling in 1974 he upheld treaty-reserved rights by interpreting the treaty language, "The right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the Territory…" to mean that the tribes were entitled to half the harvestable number of salmon returning to or passing through the tribes' usual and accustomed fishing places.

The subsequent 40 years have resulted in complex and voluminous court orders, and differences in interpretation remain on some points. Here are a few basics:

1) Conservation is the highest priority, then allocation of harvestable fish.
2) The harvestable surplus is shared roughly equally between the State (representing nontreaty fishers) and the Treaty Tribes. The Puget Sound Salmon Management Plan, a court-ordered plan adopted in *United States v. Washington,* requires allocation be made on an Allocation Unit basis, where an Allocation Unit includes all (hatchery and natural) Chinook originating from a broad geographic area such as the Strait of Juan de Fuca or Hood Canal.
3) A tribe has a right to some portion of any anadromous salmon run that traverses its U&A fishing area. The tribal allocation is thus not 50 percent per tribe, but 50 percent for the group of affected tribes.
4) Pre-terminal[2] fisheries (both treaty and nontreaty) have a duty to allow a share of the salmon bound for the terminal stream or river to return so that the terminal Treaty tribes have access to harvestable fish.

3.2. Federal Trust Responsibility and Secretarial Order

The following description of the federal trust responsibility and Secretarial Order 3206 is from NMFS (2019a).

> "The United States government has a trust or special relationship with Indian tribes. The unique and distinctive political relationship between the United States and Indian tribes is defined by statutes, executive orders, judicial decisions, and agreements and differentiates tribes from other entities that deal with, or are affected by, the Federal government. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, states that the United States has recognized Indian tribes as domestic dependent nations under its protection. The Federal government has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with Indian tribes. The relationship has been compared to one existing under common law trust, with the United States as trustee, the Indian tribes or individuals as beneficiaries, and the property and natural resources of the United States as the trust corpus (Dep't of the Interior v. Klamath Water Users Protective Ass'n, 6 532 US 1, 11, 2001). The trust responsibility has been interpreted to require Federal agencies to carry out their activities in a manner that is protective of Indian treaty rights. This policy is also

[2] We refer to a terminal fishery as one that occurs in the river from which the Chinook Salmon originate and the immediately adjacent marine fishing areas. A pre-terminal fishery is one that occurs in Puget Sound (outside of the terminal area) or in the Pacific Ocean.

reflected in the March 30, 1995, document, Department of Commerce – American Indian and Alaska Native Policy (U.S. Department of Commerce 1995). The Ninth Circuit Court of Appeals has held, however, that "unless there is a specific duty that has been placed on the government with respect to Indians, [the government's general trust obligation] is discharged by [the government's] compliance with general regulations and statutes not specifically aimed at protecting Indian tribes" (Gros Ventre Tribe v. United States, 2006, citing Morongo Band of Mission Indians v. FAA, 1998; United States v. Jicarilla Apache Nation, U.S., 131 S.Ct. 2313, 180 L.Ed.2nd 187, 2011).

"Secretarial Order 3206 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA, Secretarial Order 3206), issued by the secretaries of the Departments of Interior and Commerce, clarifies the responsibilities of the agencies, bureaus, and offices of the departments when actions taken under the ESA and its implementing regulations affect, or may affect, Indian lands, tribal trust resources, or the exercise of American Indian tribal rights as they are defined in the Order. The Secretarial Order acknowledges the trust responsibility and treaty obligations of the United States toward tribes and tribal members, as well as its government-to-government relationship when corresponding with tribes. Under the Order, the Services 'will carry out their responsibilities under the [ESA] in a manner that harmonizes the Federal trust responsibility to tribes, tribal sovereignty, and statutory missions of the [Services], and that strives to ensure that Indian tribes do not bear a disproportionate burden for the conservation of listed species, so as to avoid or minimize the potential for conflict and confrontation.' In the event that the Services determine that conservation restrictions directed at a tribal activity are necessary to protect listed species, specifically where the activity could result in incidental take under the ESA, the Services shall provide the affected tribe(s) written notice, including an analysis and determination that (i) the restriction is reasonable and necessary for conservation of the species; (ii) the conservation purpose of the restriction cannot be achieved by reasonable regulation of non-Indian activities; (iii) the measure is the least restrictive alternative available to achieve the required conservation purpose; (iv) the restriction does not discriminate against Indian activities, either as stated or applied; and (v) voluntary tribal measures are not adequate to achieve the necessary conservation purpose. More specifically, the Services shall, among other things, do the following:

- Work directly with Indian tribes on a government-to-government basis to promote healthy ecosystems (Section 5, Principle 1).
- Recognize that Indian lands are not subject to the same controls as Federal public lands (Section 5, Principle 2).
- Assist Indian tribes in developing and expanding tribal programs so that healthy ecosystems are promoted and conservation restrictions are unnecessary (Section 5, 10 Principle 3).
- Be sensitive to Indian culture, religion, and spirituality (Section 5, Principle 4).

"Additionally, the U.S. Department of Commerce issued a Departmental Administrative Order (DAO) addressing Consultation and Coordination with Indian Tribal Governments (DAO 218-8, April 26, 14 2012; Tribal Government Coordination), which implements relevant Executive Orders, Presidential Memoranda, and Office of Management and Budget Guidance. The DAO describes

actions to be 'followed by all Department of Commerce operating units … and outlines the principles governing Departmental interactions with Indian tribal governments.' The DAO affirms that the 'Department works with Tribes on a government-to-government basis to address issues concerning … tribal trust resources, tribal treaty, and other rights.'"

Chapter 4. Status, Stressors, and Habitat

Key Points:

1) The 2020 State of Salmon report categorized Puget Sound Chinook Salmon as "In Crisis" due to the gap between the number of spawners and recovery goals, the slow progress in closing that gap, and the limited likelihood of progress in the near future.
2) While there are positive signs, time is running short for Puget Sound Chinook Salmon. Bold actions are needed now.
3) Loss of the cool, productive, pollutant-free river water and estuaries needed by Chinook Salmon has continued since the development of the Puget Sound Chinook Recovery Plan due to a divergence between the habitat protection envisioned in watershed recovery plans and the measures implemented in regulatory processes. Key habitat protection components of watershed plans have not been integrated into the Washington State "Growth Management Act" nor the "Shorelines Management Act".
4) Restoration of the habitat needed to rebuild Chinook Salmon populations has been slowed by the available funding, about 22% of the identified need, and by a lack of partners to implement projects in key areas.
5) Immediate and substantially increased funding for habitat restoration and improved habitat protection (land use planning, compliance, outreach, and enforcement) are essential to conserve and rebuild Puget Sound Chinook Salmon runs.

"It is time for big, bold changes in how we look at salmon and orca recovery."

"It is time for transformative clean water infrastructure for salmon and people, time to make major advancements in salmon habitat, including fixing fish passage barriers, and time to address climate resiliency in all the work we do."

Governor Jay Inslee
August 5, 2021

Photo Source: R. Blomker, WDFW

4.1. Puget Sound Chinook Status

Puget Sound Chinook Salmon were listed as threatened under the ESA in 1999. A threatened species is one that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

Every two years the Governor's Salmon Recovery Office assesses the status of ESA-listed salmonids in Washington State (see 2020 State of Salmon). The 2020 State of Salmon report categorized Puget Sound Chinook Salmon as "In Crisis" due to the gap between the number of spawners and recovery goals, the slow progress in closing that gap, and the limited likelihood of

progress in the near future." We provide below a figure from the Puget Sound Chinook Vital Signs report to the Puget Sound Partnership (similar analysis to the 2020 Status report but updated to include data through 2019) to illustrate these points.

First, note that the light red and dark red bars are of similar height, indicating that the number of spawners in 2015-2019 (most recent five years) has changed little from 1999-2003 (just after ESA-listing). Second, note that the bars are substantially below the lines that indicate the range of spawners needed for recovery. Moving from the current status to the recovery range will require substantial improvements in the productivity of our watersheds, estuaries, and marine areas. These topics are discussed in the remainder of this chapter and in greater specificity in the chapters associated with each geographic region (Chapters 9-13).

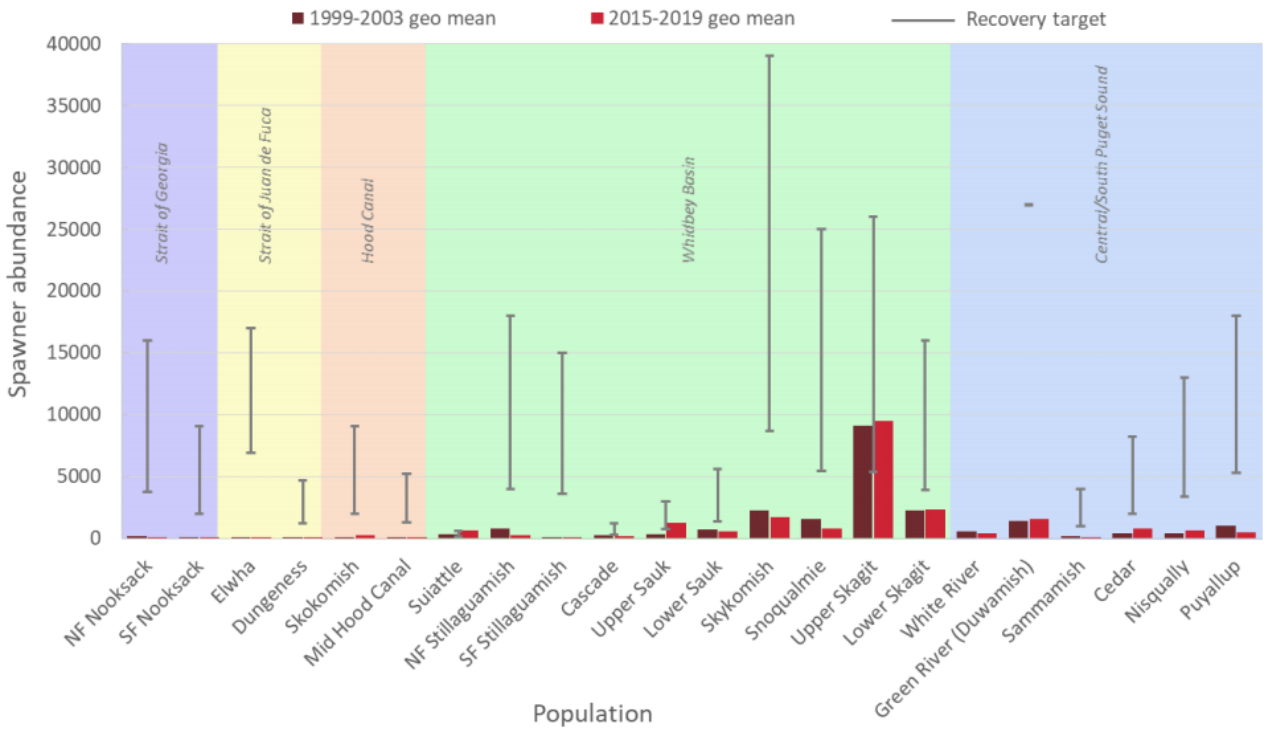


Figure 1. Geometric mean number of spawners for 1999-2003 and 2015-2019 and the recovery range for each Puget Sound Chinook Salmon population.

4.2. Stressors

Puget Sound Chinook Salmon are experiencing two major root cause stressors: habitat degradation and climate change. Rapid growth in the human population of Washington State is expected to continue in the coming decades. Without adequate protective measures, such growth will likely increase habitat degradation and loss while increasing demands on water resources, energy, land, timber, and agricultural products. These changes are likely to exacerbate the negative effects of contaminants and other legacy impacts on salmon populations. At the same time, climate change is poised to subject salmon to more intense and frequent flooding, droughts, wildfires, disease, lethal stream temperatures, growth in non-native fish species, and changing food web dynamics. Together, these stressors may reduce the survival of Puget Sound Chinook Salmon throughout their life cycle and further reduce productivity.

The population specific sections that follow in the remainder of this document provide thumbnail sketches of stressors and recovery actions. More detailed information can be found in the Puget Sound Chinook Recovery Plan (SSDC 2007; NMFS 2006), NWIFC (2020), and in reports that may be accessed on the websites of watershed recovery organizations (see Puget Sound Salmon Recovery).

4.3. Habitat Protection and Restoration

Puget Sound experienced significant salmon habitat losses over the course of the late 19th and 20th centuries. Filling of estuaries, damming rivers, splash damming practices, dikes and levee construction, shoreline armoring, conversion of natural habitats to agriculture, and other degradation occurred at greater rates than we see today. Such actions resulted in more protective state and federal environmental laws and regulations that have slowed habitat destruction in the Puget Sound. However, these laws have not resulted in 'no net loss' nor recovery of the habitat conditions that salmon require to recover and thrive.

Washington State is currently the second smallest western state in size with the second largest human population. The Puget Sound region, with its natural beauty, adjacency to diverse outdoor recreation and ports, and trained workforce, attracts businesses leading to a robust economy. Washington State continues to attract people both for these reasons and as a climate refugia for people seeking to escape harsh environmental conditions and natural disasters in other areas of the world, providing an ongoing perfect storm for salmon habitat degradation and loss.

Since the Puget Sound salmon ESA listings in 1999, Washington state, federal agencies, tribes, local governments, Regional Fisheries Enhancement Groups, non-governmental organizations, and others have been investing in and implementing habitat restoration projects designed to address the limiting factors for salmon production. These factors and projects are captured in each watershed salmon recovery plan. However, the funding provided has only been 22% of the identified need (GSRO 2020), and progress has been slowed by a lack of partners to implement projects in key areas. To implement habitat restoration projects at the necessary scale will require building more community support. In addition, key habitat elements from the local plans have not been integrated in the Washington State "Growth Management Act" nor the "Shorelines Management Act" driven planning processes and thus have not been fully integrated into the land use planning and regulatory processes.

The Treaty tribes of western Washington, NMFS, WDFW, Department of Ecology, Washington State Recreation and Conservation Office (RCO), and local governments have been tracking and monitoring components of watershed health over the past several decades. Several key reports include this information such as: "State of Our Watersheds", "State of the Sound", and "State of the Salmon". As described above, general watershed health continues to decline while we are also bearing witness to increasing effects from climate change. Increasing flood frequency and intensity, droughts, heat waves and the resulting effects of those on salmon productivity, food webs, disease are being exacerbated.

The urgency continues to increase as we see Southern Resident orca suffering, non-tribal and tribal fisheries being further curtailed, and the overall watershed health being impacted through significantly reduced marine-derived nutrient loading. The Western Washington Treaty tribes developed and are partnering with WDFW to implement their 'Habitat Strategy' and are working together to push for more significant actions necessary to reverse the decline of salmon and provide for recovery. In addition, critical climate change legislation was passed by state legislature in 2021, implementation of the

recommendations of the SRKW Task Force is progressing (see Chapter 14), and Governor Inslee has made salmon recovery a top priority of his administration.

While these are positive signs we must see significant progress in policies and funding levels for habitat protection and restoration – time is running short for Puget Sound Chinook Salmon. Climate impacts and human population growth are vastly outpacing actions necessary for the conservation and recovery of Chinook Salmon. The time for incremental progress has passed. Salmon only have a chance if bold actions such as: improved building codes that require green roofs and/or renewable energy infrastructure, renaturing degraded areas (riparian habitats, urban and suburban areas), improved water management (nutrient removal, addressing tire dust and other pollutants, addressing instream temperatures, and providing improved instream flows), and vastly increased funding levels for both habitat protection (land use planning, compliance and enforcement capacity) and restoration (fully fund the recovery plan actions), are taken now.

4.4. Pinniped and Avian Predation

Salmon play a critical role in a food chain that stretches from the upper basins of the highest mountains to the open waters of the Pacific Ocean. Through modifications to this landscape, and statutes such as the Marine Mammal Act, the interactions of Chinook Salmon with species such as seals, sea lions, and predaceous birds have been substantially altered. Dams, bridges, and other structures can increase the susceptibility of juvenile and adult Chinook Salmon to predation by concentrating the fish in restricted areas and limiting potential means to evade capture. Passage of the Marine Mammal Act in 1972 has resulted in a substantial increase in the abundance of Steller sea lions (Wiles 2015), California sea lions (Laake et al. 2018), and harbor seals in Washington and in Puget Sound (Pamplin et al. 2021).

The diet of pinnipeds varies seasonally, geographically, and in response to the availability of different sources of prey (Lance et al. 2012; Bromagin et al. 2013). While it is evident that predation by sea lions at locations such as dams in the Willamette River can be a significant source of mortality for adult salmonids (Falcy 2017), the extent of pinniped predation throughout the life cycle of salmonids is now receiving increased attention. Chasco et al. (2017) estimated that between 1970 and 2015, seals and other pinnipeds increased the amount of Chinook Salmon eaten in the inland waters of Washington from 75 to 718 tons. That was double the amount estimated to have been consumed by resident killer whales, and six time more than the combined commercial and recreational catches. Additional research has shown that those estimates are sensitive to the size of Chinook Salmon consumed. Nelson et al. (in press) found that prey size was estimated from otoliths recovered from seal scats, the impact (numbers of fish consumed) decreased by 71% indicating that pinniped predation may not be as significant an impact as estimated by Chasco et al. (2017).

Altered habitats can also increase the predation of birds upon ESA-listed salmonids. This has been most extensively studied in the Columbia River, where bird predation (primarily Caspian terns) was the single largest source of mortality for Columbia River steelhead during outmigration from Rock Island Dam to Bonneville Dam (Collis et al. 2020).

The threat to ESA-listed Puget Sound Chinook Salmon posed by predators has been recognized in the Chinook Salmon Implementation Strategy (PSP 2018) and new funding was provided in the 2021 legislative session. The Strategy recommended “improve management of predation and mortality factors that inhibit salmon recovery”. The legislature provided $940,000 for the 2021-2023 biennium to

WDFW to expand its efforts to survey the diets of seals and sea lions and identify lethal and non-lethal management actions to deter them from preying on salmon and steelhead.

Chapter 5. Recovery Plan and NMFS Analyses

Key Points:

1) The Puget Sound Chinook Recovery Plan divided the Puget Sound Chinook Evolutionarily Significant Unit (ESU) into five biogeographical areas, or Major Population Groups (MPGs). These are the Strait of Georgia, Strait of Juan de Fuca, Hood Canal, Whidbey Basin, and Central/South Sound.
2) The Recovery Plan also identified populations that must be at low risk for ESU viability. These include the North Fork Nooksack, South Fork Nooksack, Elwha, Dungeness, Skokomish, Mid-Hood Canal, Suiattle, White, and Nisqually.
3) NMFS Population Recovery Approach (PRA) further characterized populations into tiers, with Tier 1 populations of greatest value for recovery. In addition to the populations listed above, NMFS the following Tier 1 populations are: Upper Skagit, Lower Skagit, Upper Sauk, Lower Sauk, and Cascade.
4) NMFS has estimated maximum, population-specific exploitation rates (called Rebuilding Exploitation Rates or RERs) that are associated with a high probability of attaining escapement levels which will maximize the natural production for each population (the rebuilding escapement threshold) and a low probability of escapements falling below levels at which the population may become unstable (the critical escapement threshold) due to effects of fisheries.

Recovery plans are not regulatory, but they can provide context for regulatory decisions.

The recovery plan's criteria for a naturally self-sustaining ESU with a high likelihood of persistence include:

- Two to four Chinook salmon populations must be at low risk of extirpation in each of five biogeographical regions
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions must be viable

PS Chinook Recovery Plan

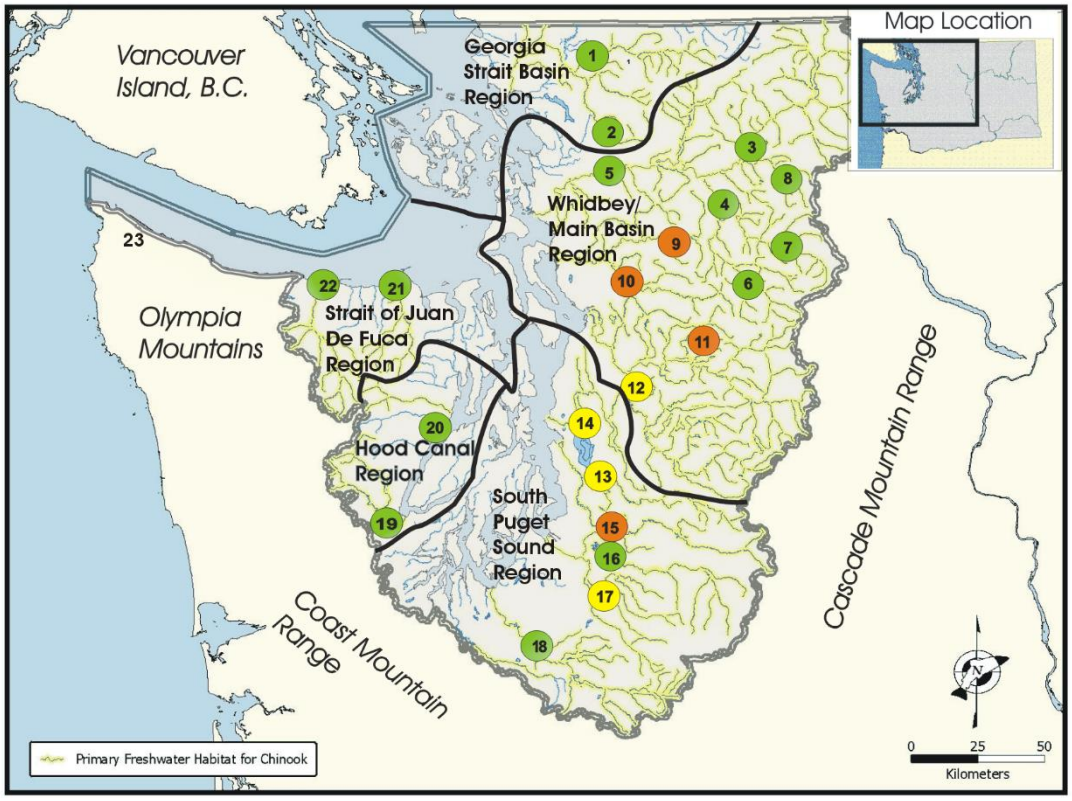
5.1. Recovery Plan & PRA

Section 4(f) of the ESA generally requires the development and implementation of a recovery plan for listed species. Recovery plans are not regulatory (NMFS 2019b), but they can help:

- provide context for regulatory decisions;
- inform decision making by federal, state, tribal, and local jurisdictions;
- organize, prioritize, and sequence recovery actions;
- guide research, monitoring, and evaluation efforts; and
- provide a framework to adaptively management recovery strategies and actions.

A recovery plan must include, to the maximum extent practicable: 1) a description of site-specific management actions necessary to conserve the species; 2) estimates of the time and funding required to achieve the plan's goals and objectives; and 3) measurable criteria that, when met, will allow the species to be removed from the endangered and threatened species list.

The Puget Sound Chinook Recovery Plan includes three components: 1) a regional plan that describes overall goals, biological objectives, limiting factors, and measures to address them at the ESU scale (Volume I; SSDC (2007)); 2) detailed, watershed specific plans, including recovery objectives, limiting factors, and actions at the population or watershed scale (Volume II); and 3) a supplement developed by NMFS (2006) that summarizes volumes I and II and provides additional guidance on several topics.



Key: Chinook salmon populations, Puget Sound Salmon Recovery Plan (NMFS 2006a)

1-North Fork Nooksack River
2-South Fork Nooksack River
3-Upper Skagit River
4-Lower Sauk River
5-Lower Skagit River
6-Upper Sauk River
7-Siuattle River
8-Upper Cascade River
9- North Fork Stillaguamish
10-South Fork Stillaguamish
11-Skykomish River
12-Snoqualmie River
13-Cedar River
14-Sammamish River
15-Duwamish-Green River
16-White River
17-Puyallup River
18-Nisqually River
19-Skokomish River
20-Mid-Hood Canal Rivers
21-Elwha River
22-Dungeness River

Population Recovery Approach designation
Tier 1 population
Tier 2 population
Tier 3 population

Figure 2. Major population groups and populations in the Puget Sound Chinook ESU. Map source: NMFS.

Consistent with the requirements of the ESA, the Puget Sound Chinook recovery plan provides measurable criteria for delisting of the Puget Sound Chinook ESU. The criteria are provided for Chinook Salmon

populations within each of five biogeographical areas (now referred to as Major Population Groups or MPGs). These MPGs are the Strait of Georgia, Strait of Juan de Fuca, Hood Canal, Whidbey Basin, and Central/South Sound. The recovery plan states that the Puget Sound Chinook ESU will have a high likelihood of persistence if each of the MPGs has the following characteristics:

1) Two to four Chinook Salmon populations must be at low risk of extirpation in each of five biogeographical regions within the ESU achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region.

2) At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable.

The recovery plan applies these general criteria and identifies specific populations that must be at low risk for ESU viability. These Chinook Salmon populations include the North Fork Nooksack, South Fork Nooksack, Elwha, Dungeness, Skokomish, Mid-Hood Canal, Suiattle, White, and Nisqually (Table 1). Additionally, for the Whidbey Basin, an early, moderately early, and late run timing population must be at low risk for ESU viability.

Table 1. MPGs, populations, populations that must be at low risk for ESU viability (NMFS (2006) Final Supplement Table 1), and PRA tier (NMFS (2010) Table 10).

MPG	Population	Need to be at Low Risk for ESU viability	PRA Tier
Strait of Georgia	North Fork Nooksack	North Fork Nooksack	1
	South Fork Nooksack	South Fork Nooksack	1
Strait of Juan de Fuca	Elwha	Elwha	1
	Dungeness	Dungeness	1
Hood Canal	Skokomish	Skokomish	1
	Mid-Hood Canal	Mid-Hood Canal	1
Whidbey Basin	Skykomish (late)	Suiattle and one population of each of the early, moderately early, and late run timing.	2
	Snoqualmie (late)		3
	NF Stillaguamish (early)		2
	SF Stillaguamish (moderately early)		2
	Upper Skagit (moderately early)		1
	Lower Skagit (late)		1
	Upper Sauk (early)		1
	Lower Sauk (moderately early)		1
	Suiattle (very early)		1
	Cascade (moderately early)		1
Central/South Sound	Sammamish (late)	White and Nisqually or one of the other populations with late run timing.	3
	Cedar (late)		3
	Green/Duwamish (late)		2
	Puyallup (late)		3
	White (early)		1
	Nisqually (late)		1

NMFS (2010) subsequently developed the Population Recovery Approach (PRA) to provide further guidance on the role of each population in recovery. The PRA:

1) identifies those populations and watersheds whose preservation and restoration will be required for recovering the listed ESU and for meeting delisting criteria;

2) identifies those populations and watersheds that should be NMFS priority for consultation and recovery activities, with the goal of meeting the ESU delisting criteria;

3) highlights those stocks and watersheds that remain as strongholds relative to others regarding the standing of VSP abundance, diversity, spatial structure, and productivity parameters; and

4) recognizes other populations that need to be preserved for retaining ESU diversity and spatial structure.

Under the PRA classification system, a Tier 1 population has the highest value to recovery. In addition to the populations NMFS (2006) previously identified that must be at low risk for ESU viability, NMFS proposed the following Tier 1 populations (Table 1): Upper Skagit. Lower Skagit, Upper Sauk, Lower Sauk, and Cascade. NMFS emphasized that the PRA is applicable only when "the agency exercises its authority under the ESA. In other contexts, NMFS will emphasize the importance of achieving broad sense recovery of all populations in Puget Sound and Washington's coast to satisfy tribal treaty rights and recreational and commercial fishing goals."

The recovery plan generally deferred to the co-managers' RMP for fishery strategies and actions. However, several important clarifications and additional guidance are provided in the supplement. The supplement notes:

- The strategies in watershed plans in Volume II do not make it clear that harvest management is a government-to-government process among Tribal, state, and Federal managers. Fisheries affecting Puget Sound Chinook Salmon are implemented under the principles of the Pacific Salmon Treaty, the Magnuson-Stevens Act and U.S. v. Washington. Fishery management will continue to fall under the purview of the laws governing each of the harvest management forums. Technical or policy forums created for the Recovery Plan and considering harvest issues must work with the parties in these existing harvest management forums to ensure that harvest planning activities are coordinated.

- The recovery plan identifies a need to reduce impacts of Canadian fisheries on some Puget Sound Chinook Salmon populations. If further improvements in survival become necessary, NMFS will first seek to obtain such improvements through negotiated adjustments under the PST. If monitoring and evaluation indicate that further survival improvements are necessary, NMFS will review all Hs {habitat, hydro, hatchery, and harvest} for potential improvements to achieve recovery of the Puget Sound Chinook ESU.

- NMFS will continue to assess recovery and survival of the ESU based on the progress of individual populations across the ESU relative to their role in recovery and recognizing that not all populations must be at low risk of extinction in order to achieve viability for the ESU as a whole. Further assessment may indicate that there are populations within individual management units that are not currently the primary focus of harvest management that require additional protection for the recovery of the ESU. This may require revisions to the current harvest objectives to afford that protection. NMFS encourages the design and implementation of population-based

monitoring and adaptive management programs that will allow such revisions in objectives if necessary.

5.2. Rebuilding Exploitation Rates

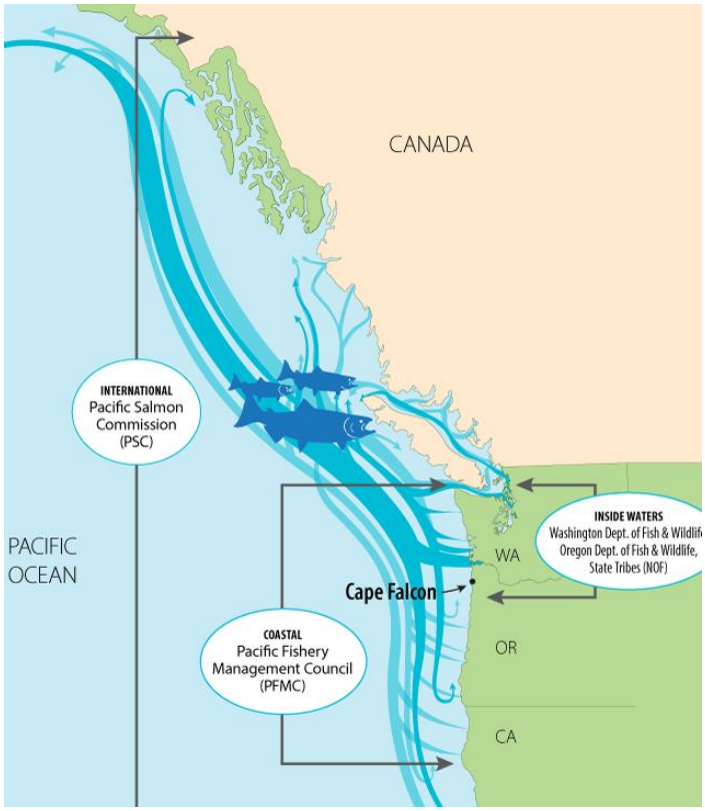
A rebuilding exploitation rate (RER) is the maximum fishing rate that provides a high probability that a population will achieve the rebuilding escapement threshold (RET) and a low probability of escapements falling below levels at which the population may become unstable (the critical escapement threshold or CET) due to effects of fisheries (NMFS 2021a). NMFS uses the RERs as a reference point for determining the likely implications of a proposed fishery for the viability/recovery of a population. A suite of fisheries that results in a fishery exploitation rate that is likely at or below the RER provides analytical support and confidence that the likely effects of the fisheries pose a low risk to that population.

We provide RERs as reference information in subsequent sections of this report on the Chinook Salmon in each watershed.

Chapter 6. Coastwide Fishery Management

Key Points:

1) Puget Sound Chinook Salmon cross multiple jurisdictional boundaries as they migrate away from and return to their natal rivers.
2) More than 75% of the fishery mortality of some stocks occurs in fisheries in Alaska and Canada.
3) The Pacific Salmon Treaty, Pacific Fishery Management Council, and the annual North of Falcon planning process now provide a comprehensive fishery management system to coordinate across jurisdictions.



6.1. Challenge of Chinook Management

Juvenile Chinook Salmon hatch from eggs buried in the gravel in streams and rivers, and then migrate out to marine waters in the Pacific Ocean – mostly heading north, but also dipping south along the coast. After spending up to five years feeding and maturing in ocean marine waters, salmon return to their natal streams to spawn.

In marine waters, Chinook Salmon from Puget Sound are often mixed with those originating in rivers in California, Idaho, Oregon, British Columbia, and Alaska. Chinook Salmon from these locations may return home through the waters of the U.S. and Canada, multiple states, and through waters fished by multiple tribes.

Historically, this migration across multiple jurisdictional boundaries created the risk of over-harvest, as each entity along the migration path tried to catch as many fish as possible (sometimes referred to as the "tragedy of the commons"). The lack of a coordinated management system resulted in fishing rates that were too great for the less productive stocks and was associated with a decline in abundance. The Pacific Salmon Treaty, Pacific Fishery Management Council, and the annual North of Falcon planning process now provide a coordinated and comprehensive fishery management system.

The distribution of the fishery mortality of Puget Sound Chinook Salmon among these jurisdictions varies depending upon factors

Coordinated Management

Coordinated west coast fishery management forums ensure consistent application of conservation objectives and complementary fishery regimes.

such as the geographic origin of the stock, the run timing and migration pattern, and the management regime in place for Puget Sound fisheries. More than 75% of the fishing mortality of Chinook Salmon from the Nooksack River occurs in fisheries in Canada and Southeast Alaska (SEAK) (Figure 3). Generally, a greater proportion of the harvest of stocks from rivers in north Puget Sound rivers occurs in fisheries in SEAK and Canada.

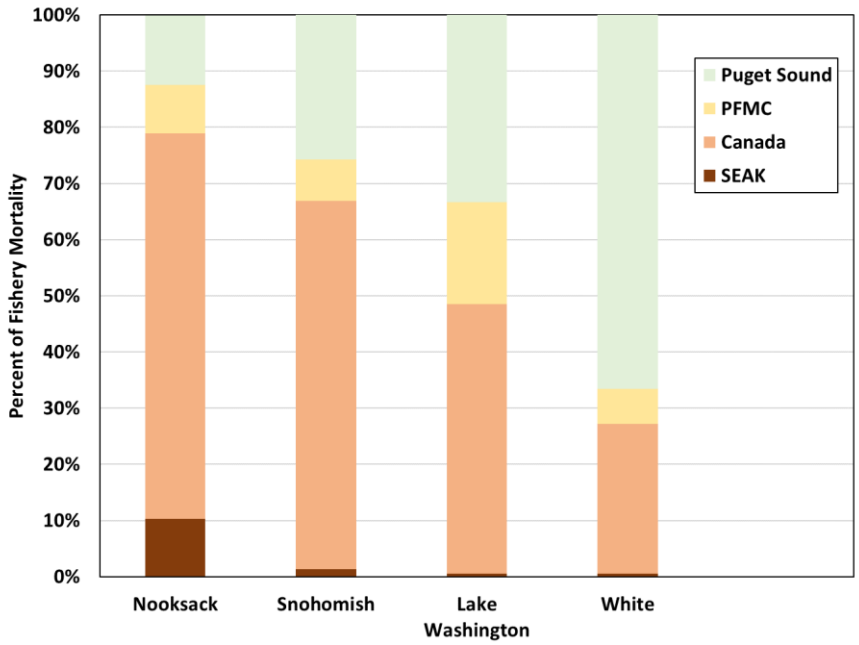


Figure 3. Average distribution of adult equivalent fishery mortality from 2009-2018 for Chinook salmon originating from different locations in Puget Sound. Source: FRAM V7.1

We will briefly describe the Pacific Salmon Treaty, Pacific Fishery Management Council, and North of Falcon processes in the following sections.

6.2. Pacific Salmon Treaty

The Pacific Salmon Treaty (PST), signed by United States and Canada in 1985, provides a framework for the two countries to cooperate on the management, research, and enhancement of Pacific salmon. The United States and Canada cooperate to prevent overfishing, provide optimum production, and ensure that each country receives benefits that are equivalent to the production of salmon in its waters. The PST is updated roughly every 10 years to reflect current conditions and address new challenges.

The 2019-2028 update to the agreement includes additional provisions to reduce fishing pressure on stocks of concern while still providing harvest opportunity for more abundant stocks. Additional harvest reductions of up to 15% in Oregon and Washington (relative to fishing rates in 2009-2015), 12.5 % in British Columbia (relative to fishing rates in 2009-2015), and 7.5% in Southeast Alaska (relative to 1999-2008 PST provisions) are being implemented on a sliding scale depending on Chinook Salmon abundance.

The PST establishes two types of management regimes for Chinook Salmon. Fisheries are classified as aggregate abundance-based management regimes (AABM) or individual stock-based management regimes (ISBM). The agreement defines an AABM fishery as “an abundance-based regime that constrains catch or total adult equivalent mortality to a numerical limit computed from either a pre-season forecast

or an in-season estimate of abundance" (PST 2020). Three fishery complexes are managed as AABM fisheries: 1) the Southeast Alaska (SEAK) sport, net and troll fisheries; 2) the Northern British Columbia (NBC) troll (statistical areas 1-5) and Haida Gwaii sport (statistical areas 1 – 2, 101, 102 and 142); and 3) the West Coast Vancouver Island (WCVI) troll (statistical areas 21, 23-27, 121, 123-127) and sport, for specified areas and time periods. For the AABM fisheries, the abundance of Chinook Salmon is predicted each year and the allowable catch determined as specified in the agreement.

All Chinook Salmon fisheries subject to the PST that are not AABM fisheries are classified as ISBM fisheries, including freshwater Chinook Salmon fisheries. An ISBM fishery is a "regime that constrains the annual impacts within the fisheries of a jurisdiction for a naturally spawning Chinook Salmon stock or stock group" (PST 2020). The ISBM obligations place limits on the allowable exploitation rate of indicator stocks not meeting management objectives, including five Puget Sound stocks (Table 2). The limits specified for the Canadian fisheries are a 12.5% reduction from the average that occurred from 2009-2015, and rates in the southern United States (SUS) (Washington, Oregon, Idaho, and California) are capped at the 2009-2015 average. The exploitation rate limit is in place regardless of stock abundance for those stocks for which a bilaterally agreed management objective has not been established.

Table 2. PST limits on exploitation rates in SUS fisheries for escapement indicator stocks not meeting management objectives. TBD: to be determined

Escapement Indicator Stock	Management Objective	Exploitation Rate Limit	FRAM [1/] Equivalent
Nooksack Spring	TBD	Average rate from 2009-2015	0.07
Skagit Spring	690		0.11
Skagit Summer/Fall	9,202		0.21
Stillaguamish	TBD		0.09
Snohomish	TBD		0.08

1/ FRAM is the acronym for the fishery planning model used by the co-managers (see Section 6.5)

6.3. Pacific Fishery Management Council

The Pacific Fishery Management Council (PFMC) is one of eight regional fishery management councils established after Congress passed the Magnuson Fishery Conservation and Management Act in 1976. The Council has jurisdiction over the U.S. West Coast Exclusive Economic Zone (3-200 miles offshore). The Council must comply with the Magnuson-Stevens Fishery Conservation and Management Act and other applicable laws, including the National Environmental Policy Act, Endangered Species Act, Marine Mammal Protection Act, various Executive Orders, and the Administrative Procedure Act.

The Council has adopted a Salmon Management Plan (PFMC 2021) to guide management of commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California. Conservation objectives for Puget Sound Chinook Salmon are based upon the NMFS consultations or approved fishery plans (such as an RMP).

6.4. North of Falcon Process

In the mid-1980s the State and the Tribes developed a cooperative paradigm where the co-managers (State and Tribes) work to reach agreement on a List of Agreed Fisheries (LOAF). Tribes regulate their members' harvest and WDFW regulates non-tribal harvesters in state waters based upon these shared fisheries.

The LOAF is developed each spring for the coming season through the North of Falcon planning process. The name of the process refers to Cape Falcon in northern Oregon, which marks the southern border of active management for Washington salmon stocks. The process starts in late February when run-size forecasts first become available for all salmon species from Washington to California. At the March PFMC meeting, preliminary decisions are made about possible ocean fishing seasons based upon the projected abundance, expected fisheries in Alaska and Canada, management objectives, and allocation requirements.

In the following month, a series of meetings are held to provide an opportunity for discussion, analysis, and negotiation among all interested parties, including two large meetings focused on fisheries throughout the *U.S. v. Washington* case area. Participants assess the biological consequences of options for the outside (ocean) and inside (Puget Sound, coastal, and Columbia River. The process is supported by technical analyses provided by professional biologists from various state, tribal and federal management agencies. WDFW convenes multiple meetings at locations throughout Washington State to solicit input and discuss options with stakeholders.

During the April PFMC meeting, the council finalizes recommendations to the Secretary of Commerce regarding ocean commercial troll and recreational fishing seasons and catch limits off the coasts of Washington, Oregon, and California. Public testimony is received at both council meetings as well as hearings scheduled between the two meetings

WDFW then completes its rule process to adopt recreational and commercial fishing regulations. Recreational fishing regulations are published in a sportfishing pamphlet, and commercial regulations are sent to all licensed commercial fishers, buyers and industry representative organizations.

6.5. Fishery Regulation Assessment Model

The Fishery Regulation Assessment Model (FRAM) is a computer model used to assess the impacts of fisheries on each stock for which a management objective has been established. It has two primary uses in the management process, pre-season planning and postseason evaluation.

1) Preseason Planning. Each year during the North of Falcon planning process fishery proposals are iteratively evaluated using FRAM to assess the consistency of the proposal with management objectives. Fishery catches, location, timing, and other factors are modified until the management objectives are achieved for all stocks.
2) Postseason Evaluation. Postseason data are available for fisheries catches and abundance for all stocks and fisheries in the mode are generally available two years after fish have returned to their rivers to spawn. Once all the data are available, FRAM is used to estimate an exploitation rate experienced by each stock during that fishing season. Postseason data are

currently available from 1992 to 2018, with the next update planned for 2022 to include data collected through 2020.

The postseason estimates of exploitation rates from FRAM often provide the basis for management objectives. For example, a management objective for future years might be the average postseason estimate of the exploitation rate in the years 2009-2014 if that rate was consistent with achieving conservation objectives.

FRAM base period data has been updated on multiple occasions during the last four years. A base period is the base set of fishing years that are used to develop key inputs for FRAM, such as stock- and age-specific estimates of fishery exploitation rates, maturation rates, and abundance. Prior to 2017, the set of years used to develop the base period was 1979 through 1982. However, since 2017, we have used 2007 through 2013 as the base period years. The period of years from 1979-1982 is often referred to the "old base period" and 2007-2013 is often referred to as the "new base period." The new base period is has only recently been completed, continues to be extensively technically reviewed, and has had multiple iterations of updates to the core data and methodologies used in the base period. These updates occur every few years and are often referred to as rounds or versions. FRAM is currently on "Round/Version 7.1" of updates. Because the underlying data are frequently updated, and new estimation methods and techniques are developed, we anticipate that further improvements and updates will occur.

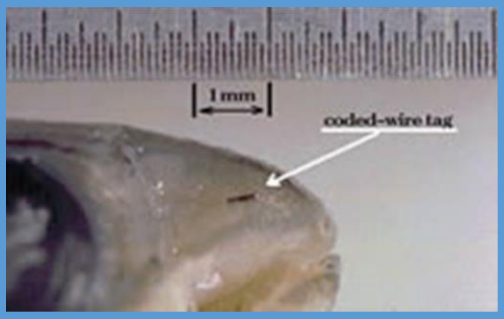
Chapter 7. Puget Sound Fisheries

Key Points:

1) Tribal ceremonial and subsistence, treaty and nontreaty commercial fisheries, and recreational fisheries occur in Puget Sound.
2) Fishery catch and non-landed mortalities, together referred to as harvest, are assessed and accounted for in the management of Puget Sound Chinook Salmon.
3) The harvest of Puget Sound Chinook Salmon in commercial fisheries generally exceeded 200,000 fish per year from 1980 through 1990. Harvest declined to approximately 49,000 fish per year in the five-year period (1994-1998) prior to ESA-listing in 1999 as the result of hatchery and fishery management conservation actions. In the most recent five-year period with postseason estimates (2014-2018), harvest of Puget Sound Chinook Salmon increased to an average of 78,000 per year, but the harvest of natural-origin Puget Sound Chinook Salmon has been further reduced to an average of 3,054 per year (4% of harvest).
4) The average recreational harvest increased from 1994-1998 to 2014-2018, but the proportion of the harvest comprised of natural-origin Chinook Salmon declined from 11% to 3%. All of the increase in harvest occurred in freshwater recreational fisheries, while the marine harvest of hatchery-origin Chinook Salmon declined by approximately 6,100 fish.
5) Recreational fisheries during the summer months in some areas are now catching Chinook Salmon at a greater rate.

"While important during the initial federal listings, today harvest in Washington has been curtailed significantly and is not a primary factor limiting salmon recovery. Fishing in Washington State is highly managed and relies primarily on hatcheries."

2020 State of Salmon



Fishery management now relies on extensive tagging and sophisticated computer models to predict and assess fishery impacts.

7.1. Introduction

In this chapter we provide an overview of salmon fisheries and fishery monitoring in Puget Sound. Fishery impacts on specific management units are assessed in subsequent chapters.

When Puget Sound Chinook Salmon were listed as a threatened species in 1999, NMFS expressed concern about the historical fishery exploitation rates on Puget Sound Chinook Salmon (64 FR 14308; March 24, 1999):

> "Historically high harvest rates in ocean and Puget Sound fisheries were likely to be a significant source of risk in the past; NMFS is hopeful that recently established lower harvest targets for Puget Sound stocks will reduce threats to the persistence of the ESU due to reductions in direct mortality and size-selective fisheries."

Since that time, fishery mortalities have been substantially reduced through the use of mark-selective fisheries and through time, area, and gear restrictions designed to minimize the mortalities of stocks returning at a level less than the management objective. The 2020 Washington State of Salmon report (GSRO 2020) concludes:

> "While important during the initial federal listings, today harvest in Washington has been curtailed significantly and is not a primary factor limiting salmon recovery. Fishing in Washington State is highly managed and relies primarily on hatcheries.
>
> In addition, a significant portion of the overall harvest of salmon originating from Washington occurs in Canada and Alaska.
>
> Protection and restoration of habitat, addressing predation, and mitigating the impacts from climate change must be pursued to fully benefit from the restrictions that have been applied to fishing for recovery."

7.2. Fishery Monitoring

The landed catch of Chinook Salmon is tracked through an extensive system of inseason and postseason assessment methods. Landed catch in commercial, ceremonial, subsistence, and test fisheries, in Washington catch areas 1 – 13 (Figure 4 and Figure 5), and associated subareas and freshwater areas, is recorded on sales receipts ('fish tickets') or other documents and compiled in a jointly maintained database. WDFW provides postseason estimates of recreational landed catch in many fisheries through analysis of Catch Record Cards (CRCs) returned from a randomly selected subset of CRCs issued annually to all recreational license holders. The information collected from CRCs is supplemented through a baseline sampling program that provides auxiliary estimates of species composition, effort, and catch per unit effort (CPUE). The baseline sampling program is geographically stratified among Areas 5-13 in Puget Sound. For this program, the objectives are to sample 120 fish per stratum for estimation of species composition, and 100 boats per stratum for the estimation of CPUE. Compilation and analysis of these data produces preliminary estimates of management year (May through April of the following year) catch by July of the subsequent year (i.e., preliminary estimate of catch for May 2019 through April 2020 provided in July 2021).

For some recreational fisheries managed under catch quotas or impact limits, catch, encounters, and effort is monitored during the season by creel surveys. In-season catch estimates are produced for coastal areas 1 – 4, some Puget Sound marine areas (varies by year), and certain freshwater Chinook Salmon fisheries (varies by year). Creel sampling regimes and analytical methods have been developed to meet standards of variance for estimates of weekly landed catch and mortality.

In addition to monitoring the landed catch, sampling of commercial and recreational fisheries is conducted to collect multiple type of biological information. Depending upon the fishery this may include sampling for coded-wire tags, scales, otoliths, measuring the length of fish, and determination of maturation and mark status.

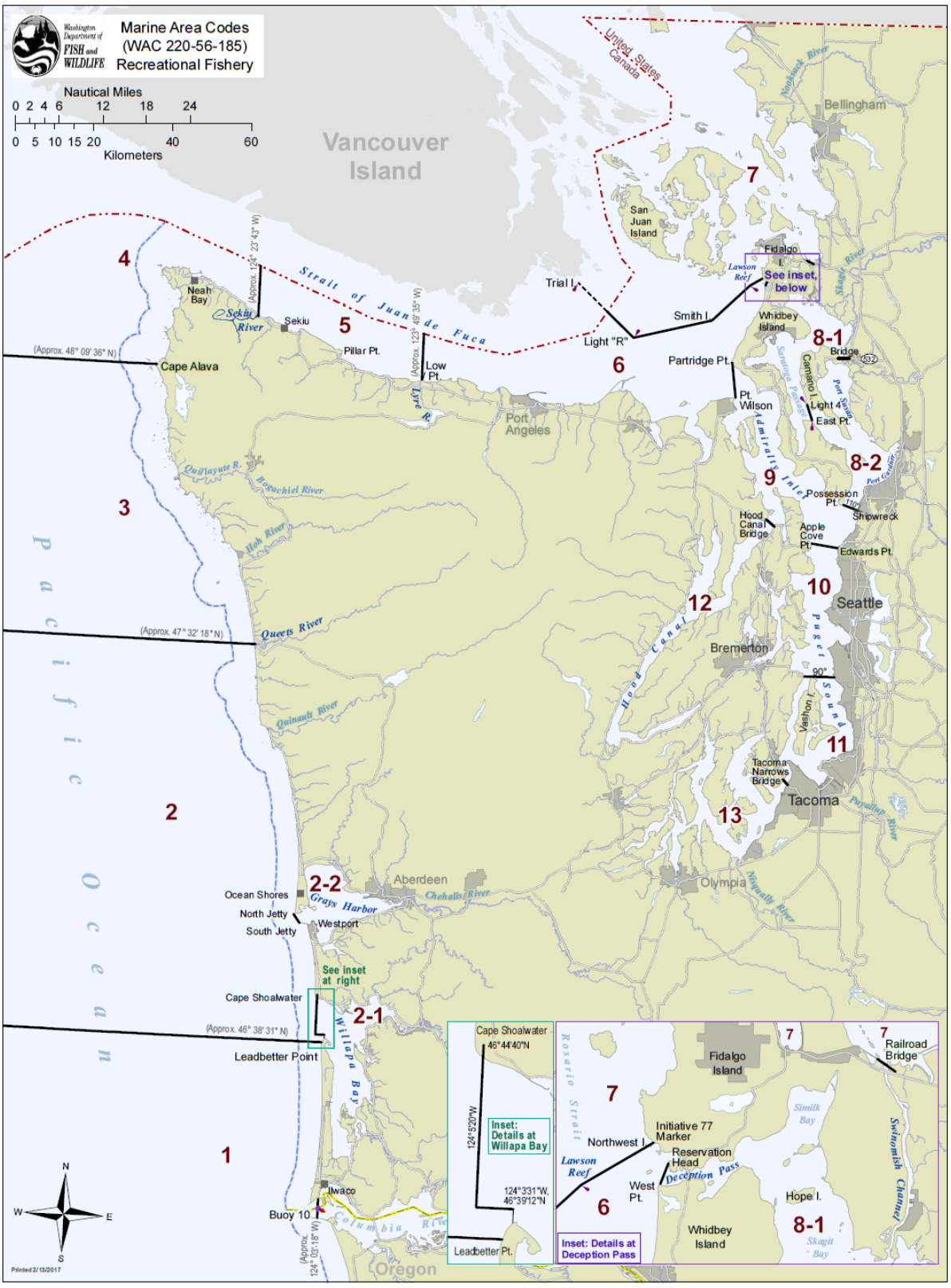


Figure 4. Washington marine recreational fishery salmon catch reporting areas.

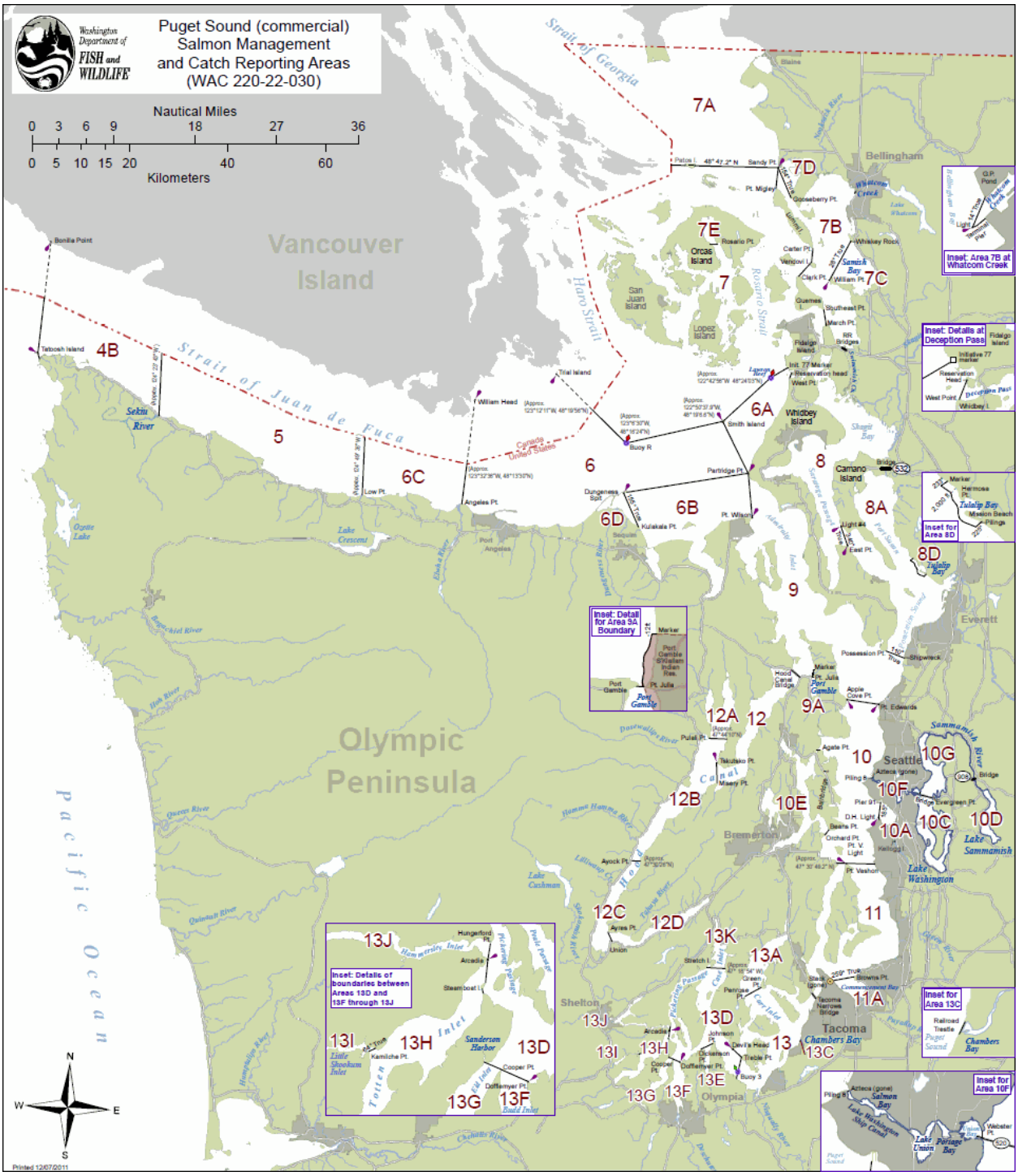


Figure 5. Puget Sound marine commercial fishery salmon catch reporting areas.

Retention of Chinook Salmon, steelhead, or other species is prohibited for some gear types and in some seasons. The most accurate estimates of numbers of fish or other species incidentally encountered, but not retained, come from direct, on-board sampling by trained technical staff. Sampling and monitoring programs implemented by WDFW have been focused on purse seine fisheries to obtain mortality estimates of non-target salmonids. In-season monitoring data are needed from purse seine vessels to estimate the number of Chinook and Coho Salmon they encounter in a fishery when they are not allowed to retain those species.

For gillnet fisheries WDFW relies primarily on fish tickets for non-target salmon catch numbers, as gillnets are required to retain Chinook and Coho Salmon in most fisheries. Release of some species may be required by rule as necessary to achieve management objectives; for example, the skiff gillnet fisheries in Dungeness Bay and Port Gamble Bay are required to release Chinook Salmon. From 2011 to 2014, WDFW focused a portion of its commercial sampling efforts on gillnet vessels to collect data on bycatch of non-target salmon, non-salable fish, and other species. In 2021 WDFW will utilize the on-board observer program to monitor purse seine and gillnet commercial fisheries prosecuted in the marine waters of Puget Sound.

Estimates of encounter rates and retention rates of Chinook Salmon for recreational fisheries are 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 sub-legal and legal non-retention rates used in fishery assessments and planning.

WDFW has implemented an extensive monitoring program to assess the effects of mark-selective fisheries where retention of unmarked, likely natural-origin, Chinook Salmon is prohibited. Area-specific sampling plans are developed annually that include dockside creel sampling, test fishing, on-water or aerial effort surveys, and angler-completed salmon trip reports (STRs, formally voluntary trip reports (VTRs)). This data is used to estimate: 1) the mark rate of the targeted Chinook Salmon population; 2) the total number of Chinook Salmon retained by size (legal or sublegal) and mark-status (marked or unmarked) group; 3) the total number of Chinook Salmon released (by size and mark-status group); 4) the coded-wire tag (CWT) and/or genetic-based stock composition of marked and unmarked Chinook Salmon mortalities; and 5) the total mortality of marked and unmarked double index tag (DIT) CWT stock groups.

7.3. Tribal Ceremonial and Subsistence Fisheries

The tribes schedule ceremonial and subsistence Chinook Salmon fisheries to provide basic nutritional benefits to their members, and to maintain the intrinsic and essential cultural values imbued in traditional fishing practices and spiritual links with the natural resources. All the tribes conduct ceremonial and subsistence fisheries in pre-terminal and/or terminal areas. Ceremonial fisheries occur at various times throughout the year and are usually conducted by a small number of selected fishers when the need arises (e.g., for funerals and special celebrations). Subsistence needs are often met in conjunction with commercial fisheries; a portion of the catch taken in the commercial fishery is taken home by fishers. Some subsistence catches are taken in separately scheduled fisheries, i.e., when commercial fishing is not allowed, subject to the availability of allowable impacts. Catches taken by treaty Indians for ceremonial and subsistence purposes are counted against the applicable treaty allocation.

7.4. Commercial Fisheries

Commercial salmon fisheries in Puget Sound, including the U.S. waters of the Strait of Juan de Fuca, Rosario Strait, Georgia Strait, embayments of Puget Sound, and Hood Canal, are managed by the tribes and WDFW under the Puget Sound Salmon Management Plan. Several tribes conduct commercial troll fisheries directed at Chinook Salmon in the Strait of Juan de Fuca. These fisheries include winter troll season in catch areas 4B, 5, 6, and 6C, and a spring/summer season in Areas 5, 6, and 6B.

Commercial net fisheries, using set and drift gill nets, purse or round-haul seines, beach seines, and reef nets are conducted throughout Puget Sound, and in the lower reaches of larger rivers. These fisheries are regulated by WDFW (nontreaty fleets) and by individual tribes (treaty fleets), with time/area and gear restrictions. In each catch area, harvest is focused on the target species or stock according to its migration timing through that area. Management periods are defined as that interval encompassing the central 80% of the migration timing of the species, in each management area. Because the migration timings of different species overlap, the actual fishing schedules may be constrained during the early and late portion of the management period to reduce impacts on non-target species. Incidental harvest of Chinook Salmon also occurs in net fisheries directed at Sockeye, Pink, Coho, and Chum Salmon.

Due to current conservation concerns, Chinook Salmon-directed commercial fisheries are of limited scope and most are directed at harvestable hatchery production in terminal areas. Nontreaty commercial fisheries directed at Chinook Salmon occur in Bellingham/Samish Bay and southern Hood Canal in the immediate vicinity of the Hoodsport Hatchery. In addition to these areas, treaty fisheries directed at Chinook Salmon include Skagit Bay and the Skagit River, Tulalip Bay, Elliott Bay and the Duwamish River, the Puyallup River, the Nisqually River, Budd Inlet, Chambers Bay, Sinclair Inlet, and the Skokomish River. A small-scale, onshore, marine set gillnet fishery is conducted in the Strait of Juan de Fuca. Small-scale gillnet research or evaluation fisheries may also occur to acquire management and research data in the Skagit River, Elliott Bay and the Duwamish River, Puyallup River, and Nisqually River. All salmon fishing-related Chinook Salmon mortality is accounted for in preseason modelling and postseason assessments.

Mortalities of Puget Sound Chinook Salmon in Puget Sound commercial fisheries generally exceeded 200,000 fish per year from 1980 through 1990. Subsequently, mortalities were substantially reduced as fishery and hatchery management conservation actions were initiated to protect natural-origin Puget Sound Chinook Salmon. By the five-year period (1994-1998) just prior to ESA-listing in 1999, the average adult equivalent mortality[3] (harvest) of Puget Sound Chinook Salmon had declined to approximately 49,000 fish per year (45,468 hatchery origin and 3,562 natural origin) (Figure 6). In the most recent five-year period with postseason estimates (2014-2018), harvest of Puget Sound Chinook Salmon increased to an average of 78,000 per year, but the harvest of natural-origin Puget Sound Chinook Salmon has been further reduced to an average of 3,054 per year (4% of harvest).

[3] Chinook Salmon are harvested at multiple ages through their entire life cycle. Since younger fish are more likely to die of natural causes prior to spawning, we multiply the mortality by an age and location specific factor ("adult equivalent") to provide a consistent measure of the reproductive value of the fish at the time and location of harvest.

7.5. Recreational Fisheries

Recreational salmon fisheries occur in marine catch reporting areas 5-13 and in rivers throughout the Puget Sound region. Recreational Chinook catch has been increasingly constrained in mixed-stock marine areas to avoid overharvest of weak Puget Sound Chinook Salmon stocks. Time and area closures and mark-selective fisheries have been implemented to limit impacts on weak wild stocks. Since the mid-1980's the total annual marine harvest of Puget Sound Chinook Salmon has declined steadily from levels in excess of 100,000 in the late 1980's, to an average of 32,200 since 2002 (Figure 7, Panel A). Freshwater recreational catch has shown an increasing trend since the late 1980's (Figure 7, Panel B), likely in response to constraints placed on marine opportunity along with the increasing abundance of some stocks. Consistent with the North of Falcon policy, a relatively small proportion of the nontreaty mortalities of Puget Sound Chinook Salmon occurs in commercial fisheries (Figure 7, Panel C).

Declining returns of natural-origin Chinook Salmon and ESA-listings in the 1990s resulted in the development of a fishery management tool to allow the harvest of abundant hatchery-origin Chinook Salmon while allowing the release of natural-origin fish. The combination of large-scale hatchery marking (i.e., fin clipping) programs and mark-selective harvest regulations makes it possible to catch and keep hatchery-origin Chinook Salmon while minimally impacting natural-origin salmon populations. In such "mark-selective fisheries" (MSFs), the fishery regulations allow the retention of adipose-fin clipped ("marked") hatchery fish but require the release of any unclipped ("unmarked", predominantly natural-origin) salmon encountered. Since WDFW implemented the first marine mark-selective Chinook Salmon fisheries in catch reporting areas 5 and 6 (Strait of Juan de Fuca) in 2003 based on state-tribal agreements (Thiesfeld and Hagen-Breaux 2005), mark-selective Chinook Salmon fishing regulations have been implemented in multiple Puget Sound areas during both the summer and winter seasons.

The mortalities of Chinook Salmon per day of fishing during the summer months appear to be increasing in some marine recreational fisheries (Figure 8). This is particularly evident in areas 6, 7, and 9, although increases were evident in multiple areas in the final year (2018) for which postseason estimates are available. The factors responsible likely varies between areas but may include increased numbers of anglers participating per day or higher catch rates. Regardless of the explanation, the higher catch per day has resulted in shorter fishery openings.

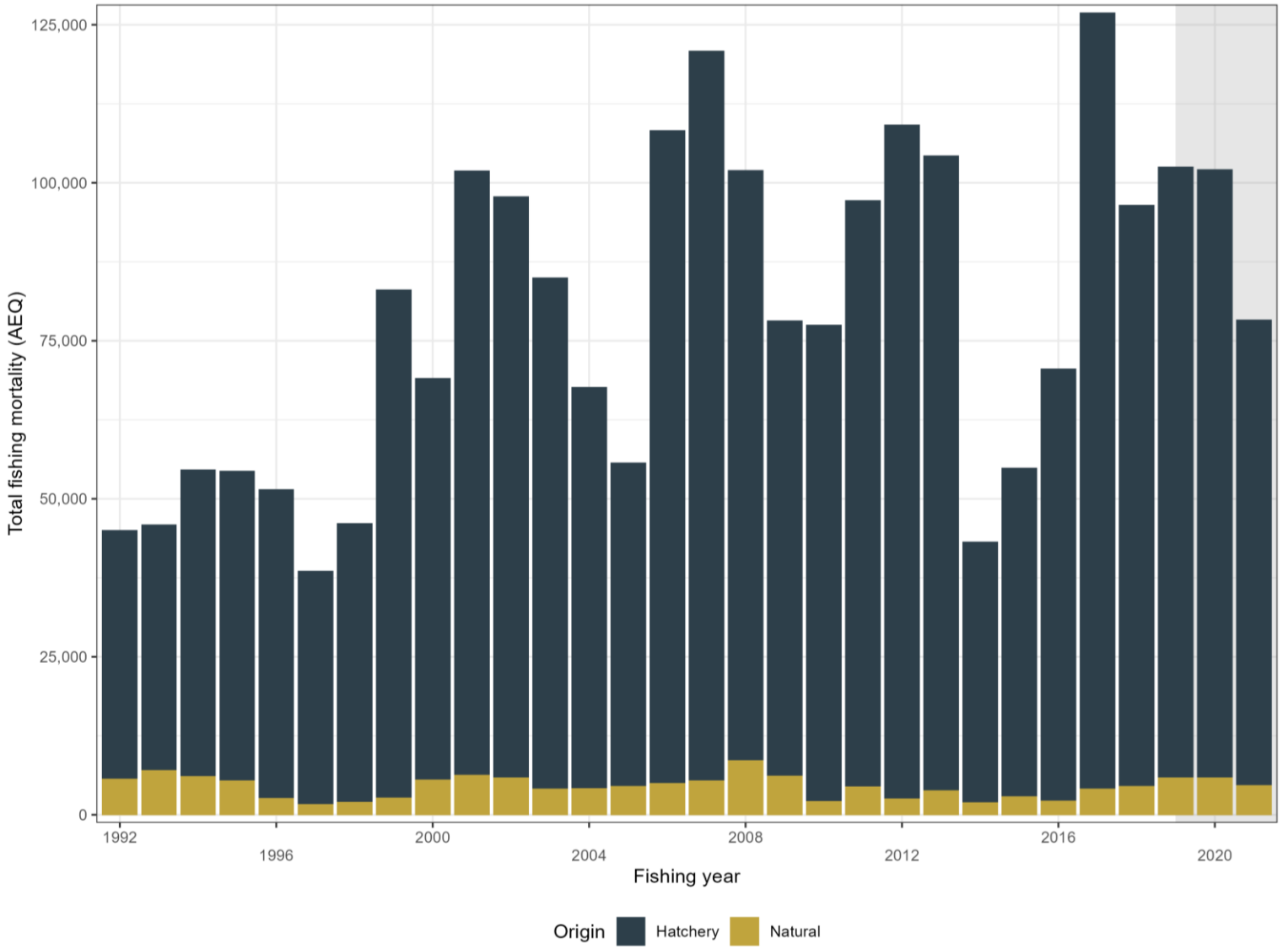


Figure 6. Adult equivalent mortalities of hatchery- and natural-origin Puget Sound Chinook Salmon in Puget Sound commercial fisheries (treaty and nontreaty) (1992 – 2018; 2019 - 2021 preseason). Source: FRAM V7.1 model runs.

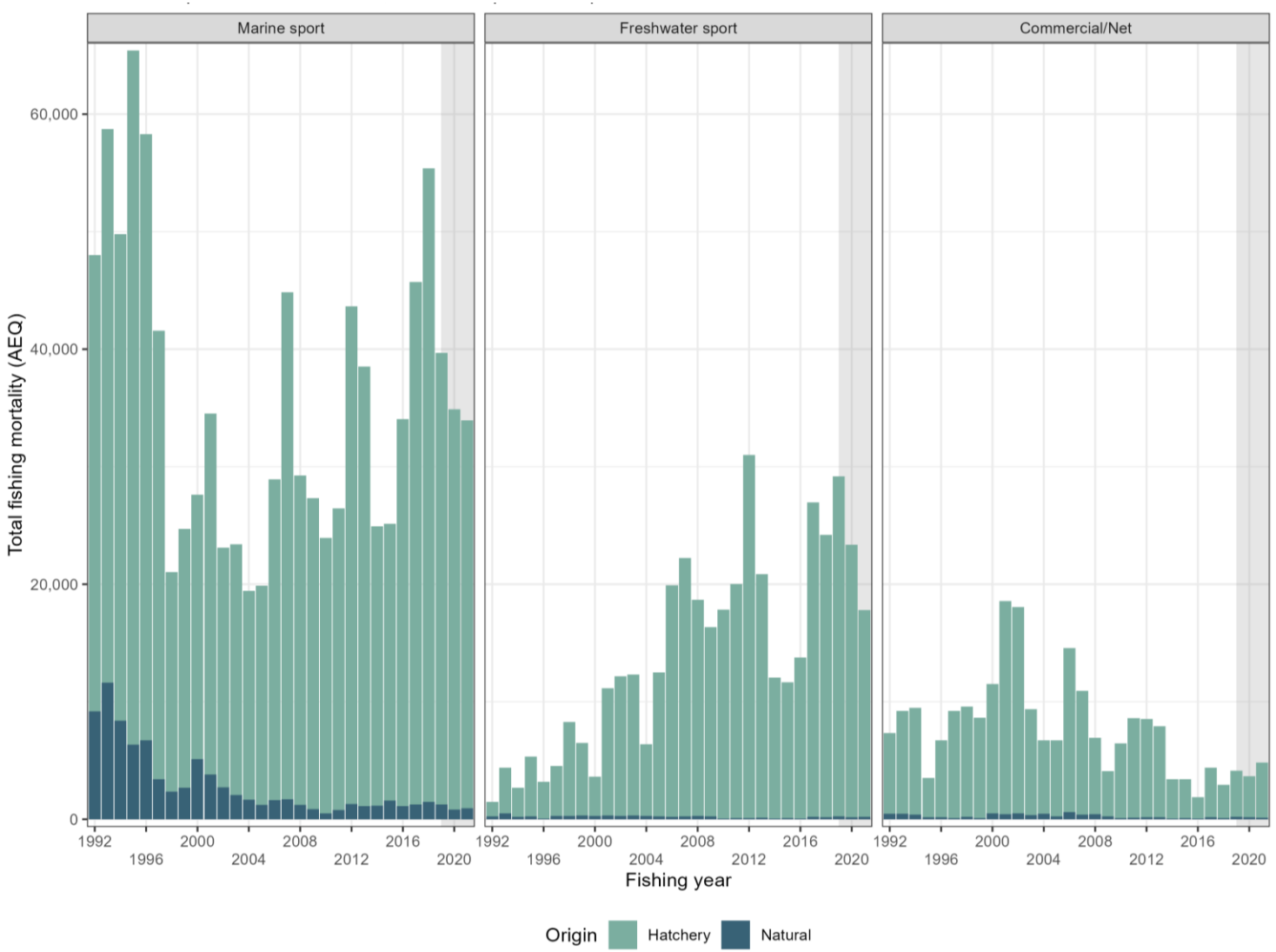


Figure 7. Adult equivalent mortalities of hatchery- and natural-origin Puget Sound Chinook Salmon in Puget Sound nontreaty fisheries (1992 – 2018 postseason; 2019 - 2021 preseason). Source: FRAM V7.1 model runs.

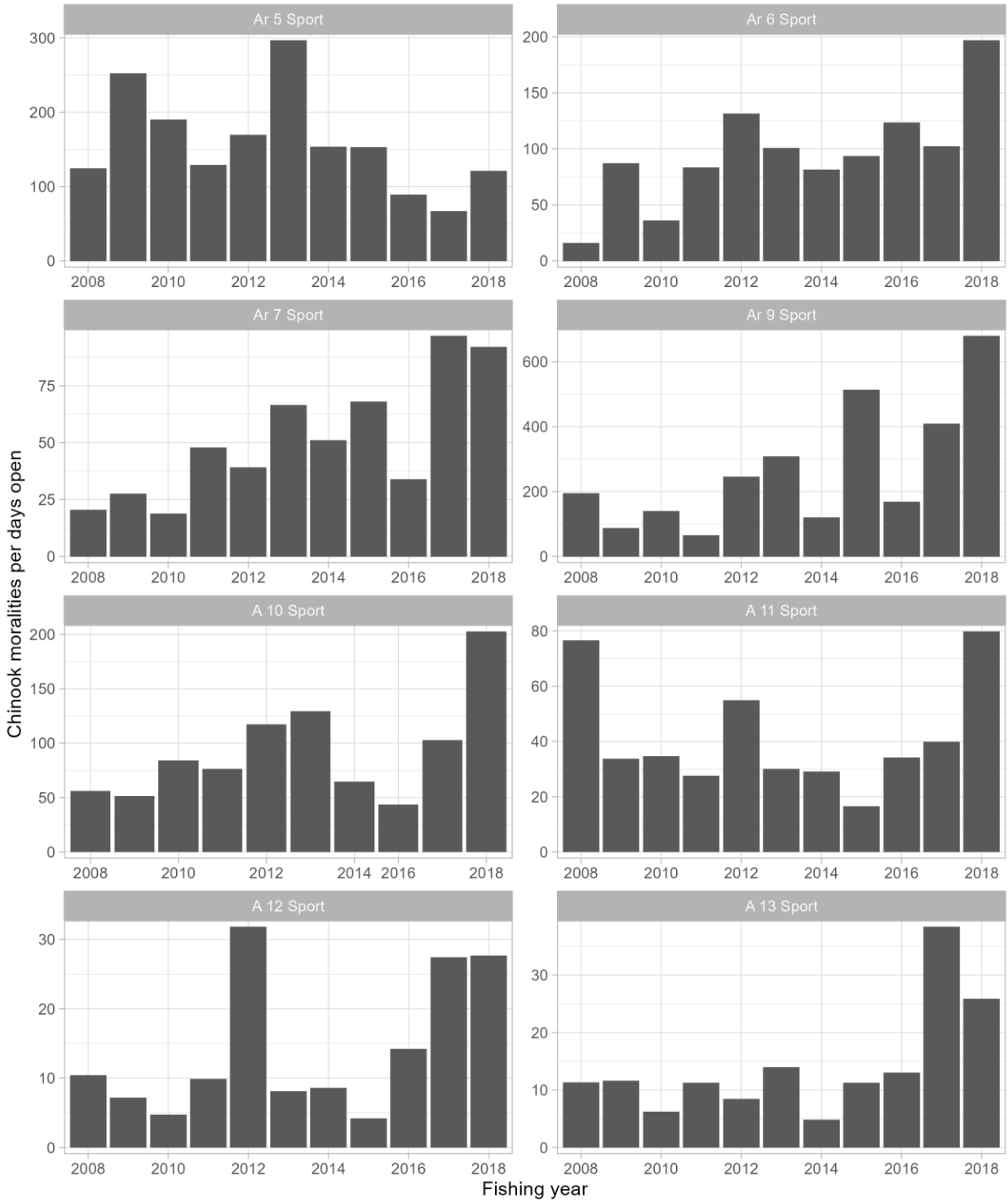


Figure 8. Estimates of mortalities per day of Puget Sound marine recreational fisheries during the summer months, 2008-2018.

7.6. Non-landed Fishery Mortality

Non-landed fishing mortality occurs when a fishing regulation requires the release of Chinook Salmon or when a Chinook Salmon is lost from the fishing gear before landing. The following are examples of non-landed mortality that occurs in salmon fisheries:

Sub-legal Releases. Regulations for recreational and troll fisheries frequently require the release of Chinook Salmon smaller than a specified length.

Non-retention. Regulations may require the release of Chinook Salmon to minimize impacts in fisheries directed at other species. For example, nontreaty seine fishers have been required to release all Chinook Salmon in all areas of Puget Sound (except in fisheries directed at hatchery-origin Chinook Salmon) in recent years.

Mark-Selective Fisheries. Regulations may require the release of unmarked, primarily natural-origin Chinook Salmon while allowing the retention of hatchery-origin salmon.

Drop-off Mortality. Chinook Salmon that are initially hooked in recreational or troll fisheries may escape from the gear prior to being brought to the boat or angler. Some of these fish will subsequently die as a result of injury or stress.

Drop-out Mortality. Chinook Salmon that are initially captured in a gillnet or purse seine may escape from the gear prior to being brought to the boat. Some of these fish will subsequently die as a result of injury or stress.

The mortality rates associated with these sources have been reviewed periodically by the Washington co-managers, as well as in the PFMC and Pacific Salmon Commission forums (see CTC 2020 for the most recent review). The release mortality rates used by the co-managers to estimate non-landed mortality vary greatly by gear type as well as by the size or maturity of the Chinook Salmon encountered (Table 3). Because catch per set is typically small for beach seine and reef net gear, it is assumed Chinook Salmon may be released without harm. Conservatively higher release mortality is assumed for some beach seine fisheries (e.g., a 50% mortality rate is used for Chinook Salmon encountered but released in the Skagit Pink Salmon fishery). The rates are incorporated into management planning and assessment models to estimate the total fishing related mortality.

WDFW requires the release of Chinook Salmon encountered in most nontreaty purse seine fisheries. Monitoring of the fisheries indicates a variable, but generally low encounter rate of Chinook Salmon relative to target species such as Coho or Chum Salmon (Table 4).

Table 3. Chinook Salmon incidental mortality rates applied to commercial and recreational fisheries in Washington.

Fishery: (designated by area, user group, and/or gear type)	Fishery Type	Comments	"Shaker" Release Mortality	"Adult" Release Mortality	"Other" Mortality[a]
PFMC Ocean Recreational[e]	Retention	N Point Arena	14.0%	n.a.	5.0%
	MSF	N Point Arena	14.0%	14.0%	5.0%
	Retention	N Point Arena	14.0%	14.0%	5.0%
	Retention	S Point Arena	23.0%[g]	n.a.	5.0%
PFMC Ocean Troll	Retention	barbless	25.5%	n.a.	5.0%
Area 5,6,7 T-Troll	Retention	barbless	25.5%	n.a.	5.0%
Puget Sound (PS) Recreational[f]	Retention	barbless	20.0%	n.a.	5.0%
	MSF	barbless	20.0%	10.0%	5.0%
	Non-Retention	barbless	20.0%	10.0% [b]	5.0% [b]
Buoy 10 Recreational	not modeled within FRAM		n.a.	n.a.	n.a.
Commercial Net					
PS Areas 4B,5,6,6C	PT[d] GN, SN		n.a.	n.a.	3.0%
WA Coastal & Col R. Net	PT[d] GN, SN		n.a.	n.a.	3.0%
PS Areas 6A,7,7A	PT[d] GN, SN, Purse S		n.a.	n.a.	1.0%
NT PS Areas: 6B,9,12,12B,12C	PT[d] GN, SN, Purse S		n.a.	n.a.	1.0%
T PS Areas:7B,7C,7D	PT[d] GN, SN, Purse S		n.a.	n.a.	1.0%
All other PS marine net	Terminal GN, SN		n.a.	n.a.	2.0%
PS Purse Seine	Non-Retention	immature	n.a.	45.0% [b]	0.0%
	Non-Retention	mature	n.a.	33.0% [b]	0.0%
PS Reef Net	Non-Retention		n.a.	0%	n.a.
Freshwater Net			n.a.	n.a.	n.a.
Tangle Net	MSF	mature	n.a.	40 & 45%	n.a.
Freshwater Recreational	Retention		n.a.	n.a.	n.a.
	MSF	TAMM	n.a.	10.0% [b]	n.a.
	Non-Retention	TAMM	n.a.	10.0% [b]	n.a.

[a] The "other" mortality rates (which include drop-out and drop-off) are applied to landed fish (retention fisheries), thus FRAM does not assess "drop-off" in non-retention fisheries. Drop-off (and release mortality) associated with CNR fisheries are estimated outside the model and used as inputs to the model. For mark-selective fisheries (MSF), "other" mortality rates are applied to legal sized encounters of marked and unmarked fish.
[b] Rate assessed externally to FRAM.
[c] None assessed.
[d] PT = Pre-terminal.
[e] Source: Salmon Technical Team (2000).
[f] Source: WDF et al. (1993).
[g] Release Mortality rate variable between years, dependent upon gear regulations

Table 4. Average number of sets observed and encounters of Chinook Salmon and other species by on-board monitoring of nontreaty commercial fisheries directed at Sockeye, Pink, and Chum Salmon (weeks 31-45) in 2016-2020. PS – purse seine; GN - gillnet

Area	Gear Type	# Sets Observed	Chinook	Coho	Sockeye	Pink	Chum	Steelhead
7	PS	26.6	90.6	105.0	3,668.2	1582	672.2	0.4
7A	PS	24.4	17.4	63.0	623.0	0.4	538.8	0.0
8A	PS	3.2	8.0	61.6	0.2	0.0	0.4	0.2
10	PS	23.2	7.8	11.4	0.0	4.2	1,431.4	0.6
11	PS	24.8	3.2	11.4	0.2	0.0	2711.4	0.0
12	PS	33.8	0.8	45.4	0.0	0.0	3,122.0	0.0
12B	PS	31.0	2.6	63.0	0.0	0.0	4,335.2	0.0
7	GN	4.0	0.0	0.5	29.2	0.0	14.7	0.2
7A	GN	9.0	0.6	1.6	316.3	0.3	24.6	0.0
10 [1/]	GN	12.0	1.0	8.0	0.0	279.0	1.0	0.0
12	GN	4.5	0.0	2.0	0.0	0.0	496.0	0.0
12B	GN	2.5	0.0	0.0	0.0	0.0	150.0	0.0

[1/] Monitoring occurred only during 2015 limited participation pink fishery.

Chapter 8. Fishery Resource Management Plan

Key Points:

1) A Resource Management Plan (RMP) is a description of a proposed fishery or hatchery program provided to NMFS for evaluation for consistency with the ESA and associated federal rules. Approval of an RMP by NMFS provides assurance that the activities described in the RMP do not violate the take prohibitions of the ESA and will not be subject to enforcement.
2) The Puget Sound Chinook RMP will establish shared conservation objectives that will provide the foundation for the state and tribal co-managers to plan and identify fisheries in each year of the projected 10-year term of the RMP. Allocation of the Chinook Salmon catch between treaty and nontreaty fisheries is not an element of the RMP.
3) NMFS anticipates that completion of the NEPA and ESA consultation processes will take up to 18 months from the time a final RMP is submitted by the co-managers.
4) The RMP is not a Recovery Plan. Limits on co-manager fisheries contribute to conservation and recovery but, in themselves, cannot recover Puget Sound Chinook Salmon. Recovery will be achieved through restoring the productivity of the habitat and addressing other factors reducing Chinook Salmon productivity.

The co-manager fishery plan must not appreciably reduce the likelihood of survival and recovery of Puget Sound Chinook salmon

Federal rules for a fishery RMP require that it:

- Be consistent with plans and conditions established within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.
- Must not appreciably slow a population that is above critical status from achieving a viable function.
- Must not compromise the management objectives for commingled naturally spawned populations where artificially propagated fish predominate.
- Set escapement objectives or maximum exploitation rates for each management unit or population based on its status and on a harvest program that assures that those rates or objectives are not exceeded.
- Include effective monitoring and evaluation programs to assess compliance, effectiveness, and parameter validation.

8.1. Introduction

In June 2000, NMFS adopted a rule prohibiting the "take" of 14 groups of salmon and steelhead listed as threatened under the ESA. NMFS adopted the take rule under section 4(d) of the ESA. The rule prohibits anyone from taking a listed salmon or steelhead except as approved by NMFS and created a means for NMFS to approve additional programs if they meet certain standards or limits set out in the rule. The 2000 rule includes 13 “limits” on the take prohibition it imposes (50 CFR 223.203(b))[4].

Limit 6 (50 CFR 223.203(b)(6)) applies to the joint tribal-state RMP currently under development by the co-managers. The limit “exempts actions undertaken in compliance with a [RMP] developed jointly” by Washington and the tribes within the

[4] For additional information about the 4(d) rule, see the NMFS document A Citizens Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast (available at 4(d) Citizen's Guide).

continuing jurisdiction of *United States v. Washington* if NMFS determines that implementing and enforcing the RMP "will not appreciably reduce the likelihood of survival and recovery of [the Puget Sound Chinook ESU]" (50 C.F.R. § 223.203(b)(6)(i)). In making this determination, NMFS must take public comment on whether the RMP addresses the criteria in Limit 4 for a Fishery Management and Evaluation Plan (FMEP) (50 CFR 223.203(b)(6)(iii)). The RMP must be implemented and enforced within the parameters of *U.S. v. Washington*, and NMFS must, on a regular basis, evaluate the effectiveness of the RMP in "protecting and achieving a level of salmonid productivity commensurate with conservation of the listed salmonids" (50 CFR 223.203(b)(6)(ii), (v)). If NMFS determines the RMP is not effective, it may withdraw the limit on activities associated with the RMP, but only if a co-manager does not make changes identified by NMFS to strengthen or alter the RMP in response to new information (50 CFR 223.203(b)(6)(v)).

Criteria for an FMEP include the following (50 CFR 223.203(b)(4)):

1) **Define populations** within affected listed ESUs, taking into account spatial and temporal distribution, genetic and phenotypic diversity, and other appropriate identifiably unique biological and life history traits. Populations may be aggregated for management purposes when dictated by information scarcity, if consistent with survival and recovery of the listed ESU. In identifying management units, the plan shall describe the reasons for using such units in lieu of population units, describe how the management units are defined, given biological and life history traits, so as to maximize consideration of the important biological diversity contained within the listed ESU, respond to the scale and complexity of the ESU, and help ensure consistent treatment of listed salmonids across a diverse geographic and jurisdictional range

2) **Utilize the concepts of "viable" and "critical" salmonid population thresholds**, consistent with the concepts contained in the technical document entitled "Viable Salmonid Populations {VSP} (McElhany et al. 2000)." The VSP paper provides a framework for identifying the biological requirements of listed salmonids, assessing the effects of management and conservation actions, and ensuring that such actions provide for the survival and recovery of listed species. Proposed management actions must recognize the significant differences in risk associated with viable and critical population threshold states and respond accordingly to minimize the long-term risks to population persistence. Harvest actions impacting populations that are functioning at or above the viable threshold must be designed to maintain the population or management unit at or above that level. For populations shown with a high degree of confidence to be above critical levels but not yet at viable levels, harvest management must not appreciably slow the population's achievement of viable function. Harvest actions impacting populations that are functioning at or below critical threshold must not be allowed to appreciably increase genetic and demographic risks facing the population and must be designed to permit the population's achievement of viable function, unless the plan demonstrates that the likelihood of survival and recovery of the entire ESU in the wild would not be appreciably reduced by greater risks to that individual population.

3) **Set escapement objectives or maximum exploitation rates** for each management unit or population based on its status and on a harvest program that assures that those rates or objectives are not exceeded. Maximum exploitation rates must not appreciably reduce the likelihood of survival and recovery of the ESU. Management of fisheries where artificially

propagated fish predominate must not compromise the management objectives for commingled naturally spawned populations.

4) **Display a biologically based rationale** demonstrating that the harvest management strategy will not appreciably reduce the likelihood of survival and recovery of the ESU in the wild, over the entire period of time the proposed harvest management strategy affects the population, including effects reasonably certain to occur after the proposed actions cease.

5) **Include effective monitoring and evaluation programs** to assess compliance, effectiveness, and parameter validation. At a minimum, harvest monitoring programs must collect catch and effort data, information on escapements, and information on biological characteristics, such as age, fecundity, size and sex data, and migration timing.

6) **Provide for evaluating monitoring data** and making any revisions of assumptions, management strategies, or objectives that data show are needed.

7) **Provide for effective enforcement and education**. Coordination among involved jurisdictions is an important element in ensuring regulatory effectiveness and coverage.

8) **Include restrictions on resident and anadromous species fisheries** that minimize any take of listed species, including time, size, gear, and area restrictions.

9) **Be consistent with plans and conditions established within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations**.

8.2. Puget Sound Chinook RMP

The Puget Sound Chinook RMP will establish management objectives for Puget Sound Chinook Salmon and provide guidance in planning annual salmon fisheries in the Puget Sound region. In addition to guiding the implementation of salmon fisheries in Puget Sound, the RMP will also account for harvest impacts of other fisheries that impact Puget Sound Chinook Salmon, including those in other states and Canada, to assure that conservation objectives for Puget Sound Chinook Salmon management units are achieved. The RMP's accounting for total fishery-related mortality includes incidental harvest in fisheries directed at other salmon species and non-landed mortality.

The tribes and WDFW submitted multi-year RMPs in 2004 and 2010, and each was approved by NMFS pursuant to the procedures and criteria in the 4(d) rule. The co-managers intend to develop a new RMP using the 2010 RMP as a starting point and updating the management unit objectives and status profiles with new information. Since 2014, the co-managers have obtained an ESA exemption from NMFS for Puget Sound salmon fisheries on a year-to-year basis using a different regulatory process (a Section 7 consultation). A multi-year RMP provides greater certainty to the co-managers regarding management objectives, and it provides NMFS with the opportunity to evaluate the longer-term effects of a proposed fishery regime.

In making its determination on the RMP under the 4(d) rule, NMFS must comply with the National Environmental Policy Act ("NEPA") and section 7 of the ESA by consulting with itself and preparing a biological opinion ("BiOp"). NMFS anticipates that completion of the NEPA and ESA consultation processes will take up to 18 months from the time a final RMP is submitted by the co-managers. As a result, WDFW and the co-manager tribes must submit the RMP to NMFS in 2021, for example, to obtain

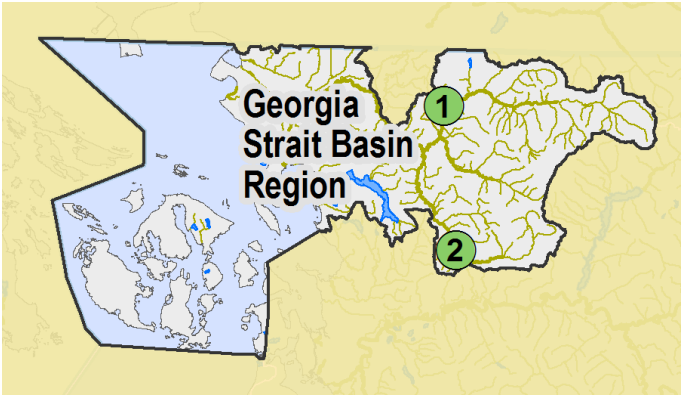
NMFS's determination on the RMP under Limit 6 of the 4(d) rule – and the accompanying ESA exemption – for salmon fisheries in Puget Sound starting in May of 2023.

It is important to note that the RMP establishes a conservation basis for the state and tribal co-managers to develop annual fisheries during the term of the RMP. Allocation of the Chinook catch between treaty and nontreaty fisheries is not an element of the RMP. It is also important to recognize that an RMP is not a recovery plan. Rather, it is a regulatory tool to exempt fisheries from the ESA take prohibition provided that the fisheries "will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs." As discussed above, limits on co-manager fisheries are contributing to conservation and recovery but, in themselves, cannot recover Puget Sound Chinook Salmon. That can only be achieved through restoring the productivity of freshwater and marine habitat. Protecting and restoring habitat is a key focus of the recovery plan for Puget Sound Chinook Salmon, and WDFW is strongly supportive and fully engaged in a broad range of actions to conserve and recover Puget Sound Chinook Salmon.

Chapter 9. Strait of Georgia MPG

Videos: Restoring the Nooksack River, Middle Fork Nooksack

Key Points:



1) The Puget Sound recovery plan identified two genetically unique populations in the Strait of Georgia MPG (see map for locations): North Fork Nooksack (1) and South Fork Nooksack (2).
2) Both populations have been designated by NMFS as Tier 1, indicating their importance for preservation, restoration, and ESU recovery.
3) Habitat degradation has substantially reduced the productivity of both populations. On average in 2017 and 2018, there were less than 100 North Fork and less than 260 South Fork, natural-origin spawners.
4) Maintenance and rebuilding of the populations is critically dependent on the hatchery conservation programs operated by the co-managers and on habitat restoration.
5) Most (> 75%) of the fishery mortality on the Nooksack management unit occurs outside of the SUS. Total fishery exploitation rates averaged 0.31 in 2009-2018 relative to NMFS RER of 0.05.
6) Fishery exploitation rates in the SUS from 2009-2018 averaged 0.06.

NMFS PRA Designation

Tier 1:

MF Nooksack Dam Removal

Removal of a dam on the Middle Fork Nooksack River in 2020 provided access to 16 river miles of relatively pristine habitat with the potential to increase Chinook production by 30%.

Photo Source: Puget Sound Partnership

9.1. Introduction

The Strait of Georgia MPG is in the northeast corner of the Puget Sound Chinook ESU and includes two Chinook Salmon populations, the North Fork Nooksack and the South Fork Nooksack. NMFS has classified both populations as Tier 1, indicating that they are among the most important populations for preservation, restoration, and ESU recovery.

Substantial conservation and habitat restoration efforts are underway by the Lummi Nation, Nooksack Indian Tribe, WRIA 1 Watershed Management Board, Nooksack Salmon Enhancement Association, WDFW, and other recovery partners.

The co-managers assess fishery exploitation rates on a single management unit (MU), Nooksack, while continuing to monitor the number of spawners for each population (Table 5).

Table 5. Correspondence of populations and management units in the Strait of Georgia MPG.

River Basin	Population	Tier	Management Unit
Nooksack	North Fork Nooksack	1	Nooksack
	South Fork Nooksack	1	

9.2. Nooksack MU

Synopsis:

NMFS Tier Designations

North Fork Nooksack: 1
South Fork Nooksack: 1

Fishery Exploitation Rates

NMFS RER: 0.05
PST SUS Exploitation Rate Limit: 2009-2015 average (0.07 as assessed by FRAM)
% Fishery Mortality in SUS Fisheries: 21% (2009-2018)
Average Total Exploitation Rate: 0.31 (2009-2018)
Average SUS Exploitation Rate: 0.06 (2009-2018)

Average Spawners (2017-2018; most recent years of estimates)

Total Spawners
- Nooksack MU: 2,841
- North Fork Nooksack: 1,787
- South Fork Nooksack: 1,054

Natural-Origin Spawners
- Nooksack MU: 328
- North Fork Nooksack: 71
- South Fork Nooksack: 257

The North Fork Nooksack and South Fork Nooksack Chinook Salmon populations are genetically distinct from all other Puget Sound Chinook Salmon and from one another. NMFS has designated both populations as Tier 1 because of their importance to the recovery of the Puget Sound Chinook ESU. The biological opinion associated with the 2019 update to the Pacific Salmon Treaty identified the Nooksack as one of the "weakest populations that are considered essential for recovery and those most affected by northern fisheries" (NMFS 2019c).

Habitat degradation has substantially reduced the ability of Chinook Salmon to sustain themselves in the Nooksack River. Habitat degradation includes (SSDC 2007): 1) instability of channel in the upper and middle portions of the North and South Forks; 2) increased sediment coming from natural and human causes, and changes in how that sediment is transported through the system; 3) loss of logs and other structures that create pools and rearing places for the fish; 4) levees and dikes mostly, in the South Fork and mainstem, that constrain the river and eliminate side channels where fish rear and could seek refuge during floods; 5) obstructions that block fish from key habitats; 6) temperature and low summer/fall flows

in the South Fork; and 7) changes along marine shorelines in Bellingham Bay and in nearshore areas that have reduced the suitability of habitat for rearing juvenile Chinook Salmon.

The degradation of habitat has reduced the survival of Chinook Salmon that rear, spawn, and migrate through the Nooksack River. This is reflected in the RER of 0.05, the lowest RER estimated for any of the Puget Sound Chinook Salmon populations.

Priority actions include the following (see Nooksack Key Actions):

Action 1: Restore fish passage at critical barriers. Obstructions such as culverts, dams, tidegates, and floodgates block access to upstream habitats for both returning adults and juveniles. In WRIA 1, there are two major barriers that are limiting early Chinook Salmon: Middle Fork Nooksack Diversion Dam (removed in 2020) and Canyon Creek Barrier.

Action 2: Restore habitat in the South Fork, Middle Fork, and North Fork Nooksack River, Mainstem Nooksack River, and major early chinook tributaries. High quality salmon habitat is self-sustaining when functioning properly. However, there is little habitat in WRIA 1 that is considered properly functioning. This action proposes a range of restoration strategies and projects. Four project types considered as part of this action are: 1) large wood jams that stabilize channels, increase habitat complexity, and reconnect rivers to floodplains; 2) streamside (riparian) plantings to increase shading, bank stability, and wood inputs to streams; 3) levee removals/setbacks to increase flood storage and channel/floodplain connectivity; and 4) acquisition of land at risk of development or with high restoration potential.

Action 3: Integrate salmon recovery needs with floodplain management. Traditional flood control methods typically have not considered impacts to fish. However, a strategic approach to floodplain management can benefit both people and fish. This action is to identify and implement the steps that will lead to integrating salmon recovery needs and floodplain management.

Action 4: Integrate habitat protection with local land use regulations. Two local regulations, the Critical Areas Ordinance (CAO) and the Shoreline Management Program (SMP), are important in guiding the interaction of human development and fish habitat.

Action 5: Establish new instream flows for WRIA 1. Instream flow levels set in 1986 by the state Department of Ecology will be revisited over the next several years through the WRIA 1 Watershed Management Project. Any new flow regimes will affect how much water is available for current and future instream and out-of-stream uses, as well as water quality and available fish habitat.

Action 6: Protect and restore priority estuarine and nearshore areas. The goal of this action is to protect and restore priority estuarine and nearshore areas that will lead to the recovery of the Nooksack stocks of chinook and other salmonids.

Action 7: Restore and reconnect isolated habitats in lowland and independent tributaries. This action is similar to Action #2 except that it focuses on projects in the Nooksack River's lowland tributaries, which are a lower priority for recovery of early chinook. Factors limiting fish populations in these streams include barriers to fish passage, lack of habitat complexity, impaired riparian functions, and water quantity and quality.

Action 8: Establish a South Fork gene bank and supplementation program. Improving stream habitat conditions is critical to the recovery of South Fork Chinook Salmon, but it will be a gradual and long-term process. As an interim measure to preserve the unique genetic characteristics of this stock, a South Fork gene bank and supplementation program will operate at Skookum Hatchery. This hatchery conservation program is now underway with funding through a Pacific Salmon Treaty implementation grant and other sources.

Substantial investments in habitat restoration are underway (see Lummi Nation and Nooksack Indian Tribe sections of 2020 Watershed Status for a summary of habitat conditions and actions). A significant step forward was made in 2020 with the removal of a dam on the Middle Fork Nooksack River that had blocked passage of salmon and steelhead since 1961. Local, state, federal, and private funding totaling more than $17 million resulted in restoring access to more than 16 river miles of relatively pristine habitat with the potential to increase Chinook production by 30% (NMFS 2020a; NWIFC 2020). As of 2020, the Washington State Forest Road Maintenance and Abandonment Plan (RMAP) has led to the repair and/or abandonment of the majority of 1,426 total miles of private and state-owned forest roads in the upper Nooksack River watershed. RMAP has also resulted in the repair or removal of 45 of 58 (78%) fish barrier culverts on private and state-owned forest roads (NWIFC 2020).

The unique genetic characteristics of each of the populations, and the threat of extirpation, has resulted in the initiation of hatchery conservations programs for both populations. The Kendall Creek Hatchery (North Fork Nooksack, operated by WDFW) and the Skookum Creek Hatchery (South Fork Nooksack, operated by the Lummi Nation) have been vital in conserving this important genetic diversity and increasing the abundance of these populations. Returns of hatchery-origin Chinook Salmon in 2020 were sufficient to allow the opening of a recreational fishery directed at hatchery -origin Chinook Salmon for the first time since 1954 (WDFW 2020).

The United States is obligated under the Pacific Salmon Treaty to monitor fishery exploitation rates on North Fork Nooksack Chinook Salmon. Juvenile Chinook Salmon reared at the Kendall Creek Hatchery receive a CWT; subsequent recoveries of tagged fish in Canadian and U.S. fisheries are used to monitor compliance with the ISBM obligations of the Pacific Salmon Treaty (see Section 5.2). In addition to being tagged, the fish are marked by a clipped adipose fin clip so that they can be identified in fisheries, primarily in Canada, that rely upon this clip to identify tagged fish. The Pacific Salmon Treaty limits the exploitation rates to the average rate from 2009-2015, equivalent to 0.07 when measured using the domestic management model (FRAM).

Total fishery exploitation rates on Nooksack Chinook Salmon have been reduced (Figure 9). Total fishery exploitation rates have dropped from an average of 0.39 from 1992-1998 to 0.32 from 2009-2018. Most (> 75%) of the total fishing mortality on the Nooksack MU occurs in fisheries in locations other than the SUS (Figure 10Figure 15). The average exploitation rate in SUS fisheries has remained low, averaging 0.07 from 1992-1998 and 0.06 from 2009-2018.

Estimates of the number of spawners rely on genetic analyses and marking to distinguish North Fork, South Fork, and other Chinook Salmon in the basin. Because of the complexity of the analysis, 2018 is the most recent year with spawner estimates. The methods used to estimate spawners have improved through the years which makes the assessment of long-term trends challenging. However, the initiation of the South Fork Nooksack hatchery conservation program has contributed to a substantial increase in

spawners in the Nooksack River (Figure 11). An average of 1,054 total (hatchery- and natural-origin) South Fork (Figure 12) and 1,717 North Fork Chinook Salmon (Figure 13) spawned in the river in 2017 and 2018. The average number of natural-origin spawners in 2017 and 2018 was 257 in the South Fork and 71 in the North Fork. Because of the low productivity of Chinook Salmon spawning in the rivers, maintenance of the populations continues to rely on the conservation hatchery programs.

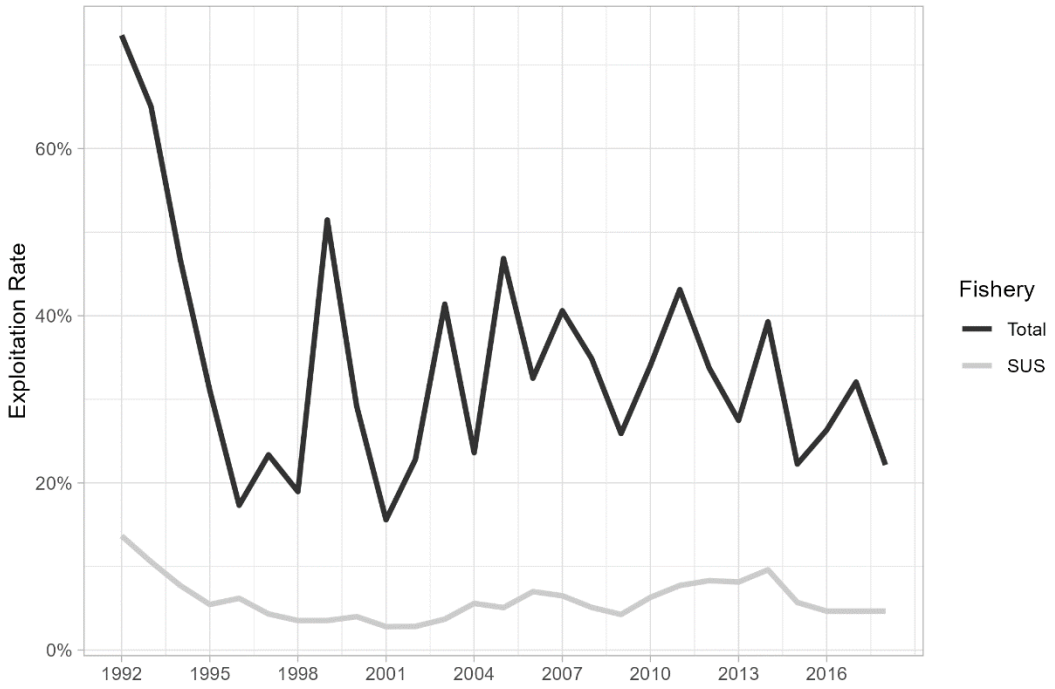


Figure 9. Fishery exploitation rates on the Nooksack MU in all fisheries and in the SUS, 1992-2018.

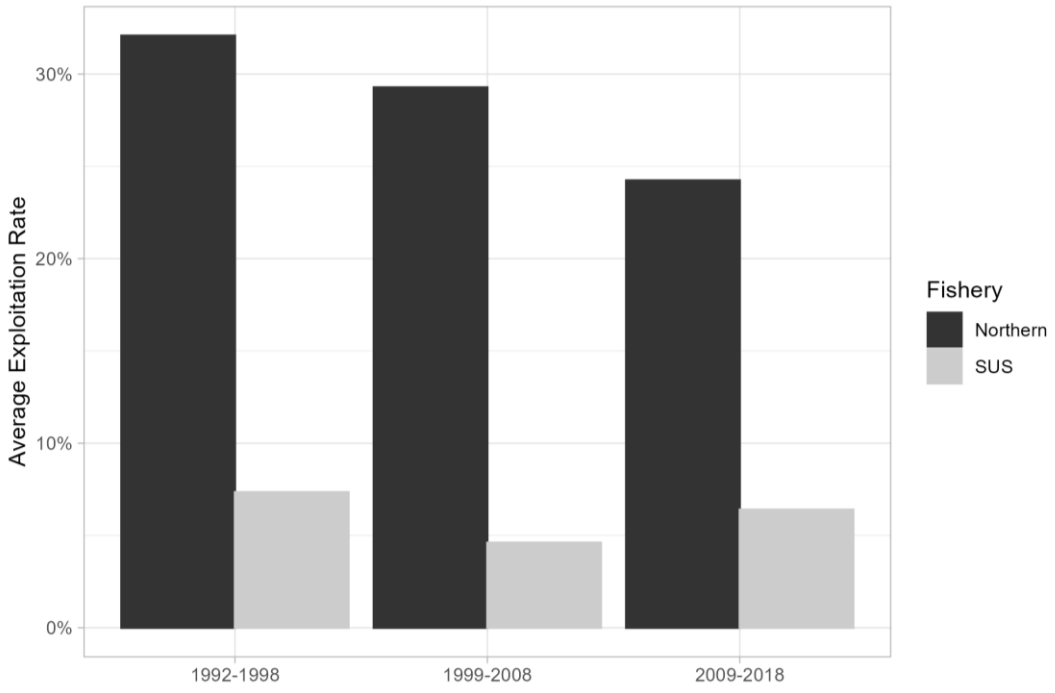
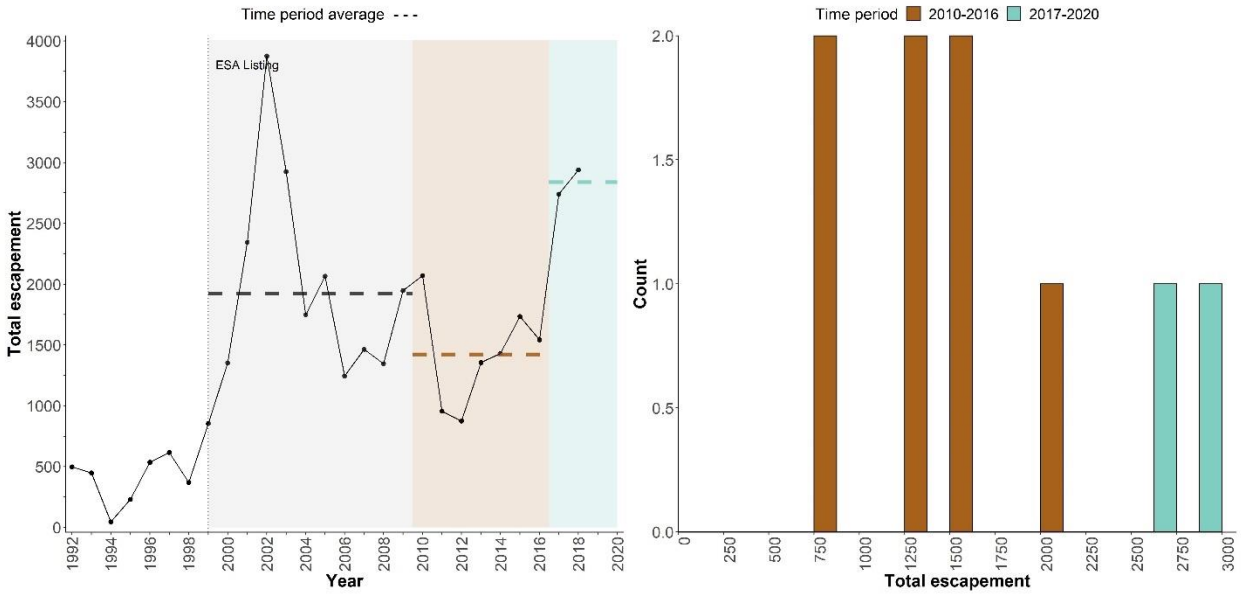


Figure 10. Average exploitation rates on the Nooksack MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

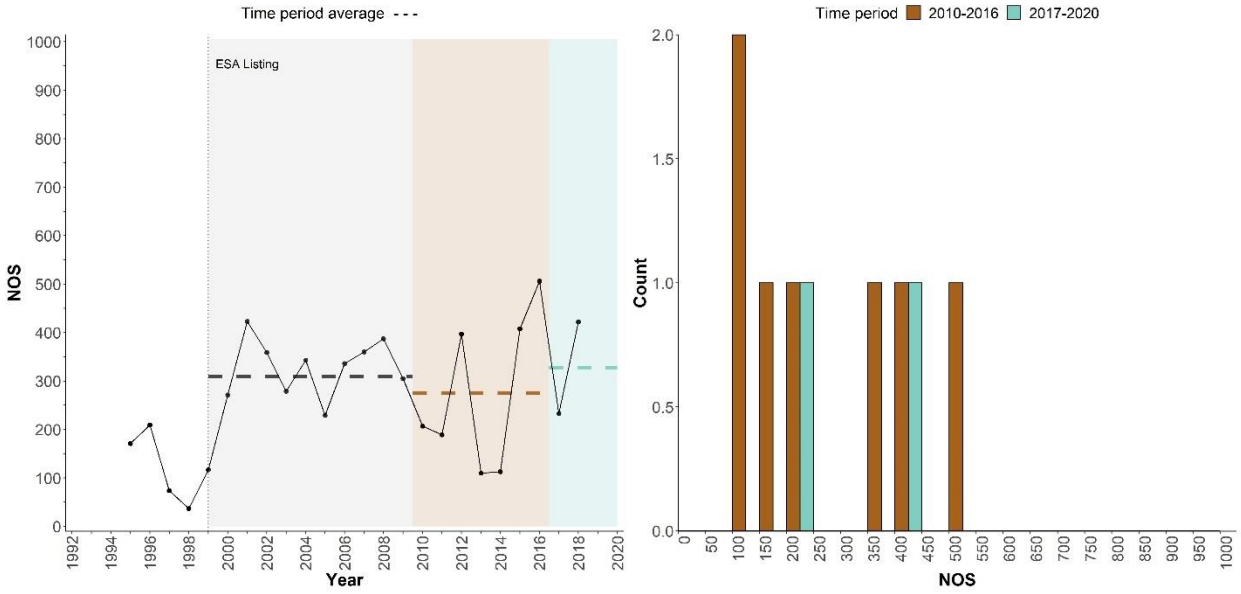
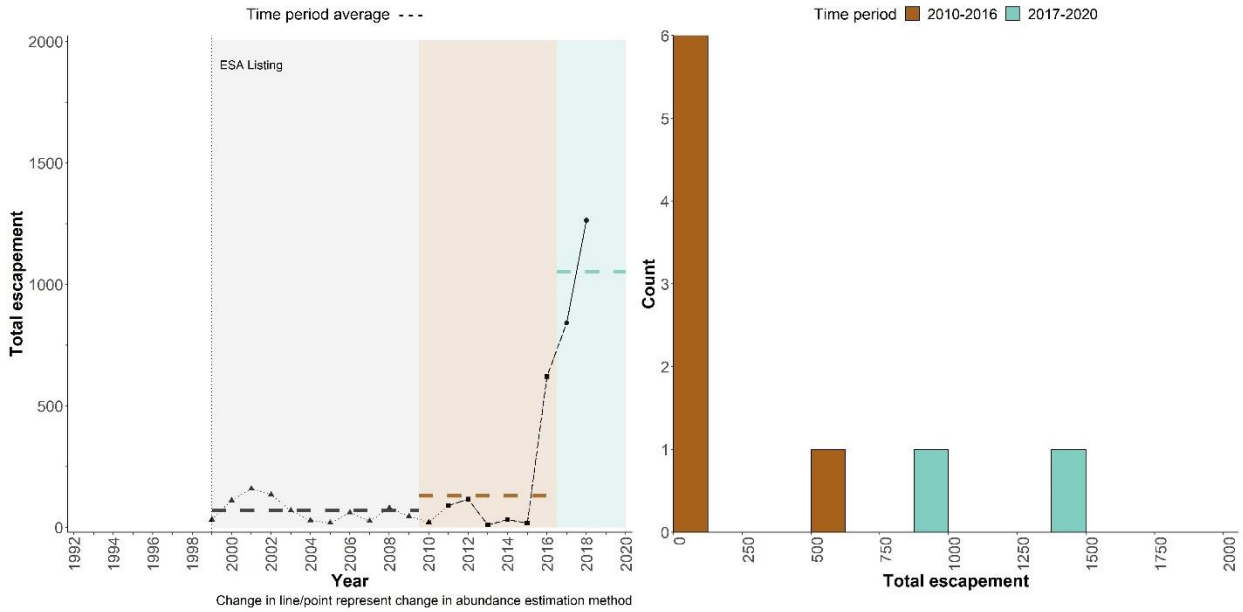


Figure 11. Total (Panel A) and natural-origin (Panel B) spawners for the Nooksack MU. Spawner estimation method changed in multiple years and estimates from across time series may not be comparable.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

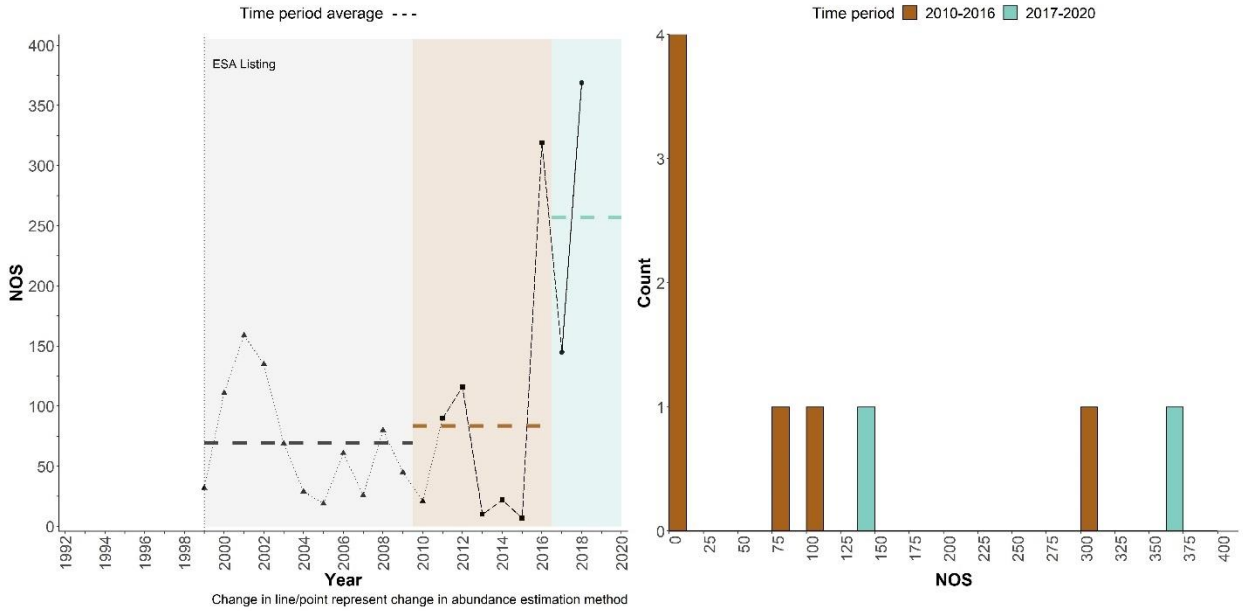
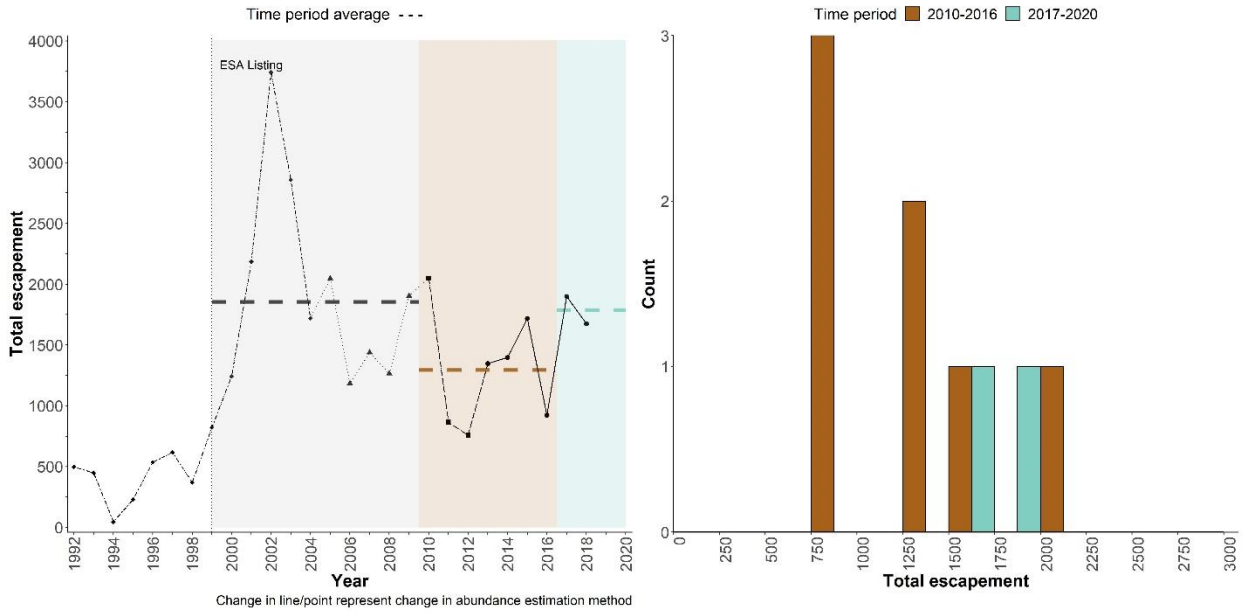


Figure 12. Total (Panel A) and natural-origin (Panel B) South Fork Nooksack spawners. Spawner estimation method changed beginning in 2011 and 2017 and estimates from across time series may not be comparable.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

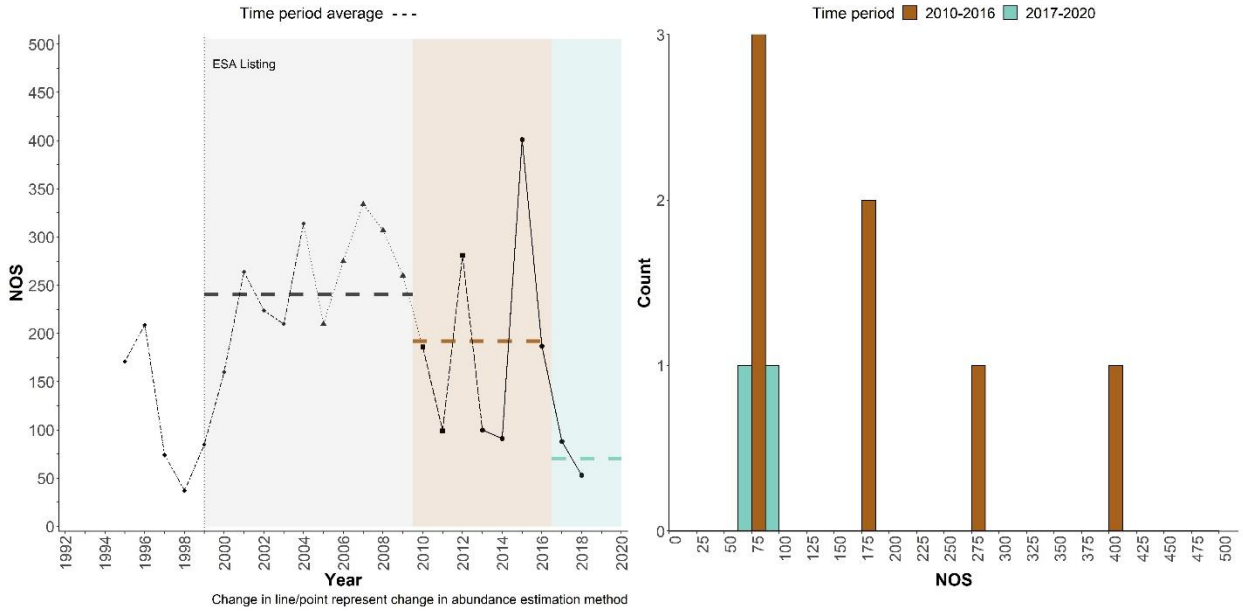


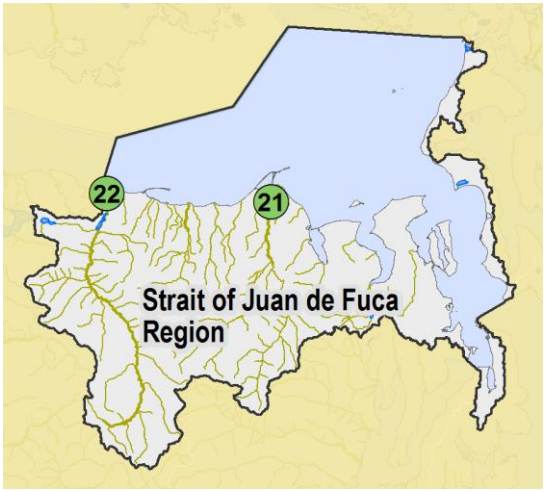
Figure 13. Total (Panel A) and natural-origin (Panel B) North Fork Nooksack spawners. Spawner estimation method changed in 2005, 2009, and 2013 and estimates from across time series may not be comparable.

Chapter 10. Strait of Juan de Fuca MPG

Videos: Elwha River Restoration, Dungeness River

Key Points:

1) The Puget Sound recovery plan identified two genetically unique populations (see map for locations), Dungeness (21) and Elwha (22), in the Strait of Juan de Fuca MPG. Both have been designated by NMFS as Tier 1 populations, indicating that they are of the highest importance to recovery of the ESU.
2) Legacy effects of two dams on the Elwha River, and habitat degradation of the Dungeness River, reduced the number of natural-origin spawners to less than 100 Chinook Salmon in some years from 2013-2017. The number of natural-origin spawners has increased in recent years to approximately 200-300 fish in each river.
3) Hatchery conservation programs in both rivers are maintaining the populations until habitat restoration increases the productivity of the Chinook Salmon runs.
4) Most (~80%) of fishery mortality on the Elwha and Dungeness management units occurs outside of the SUS. Total fishery exploitation rates averaged 0.26 for both MUs from 2009-2018
5) Fishery exploitation rates in the SUS from 2009-2018 averaged 0.05 (Elwha) to 0.06 (Dungeness).
6) A fishing moratorium has been in place in the Elwha River since 2011, and no fisheries directed at Chinook Salmon occur in the Dungeness River.



NMFS PRA Designation

Tier 1:

Elwha Dam Removal

The removal of two dams on the Elwha River provided access to miles of pristine habitat in the Olympic National Park and the potential for a large sustainable run of Chinook Salmon.

Photo Source: National Park Service

10.1. Introduction

The Puget Sound Chinook recovery plan identified two genetically unique populations in the Strait of Juan de Fuca MPG: Elwha and Dungeness. Both populations have been designated as Tier 1 by NMFS, indicating that they are of the highest importance to recovery of the ESU. Natural production from these rivers has been severely impacted by the legacy effects of two dams (Elwha River) and habitat degradation.

Substantial conservation and habitat restoration efforts are underway by the Lower Elwha Klallam Tribe, Jamestown S'Klallam Tribe, North Olympic Peninsula Lead Entity, WDFW, and other recovery partners. These include the removal of two dams

on the Elwha River and the restoration of two miles of the floodplain in the lower Dungeness River.

The correspondence between the populations and the management units used by the co-managers is summarized in Table 6.

Table 6. Correspondence of populations and management units in the Strait of Juan de Fuca MPG.

River Basin	Population	Tier	Management Unit
Elwha	Elwha	1	Elwha
Dungeness	Dungeness	1	Dungeness

10.2. Elwha MU

Video: Elwha River Restoration

Synopsis:

NMFS Tier Designation

Elwha: 1

Fishery Exploitation Rates

NMFS RER: not estimated
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 20% (2009-2018)
Average Total Exploitation Rate: 0.26 (2009-2018)
Average SUS Exploitation Rate: 0.05 (2009-2018)

Average Spawners (2017-2020)

Total Spawners: 4,056
Natural-Origin Spawners: 199

The Elwha is a genetically distinct population of Chinook Salmon that NMFS has designated as Tier 1 because of its importance to the recovery of the Puget Sound Chinook ESU. The biological opinion associated with the 2019 update to the Pacific Salmon Treaty identified the Elwha as one of the "weakest populations that are considered essential for recovery and those most affected by northern fisheries" (NMFS 2019c). NMFS has not estimated an RER for the population due to the lack of sufficient data.

The removal of two dams on the Elwha River in 2012 provided access to more than 70 miles of spawning and rearing habitat, much of it inside the pristine waters of the Olympic National Park. As the legacy effects of the dams diminish, natural production of Chinook Salmon is anticipated to increase, with the potential for one of the largest Chinook Salmon runs in the Puget Sound ESU (see Lower Elwha Klallam Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions). Priority actions include: 1) restoration of marine shorelines to encourage the recovery of sensitive and critical nearshore systems like eelgrass meadows and estuaries; 2) the removal of abandoned flood control dikes in the floodplain of the Elwha River; 3) the placement of engineered log jams in Elwha River; 4) the addition of free wood in Elwha River side-channels; and 5) revegetation of the Elwha River floodplin now exposed by the removal of the dams.

Total fishery exploitation rates on Elwha Chinook Salmon have been markedly reduced (Figure 14). Most (80%) of the total fishing mortality on Elwha Chinook Salmon occurs in fisheries in locations other than the SUS (Figure 15). Total fishery exploitation rates have dropped from an average of 0.40 from 1992-1998 to 0.26 from 2009-2018. The average exploitation rate in SUS fisheries dropped from 0.15 to 0.05 during those same time periods. The average number of natural-origin spawners was 199 from 2017-2020, with an average of 4,056 Chinook Salmon spawning in the Elwha River (Figure 16).

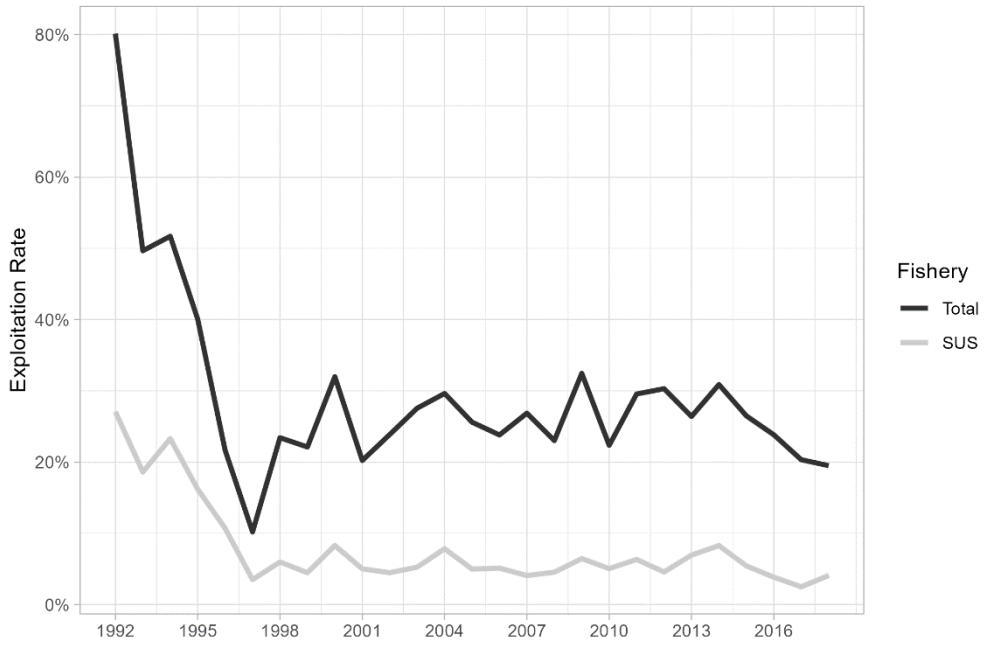


Figure 14. Fishery exploitation rates on the Elwha MU in all fisheries and in the SUS, 1992-2018.

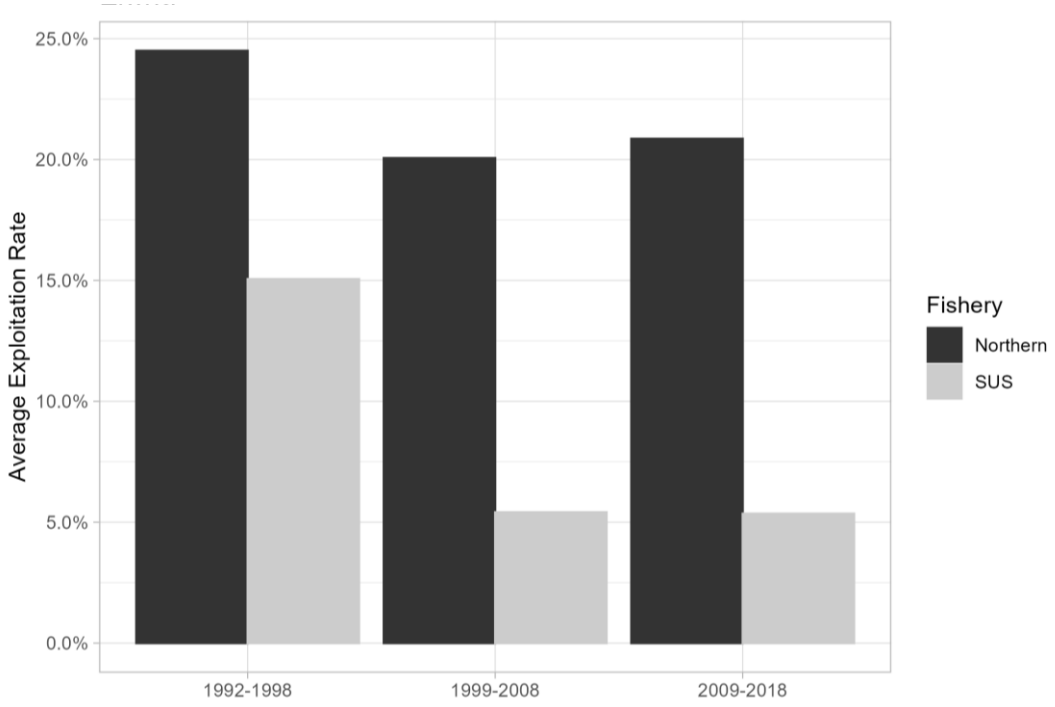
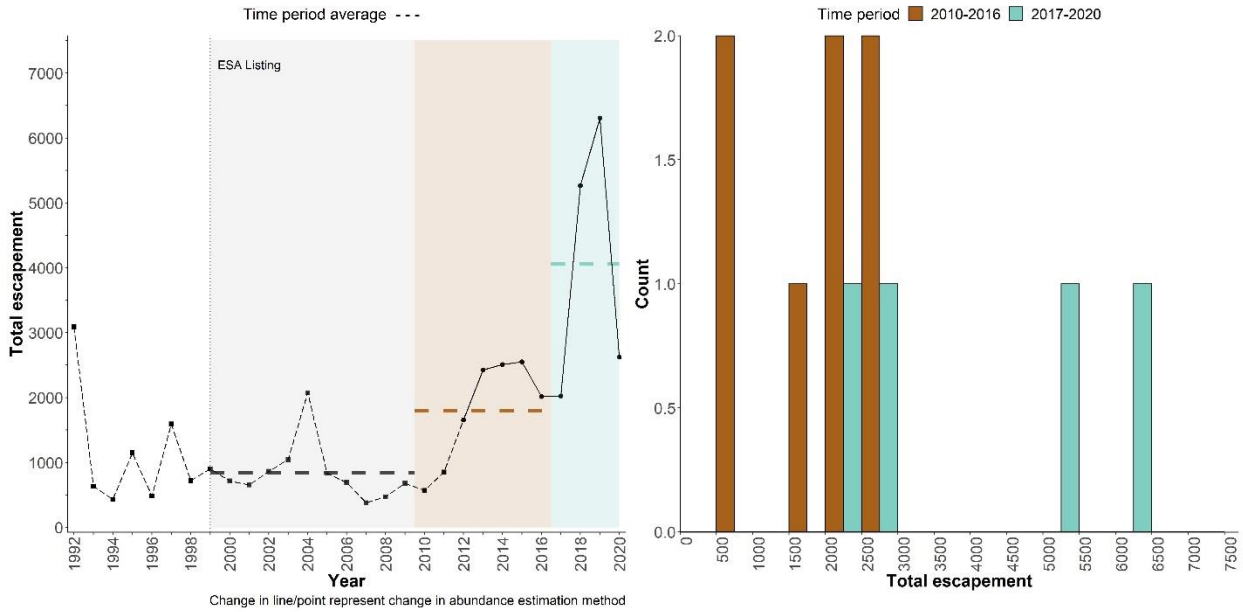


Figure 15. Average exploitation rates on the Elwha MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

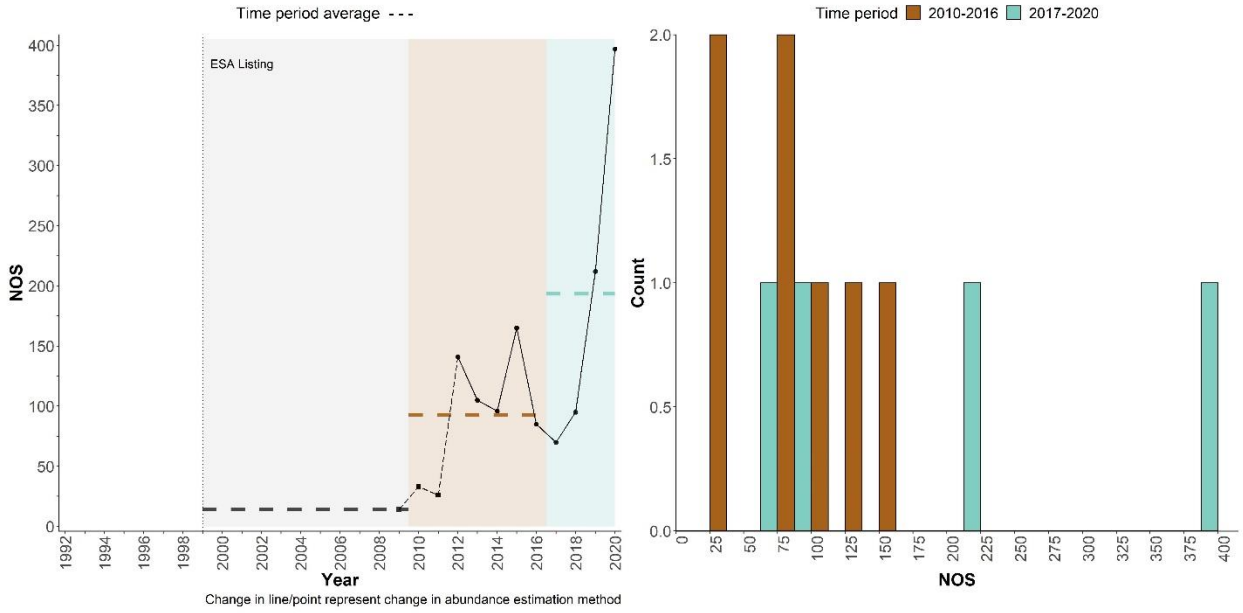


Figure 16. Total spawners (Panel A) and natural-origin spawners (Panel B) in the Elwha River. Spawner estimation method changed beginning in 2012; estimates from before and after that date may not be comparable.

10.3. Dungeness MU

Video: Dungeness River

Synopsis:

NMFS Tier Designation

Dungeness: 1

Fishery Exploitation Rates

NMFS RER: not estimated
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 21% (2009-2018)
Average Total Exploitation Rate: 0.26 (2009-2018)
Average SUS Exploitation Rate: 0.06 (2009-2018)

Average Spawners (2017-2020)

Total Spawners: 741
Natural-Origin Spawners: 186

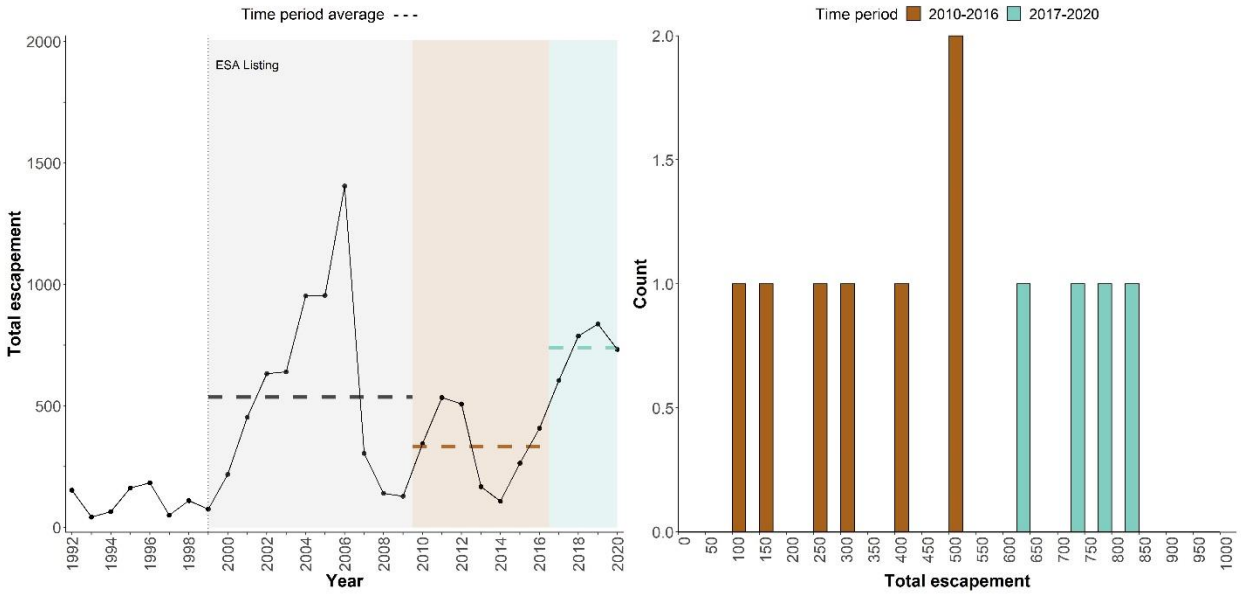
NMFS has designated Dungeness River Chinook Salmon as Tier 1 because of their importance to the recovery of the Puget Sound Chinook ESU. The biological opinion associated with the 2019 update to the Pacific Salmon Treaty identified the Dungeness as one of the "weakest populations that are considered essential for recovery and those most affected by northern fisheries" (NMFS 2019c). NMFS has not estimated an RER for the population because of the lack of sufficient data.

Key factors limiting recovery include agricultural water withdrawals, shoreline bank armoring, riparian clearing and sediment impacts, and the loss of floodplains (NWIFC 2020). Major restoration efforts are underway throughout the basin, including the $5 million Lower Dungeness River Floodplain Restoration Project. The project will remove a dike and restore 150 acres of former agricultural land to a healthy floodplain, resulting in two miles of high quality salmon habitat, and functioning side channels in a publicly owned, permanently protected floodplain (see Jamestown S'Klallam Tribe sections of 2020 Watershed Status for a summary of habitat conditions and actions). Other priority habitat restoration actions include placing engineered log jams to stabilize and diversify habitat and increasing river flows during the late summer.

A hatchery conservation program operates to maintain this unique Chinook Salmon population while the productivity of the river is restored. With funding through a Pacific Salmon Treaty implementation grant and other sources, this program has been successful at maintaining the population when less than 50 natural-origin Chinook Salmon spawned in 2013 and 2014 (Figure 17). The average number of natural-origin spawners was 186 from 2017-2020, with an average of 741 Chinook Salmon spawning in the Dungeness River.

Fishery exploitation rates on Dungeness Chinook Salmon were substantially reduced in the early 1990s (Figure 18). Most (79%) of the total fishing mortality on Dungeness Chinook Salmon occurs in fisheries in locations other than the SUS (Figure 19). Total fishery exploitation rates have dropped from an average of 0.33 from 1992-1998 to 0.26 from 2009-2018. The greatest reduction in exploitation rates occurred in SUS fisheries, which declined from an average of 0.13 to 0.06.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

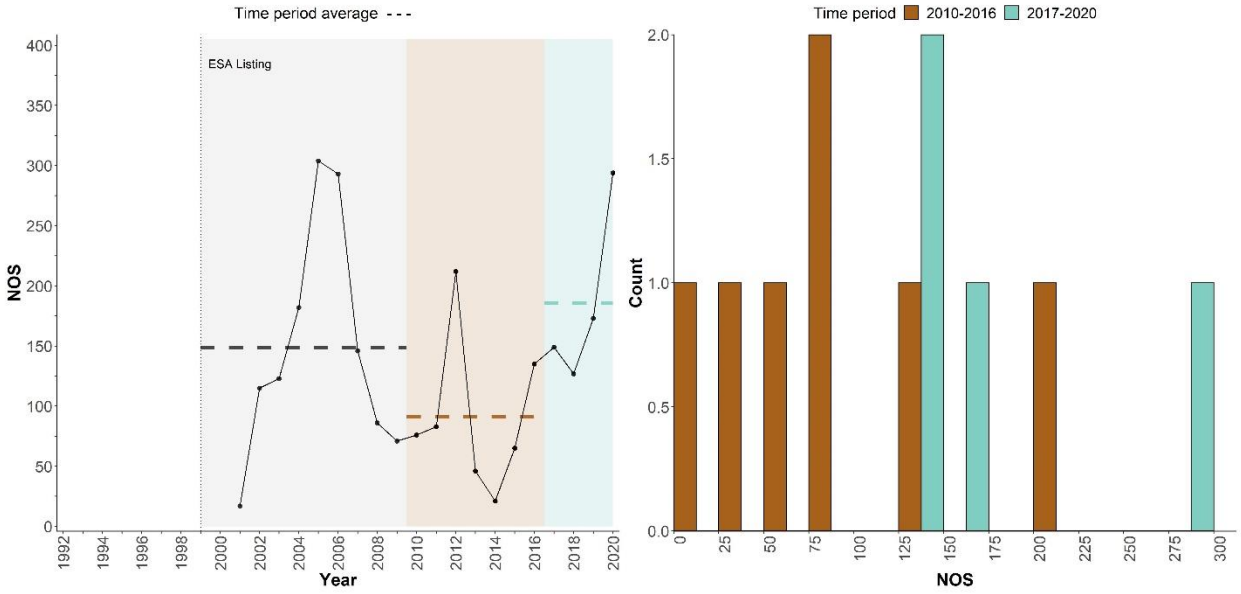


Figure 17. Total spawners (Panel A) and natural-origin spawners (Panel B) in the Dungeness River.

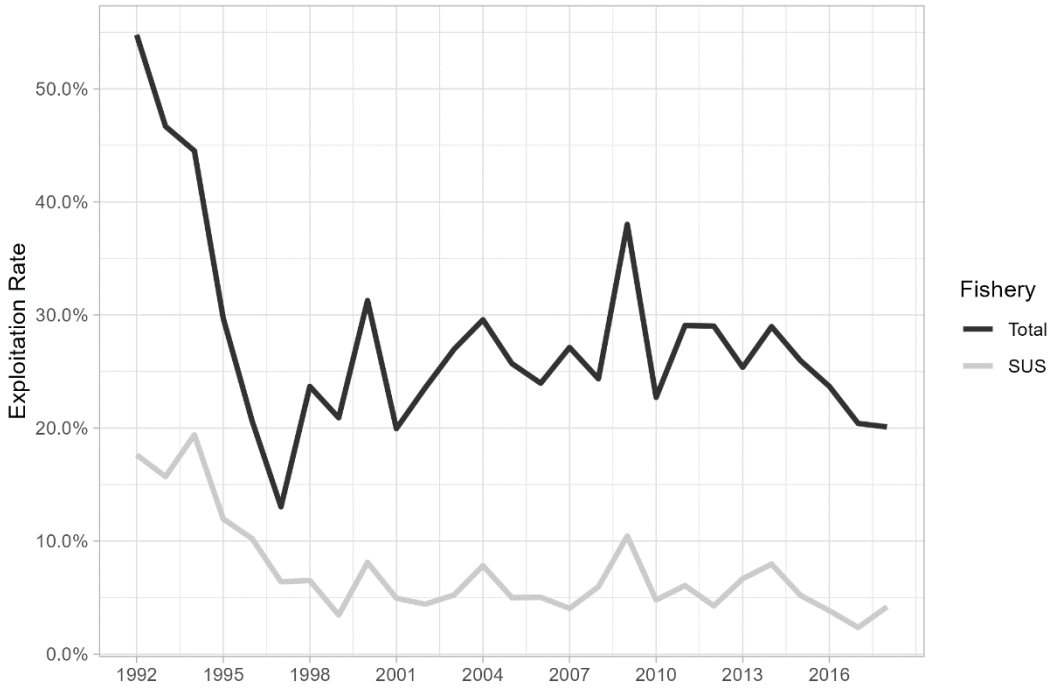


Figure 18. Fishery exploitation rates on the Dungeness MU in all fisheries and in the SUS, 1992-2018.

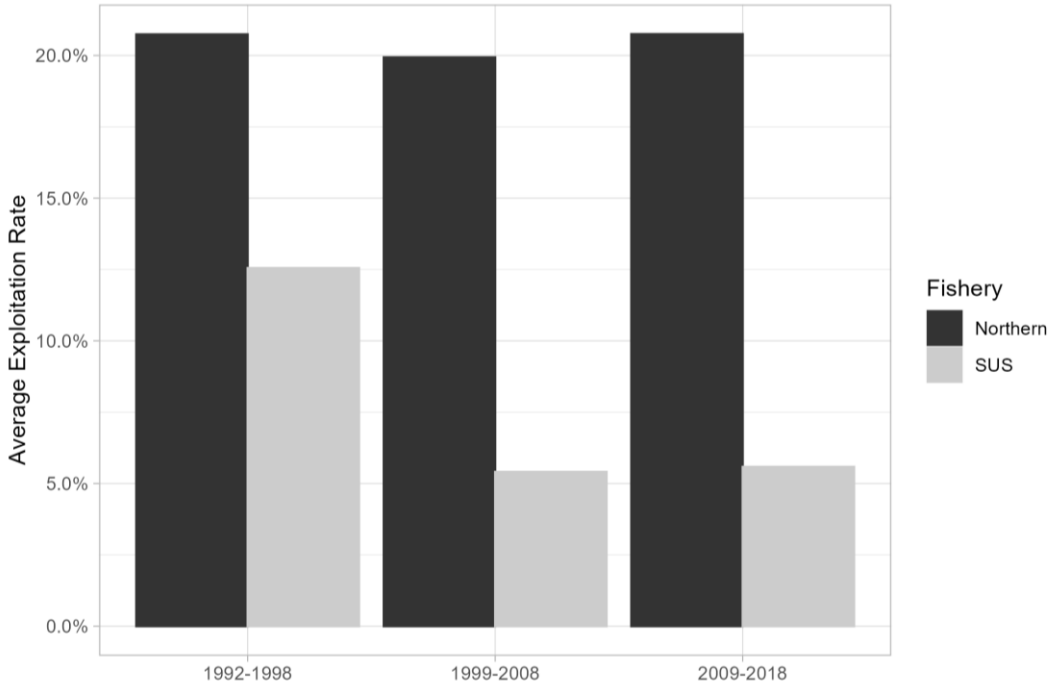


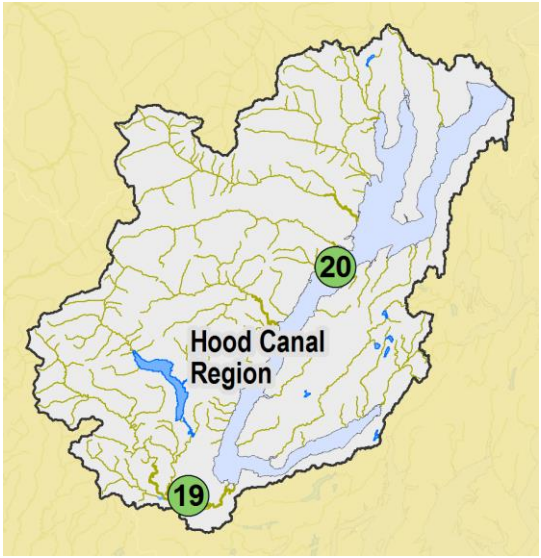
Figure 19. Average exploitation rates on the Dungeness MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Chapter 11. Hood Canal MPG

Video: Restoring the Skokomish Watershed

Key Points:

1) The Puget Sound recovery plan identified two historical populations (see map for locations), Skokomish (19) and Mid-Hood Canal (20), in the Hood Canal MPG.
2) If a Mid-Hood Canal Chinook Salmon population existed historically, it is no longer present.
3) The historical, indigenous Skokomish River Chinook Salmon population has also been lost due to habitat degradation, passage barriers and water diversion associated with the Cushman Hydroelectric project, fishing, and extensive hatchery production.
4) Lacking an indigenous population in the Skokomish River, the co-managers are implementing two strategies with the objective of re-establishing a locally-adapted population of Chinook Salmon: a) reintroduction of spring Chinook; and b) experimental selection of later-returning Chinook salmon in an attempt to recreate life history patterns that have been lost.
5) The co-managers fishery management strategy for the Skokomish River is intended to not impede recovery of spring Chinook Salmon, not adversely affect the potential for recovering a late-timed (fall) run, and maintain a stable abundance of natural spawners in the Skokomish River.



NMFS PRA Designation

Tier 1:

Skokomish Spring Chinook

After a 92-year absence, a $62 million investment in state-of-the-art hatcheries has brought spring Chinook salmon back to the Skokomish River.

Photo: Tacoma Public Utilities

11.1. Introduction

The Hood Canal MPG may historically have had two Chinook Salmon populations – one in the Skokomish River and one in Mid-Hood Canal rivers (Hamma Hamma, Duckabush, and Dosewallips). Neither historical population remains (SIT and WDFW 2017).

Major habitat restoration actions have been implemented through the efforts of the Skokomish Indian Tribe, Point No Point Treaty Council, Port Gamble S'Klallam Tribe, Hood Canal Coordinating Committee, Hood Canal Salmon Enhancement Group, and other recovery partners.

Chinook Salmon that now return to the Skokomish River originated from the Green River stock (a non-local stock) that has been cultured at the George Adams Hatchery on the Skokomish

River for many years. The small numbers of Chinook Salmon returning to the Mid-Hood Canal rivers are also descendants of the Green River stock and are referred to as the Mid-Hood Canal MU (Table 7).

Table 7. Correspondence of populations and management units in the Hood Canal MPG.

River Basin(s)	Historical Population	Tier	Management Unit
Skokomish	Skokomish (extirpated)	1	Skokomish
Hamma Hamma, Dosewallips, Duckabush	Mid-Hood Canal [1/] (extirpated)	1	Mid-Hood Canal

[1/] It is unclear if a historical population existed; see text for discussion.

11.2. Skokomish MU

Video: Restoring the Skokomish Watershed

Synopsis:

NMFS Tier Designation

Skokomish: 1

Fishery Exploitation Rates

NMFS RER: 0.35
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 76% (2009-2018)
Average Total Exploitation Rate: 0.56 (2009-2018)
Average SUS Exploitation Rate: 0.43 (2009-2018)

Average Spawners (2017-2020)

Total Spawners: 3,711
Natural-Origin Spawners: 378

The Skokomish River is believed to have historically supported spring- and fall-runs of Chinook Salmon (Ruckelshaus et al. 2006). Both have been extirpated and the Chinook Salmon now spawning in the Skokomish River are derived from the Green River stock used at the George Adams Hatchery (NMFS 2021a). The loss of the indigenous Skokomish River Chinook Salmon likely resulted from multiple factors, including the passage barriers and water diversion associated with the Cushman Hydroelectric project, floodplain development, estuary modifications, extensive logging, and expanded fishing patterns, and extensive hatchery production (SIT and WDFW 2010).

Although much work remains to be done, the efforts of the Skokomish Indian Tribe and recovery partners have resulted in increases in forest cover in the basin, replanting of riparian trees, improved flows in the North Fork Skokomish River, and the most complete restoration of an estuary in the Puget Sound region (see Skokomish Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions). The Skokomish Recovery Plan (SIT and WDFW 2017) identifies strategies and target conditions for key Skokomish River basin habitat attributes, including pool habitat, large woody debris, riparian cover, floodplain connectivity, and channel capacity.

Lacking an indigenous population, the co-managers are implementing two strategies to attempt to re-establish a locally-adapted population of Chinook Salmon (SIT and WDFW 2017): 1) reintroduction of spring Chinook Salmon using eggs from the Marblemount Hatchery on the Skagit River (implemented at the Tacoma Public Utilities North Fork Hatchery; and 2) experimental selection of later-returning Chinook Salmon in an attempt to recreate life history patterns that have been lost (implemented at the George Adams Hatchery.

The co-managers fishery management strategy for the Skokomish River has three objectives:

1) Spring Chinook. Ensure that fishery-related mortality will not impede recovery of spring Chinook Salmon in the watershed or adversely affect the potential for recovering a late-timed (fall) population component.
2) Late Fall Chinook. Ensure that fishery-related mortality will not adversely affect the potential for recovering a late-timed (fall) population component.
3) Green River Origin Chinook. Ensure sufficient escapement to meet hatchery broodstock requirements and to maintain stable abundance of natural spawners in the Skokomish River.

Total fishery exploitation rates on the Green River origin, Skokomish MU, are presented in Figure 20 and Figure 21. Note that these rates are for the Green River-origin stock and are only relevant to objective 3. An average of 3,711 Chinook Salmon spawned in the Skokomish River from 2017-2020 of which 378 were originated from spawners in the river in the previous cycle (Figure 22).

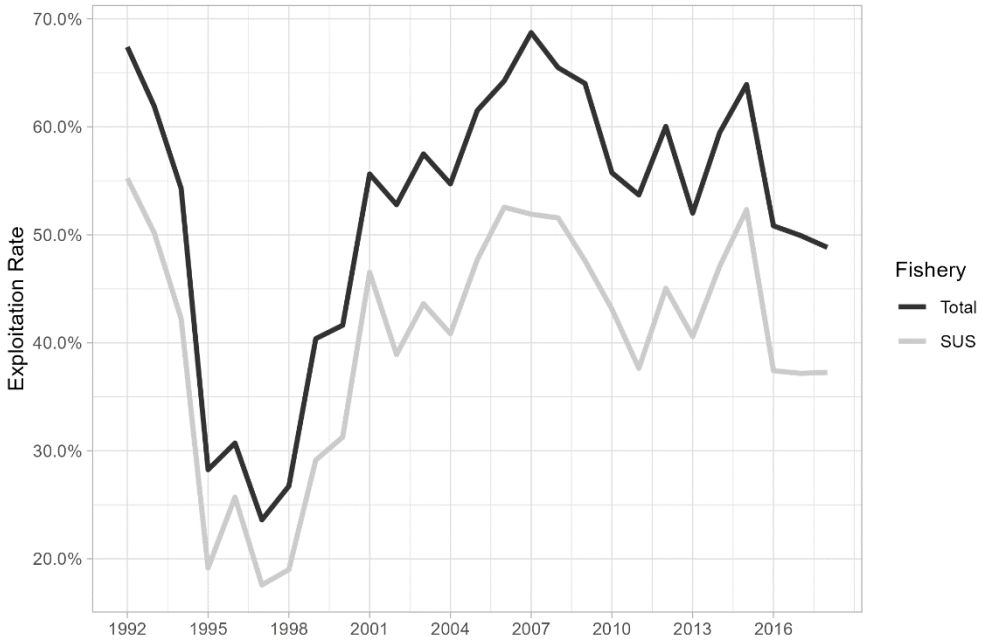


Figure 20. Fishery exploitation rates on the Skokomish MU in all fisheries (Total) and in the SUS, 1992-2018.

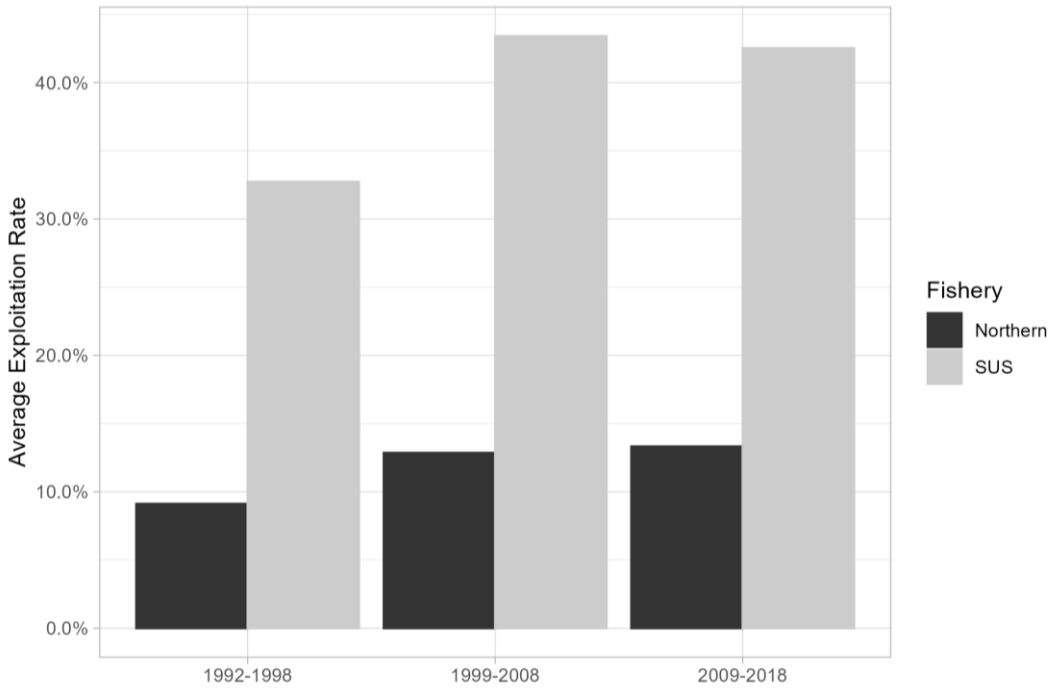
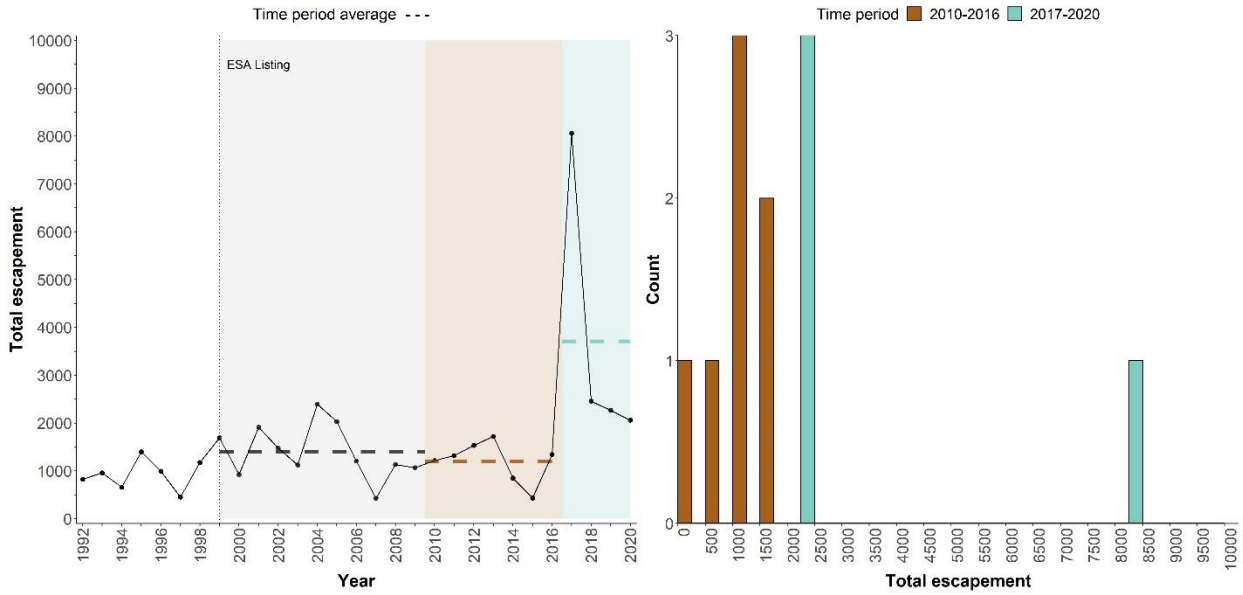


Figure 21. Average exploitation rates on the Skokomish MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

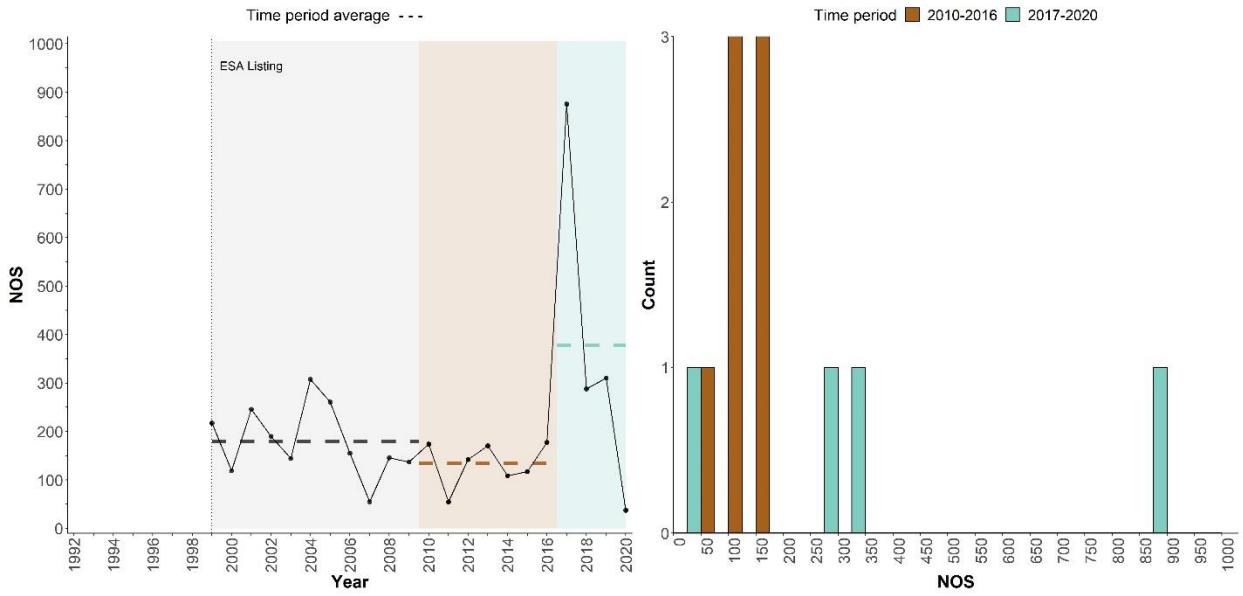


Figure 22. Total spawners (Panel A) and natural-origin spawners (Panel B) in the Skokomish River.

11.3. Mid-Hood Canal MU

Synopsis:

NMFS Tier Designation:

Mid-Hood Canal: 1

Fishery Exploitation Rates

NMFS RER: not estimated

PST SUS Exploitation Rate Limit: none established

% Fishery Mortality in SUS Fisheries: 46% (2009-2018)

Average Total Exploitation Rate: 0.25 (2009-2018)

Average SUS Exploitation Rate: 0.11 (2009-2018)

Average Spawners (2017-2020)

Total Spawners: 114

Natural-Origin Spawners: 17

Viability criteria in the Puget Sound Chinook recovery plan are built in part on a recommendation from the Puget Sound Technical Recovery Team (TRT) that, for the Puget Sound Chinook ESU to have a high likelihood of persistence, at "least two to four populations in each of the 5 bio-geographical regions of Puget Sound must attain a low risk status" (SSDC 2007). This guidance was subsequently used in the NMFS supplement to the recovery plan to identify specific populations that needed to achieve a low risk of extirpation for the ESU to be viable. The Skokomish and Mid-Hood Canal were identified as the two populations for the Hood Canal MPG, presumably because these were the only two populations believed to be extant at that time. This also resulted in NMFS designating Mid-Hood Canal as a Tier 1 population.

The historical presence of a Chinook Salmon population in the Mid-Hood Canal rivers is uncertain. When the TRT deduced the historical population structure of Chinook Salmon in Mid-Hood Canal, it decided that collectively the three Mid-Hood Canal watersheds (Dosewallips, Duckabush, and Hamma Hamma) may have supported a single independent Chinook Salmon population based on the similarity of freshwater and estuarine habitats and the close proximity of these rivers to each other. However, due to the proximity of the Mid-Hood Canal rivers to the Skokomish River, the TRT recognized the possibility of genetic exchange between Chinook Salmon originating in the Mid-Hood Canal rivers and Chinook originating in the Skokomish River. Accordingly, the TRT considered alternative population scenarios for the Chinook Salmon populations in Hood Canal, including the possibility that there were one or more self-sustaining populations of Chinook Salmon in the Skokomish River that largely supported a Mid-Hood Canal sub-population.

The TRT concluded that the "historical characteristics of Hood Canal Chinook Salmon are largely unknown" and that the "largest uncertainty is the degree to which Chinook Salmon spawning aggregations are demographically linked in the Dosewallips, Hamma Hamma, and Duckabush rivers" (Ruckelshaus et al. 2006).

Key considerations included the following:

1) The "overall size of each watershed and the area accessible to anadromous fish are small relative to other independent populations" of Chinook Salmon in the Puget Sound ESU (Ruckelshaus et al. 2006).

2) "Only a few historical reports document Chinook Salmon spawning in the mid-Hood Canal streams, which might suggest that they were not abundant in any one stream before hatchery supplementation began in the early 1900s" (Ruckelshaus et al. 2006).

3) Some historical records indicate the presence of a spring run or a late fall run. If those runs existed historically, they have now been extirpated (Ruckelshaus et al. 2006).

4) Genetic data were not informative and the lack of difference in allele frequencies between Skokomish River and Hamma Hamma River Chinook Salmon probably reflects "the use of Green River-origin broodstock for hatchery programs in Hood Canal" (Ruckelshaus et al 2006).

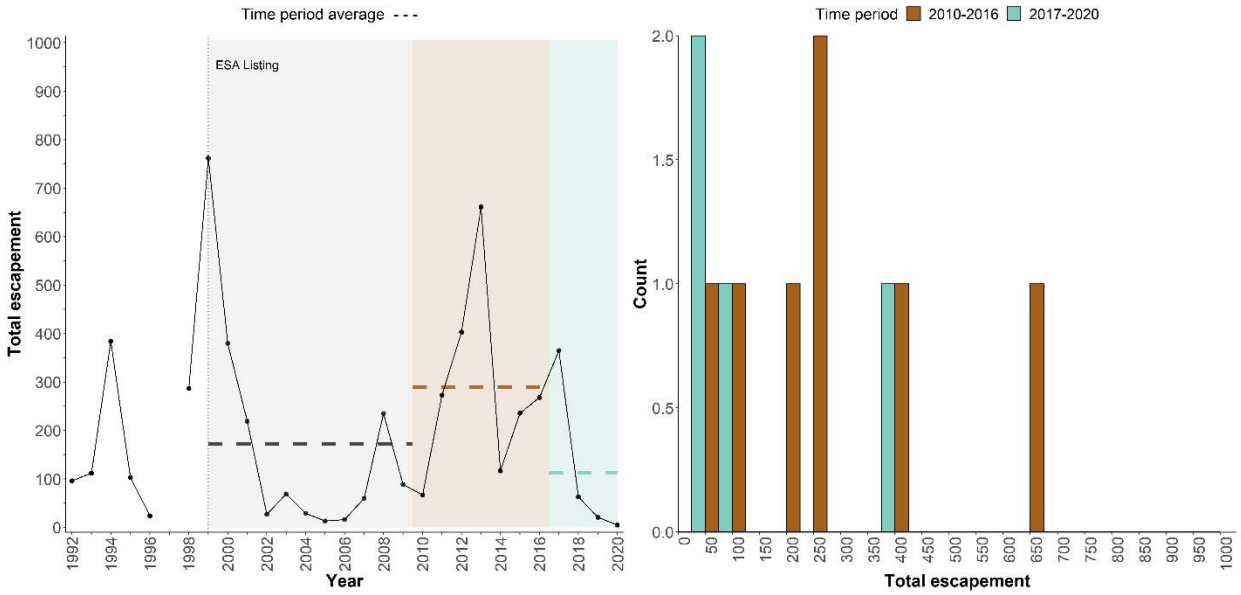
The TRT noted the long history of releases of Green River-origin Chinook Salmon from hatcheries in the Hood Canal region and the resultant lack of differentiation between adult Chinook Salmon returning to the Skokomish River and the mid-Hood Canal rivers. WDFW subsequently analyzed juvenile Chinook sampled from the Duckabush River and found that they were also closely associated with the George Adams Hatchery/Green River origin stock.

A hatchery conservation program was initiated in 1995 on the Hamma Hamma River with the goal of restoring a viable, self-sustaining, natural-origin Chinook population to the Mid-Hood Canal river systems. The program was intended to help restore and maintain a sustainable, locally adapted, natural-origin Chinook population by using supplementation hatchery fish to increase the number of naturally spawning adults on the spawning grounds. Beginning in 2005, the supplementation program attempted to collect 100% of its broodstock from the Hamma Hamma River to help promote local adaptation. However, too few Chinook Salmon returned to the Hamma Hamma River to meet the supplementation program's broodstock collection goal. Consequently, the program continued to rely on the George Adams Hatchery as a source of broodstock.

The supplementation program was terminated after a 20-year experiment (last releases in 2015) because the program did not result in a sustained increase in the number of natural-origin recruits. The number of spawners in the Mid-Hood Canal rivers dropped to 63 in 2018 (4- and 5-year-old return from hatchery conservation program), 21 in 2019 (only 5-year-old return from hatchery conservation program), and 5 in 2020 (Figure 23).

Fishery exploitation rates on Mid-Hood Canal Chinook Salmon were substantially reduced in the early 1990s (Figure 24). Total fishery exploitation rates have dropped from an average of 0.35 from 1992-1998 to 0.25 from 2009-2018. The greatest reduction in exploitation rates occurred in SUS fisheries, which declined from an average of 0.26 to 0.11. About half (54%) of the total fishing mortality on the Mid-Hood Canal MU occurs in fisheries in locations other than the SUS (Figure 25). NMFS has not estimated an RER for Chinook Salmon from the Mid-Hood Canal rivers because of the lack of appropriate data.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

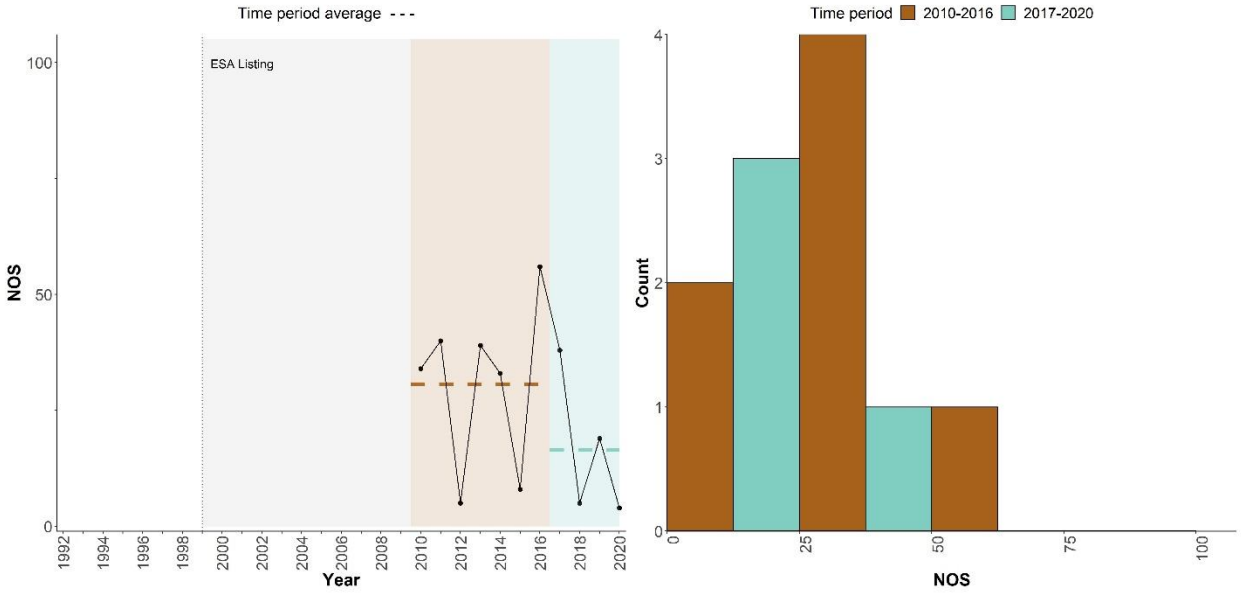


Figure 23. Total spawners (Panel A) and natural-origin spawners (Panel B) in Mid-Hood Canal rivers.

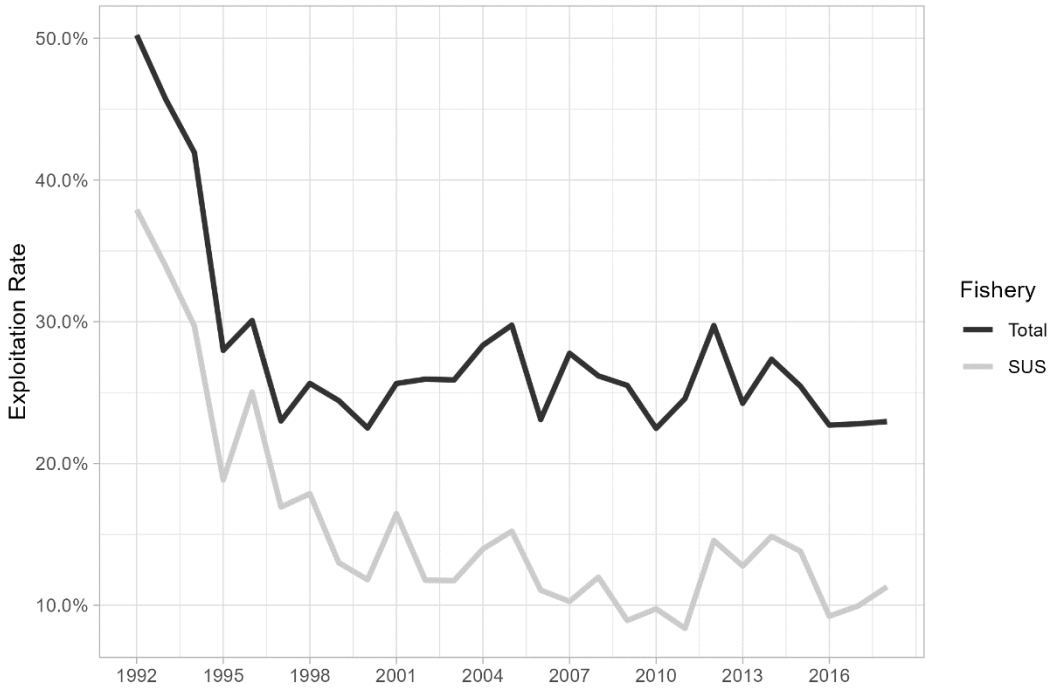


Figure 24. Fishery exploitation rates on the Mid-Hood Canal MU in all fisheries (Total) and in the SUS, 1992-2018.

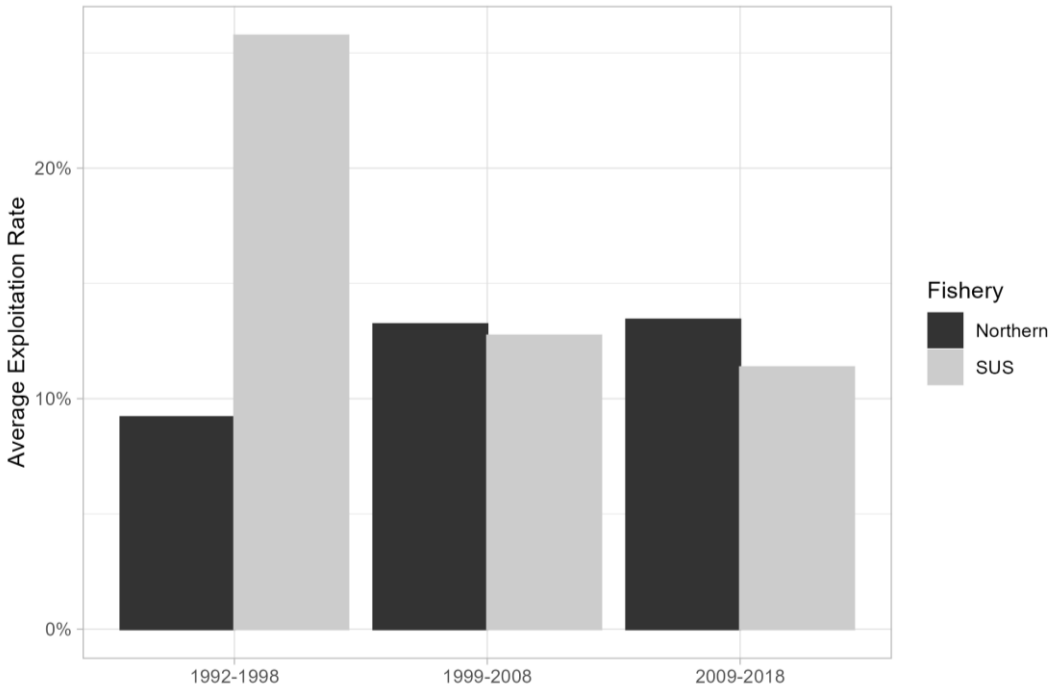


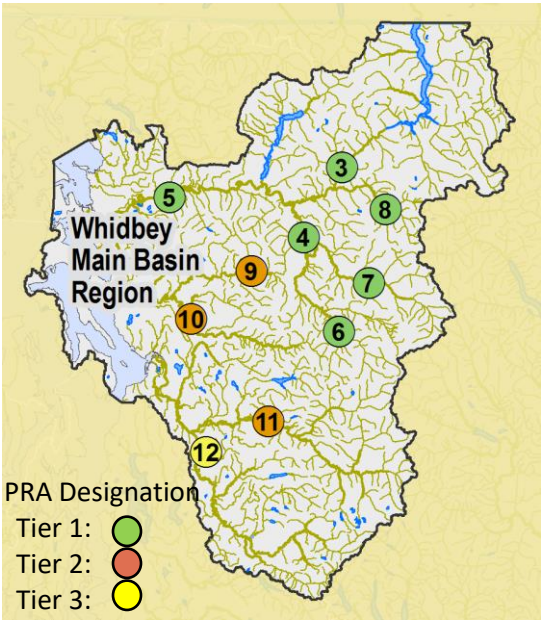
Figure 25. Average exploitation rates on the Mid-Hood Canal MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Chapter 12. Whidbey Basin MPG

Videos: Skagit, Stillaguamish, Stillaguamish Estuary, Smith Island, Pilchuck Dam

Key Points:

1) The Puget Sound recovery plan identified ten historical populations in the Whidbey Basin MPG (see map for locations): Upper Skagit (3), Lower Sauk (4), Lower Skagit (5), Upper Sauk (6), Suiattle (7), Cascade (8), North Fork Stillaguamish (9), South Fork Stillaguamish (10), Skykomish (11), and Snoqualmie (12).
2) NMFS designated all populations in the Skagit River basin as Tier 1, indicating their importance for preservation, restoration, and ESU recovery.
3) All of the rivers in this geographic area have retained the indigenous Chinook Salmon populations (i.e., they have not been replaced by a non-local stock introduced by a hatchery program).
4) Most (56%-73%) of the fishery mortality on these management units occurs in fisheries outside of the SUS.
5) Total fishery exploitation rates have declined since the early 1990s for the summer/fall stocks. The average total fishery exploitation rates from 2009-2018 for each of the management units was less than or slightly above the NMFS estimate of the RER.
6) Average (2009-2018) exploitation rates in SUS fisheries for the management units were 0.08 for the Stillaguamish and Snohomish, 0.11 for Skagit Spring, and 0.18 for the Skagit Summer/Fall management unit.
7) The trends in the number of spawners varied, with the Skagit Spring MU increasing and the Stillaguamish and Snohomish MUs declining.



Habitat protection and restoration, like the Barnaby Slough project, are advancing Chinook salmon recovery. For the first time in nearly 30 years anglers were able to fish for spring Chinook salmon in the lower Skagit River in 2019.

Photo: NWIFC

12.1. Introduction

The Whidbey Basin MPG includes Chinook Salmon in the Skagit, Stillaguamish, and Snohomish Rivers. This MPG has more populations, and some of the strongest populations, in

the Puget Sound Chinook ESU. NMFS has designated all of the Chinook Salmon populations in the Skagit River as Tier 1, indicating their importance for preservation, restoration, and ESU recovery.

The correspondence between the populations and the management units used by the co-managers is summarized in Table 8.

Table 8. Correspondence of populations and management units in the Whidbey Basin MPG.

River Basin	Historical Population	Tier	Management Unit
Skagit	Cascade	1	Skagit Spring
	Upper Sauk	1	
	Suiattle	1	
	Upper Skagit	1	Skagit Summer/Fall
	Lower Skagit	1	
	Lower Sauk	1	
Stillaguamish	North Fork Stillaguamish	2	Stillaguamish
	South Fork Stillaguamish	2	
Snohomish	Skykomish	2	Snohomish
	Snoqualmie	3	

12.2. Skagit Spring

Videos: Skagit

Synopsis:

NMFS Tier Designation

Cascade: 1
Upper Sauk: 1
Suiattle: 1

NMFS RER:

Cascade: 0.35
Upper Sauk: 0.24
Suiattle: 0.32

Fishery Exploitation Rates

% Fishery Mortality in SUS Fisheries: 44% (2009-2018)
PST SUS Exploitation Rate Limit: 2009-2015 average (0.11 as assessed by FRAM)
Average Total Exploitation Rate: 0.24 (2009-2018)
Average SUS Exploitation Rate: 0.11 (2009-2018)

Average Total Spawners (2017-2020)

Skagit Spring MU: 1,952
Cascade: 186
Upper Sauk: 1,181
Suiattle: 585

Chinook Salmon in the Skagit River basin are genetically distinct from Chinook Salmon in other Puget Sound rivers and have varying levels of genetic differentiation between the populations within the basin (Ruckelshaus et al. 2006). NMFS has designated each of these populations as Tier 1 because of their importance to the recovery of the Puget Sound Chinook ESU.

Although the returns of natural-origin spring Chinook Salmon to the Skagit River are among the strongest in Puget Sound, they remain far below the historical levels. The Skagit River basin is the largest within the Puget Sound ESU and produces the greatest number of summer/fall Chinook Salmon. Production is hampered by habitat degradation that includes barriers to passage, armoring of nearshore habitat, channel confinement that results in scouring out of salmon eggs during high flow, loss of estuarine habitat critical to rearing juvenile Chinook Salmon, and the presence of hydroelectric dams that block access to 47% of the basin (see Swinomish Tribal Community, Upper Skagit Tribe, and Sauk-Suiattle Tribe sections of 2020 Watershed Status for a summary of habitat conditions and actions).

Substantial habitat restoration projects are underway in the Skagit River basin through the efforts of the Swinomish Tribal Community, Upper Skagit Tribe, Sauk-Suiattle Tribe, Skagit River System Cooperative, Skagit Watershed Council, Skagit Fishery Enhancement Group, and WDFW. Because the greatest losses of rearing habitat have happened in the estuary, and because of its relatively high rearing productivity, the Skagit Chinook Recovery Plan identifies estuary habitat as the greatest habitat restoration need for Chinook Salmon recovery in the Skagit watershed. The plan establishes a goal of restoring enough estuary habitat to hold an additional 1.35 million juvenile Chinook beyond its current capacity. The restoration of seven estuaries and sloughs from 2007-2016 resulted in achieving 35% of the recovery plan target for increased Chinook Salmon smolt capacity (WDFW 2020). Within the lower mainstem, a $3 million project was initiated in 2021 to restore and reconnect Barnaby Slough to the Skagit River. This project is expected to be completed by 2024 and provide up to two miles of additional habitat for the Skagit River Chinook Salmon. The current Federal Energy Regulatory Commission license for the three dams on the Skagit River operated by Seattle City Light expires in 2025. Discussions are underway to ensure that, under the license, the dams will be operated in a manner consistent with the recovery of ESA-listed steelhead, Chinook Salmon, Bull Trout, and Southern Resident Killer Whales.

The United States is obligated under the Pacific Salmon Treaty to monitor fishery exploitation rates on Skagit Spring Chinook Salmon. Juvenile Chinook Salmon reared at the Marblemount Hatchery receive a CWT; subsequent recoveries of tagged fish in Canadian and U.S. fisheries are used to monitor compliance with the ISBM obligations of the Pacific Salmon Treaty (see Section 5.2). In addition to being tagged, the fish are identified by an adipose fin clip so that they can be identified in fisheries, primarily in Canada, that rely upon this clip to identify tagged fish. When the Skagit Spring Chinook return results in less than 690 spawners, the Pacific Salmon Treaty limits the exploitation rates to the average rate from 2009-2015. This is equivalent to 0.11 when measured using the domestic fishery management model (FRAM).

Total exploitation rates averaged 0.24 in 2009-2018 which is less than or equal to the RERs NMFS estimated for the Skagit spring Chinook Salmon populations (Figure 26). The SUS exploitation rate has averaged 0.11 over the same time period. More than half (54%) of the fishery mortality on Skagit Spring Chinook Salmon occurs in fisheries outside of the SUS (Figure 27).

The number of spawners in the Skagit Spring MU has increased since the time of ESA listing (Figure 28), with most of the increase occurring in the Upper Sauk (Figure 29 - Figure 31). Note that estimates of the

proportion of the Chinook Salmon spawners in the Skagit River originating from hatchery releases are not available, although believed to be small.

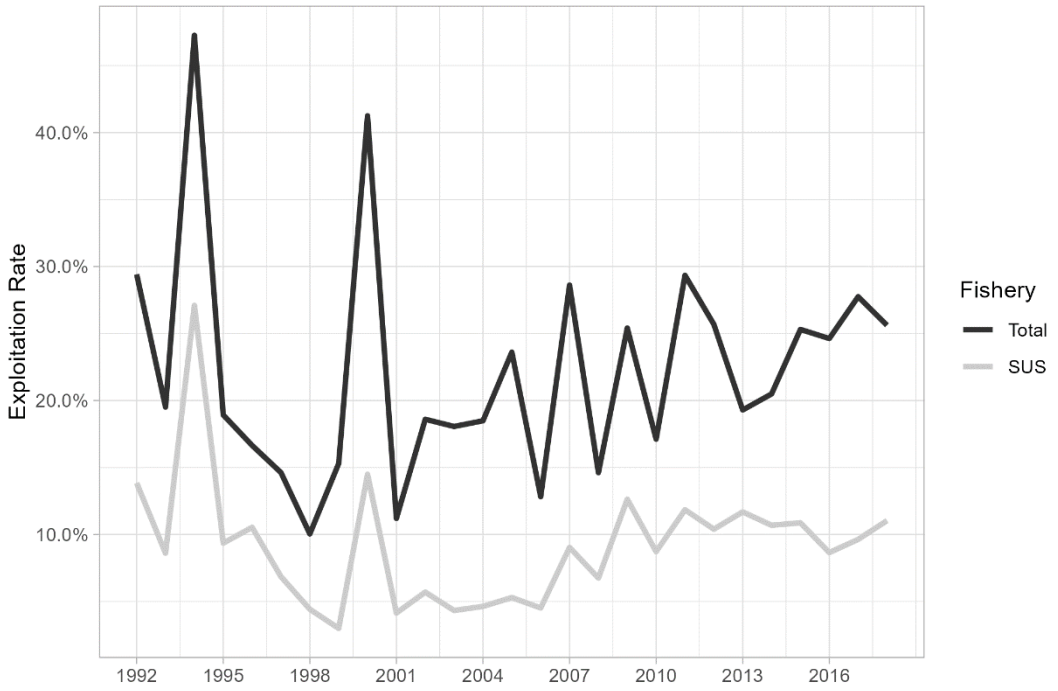


Figure 26. Fishery exploitation rates on the Skagit Spring MU in all fisheries (Total) and in the SUS, 1992-2018.

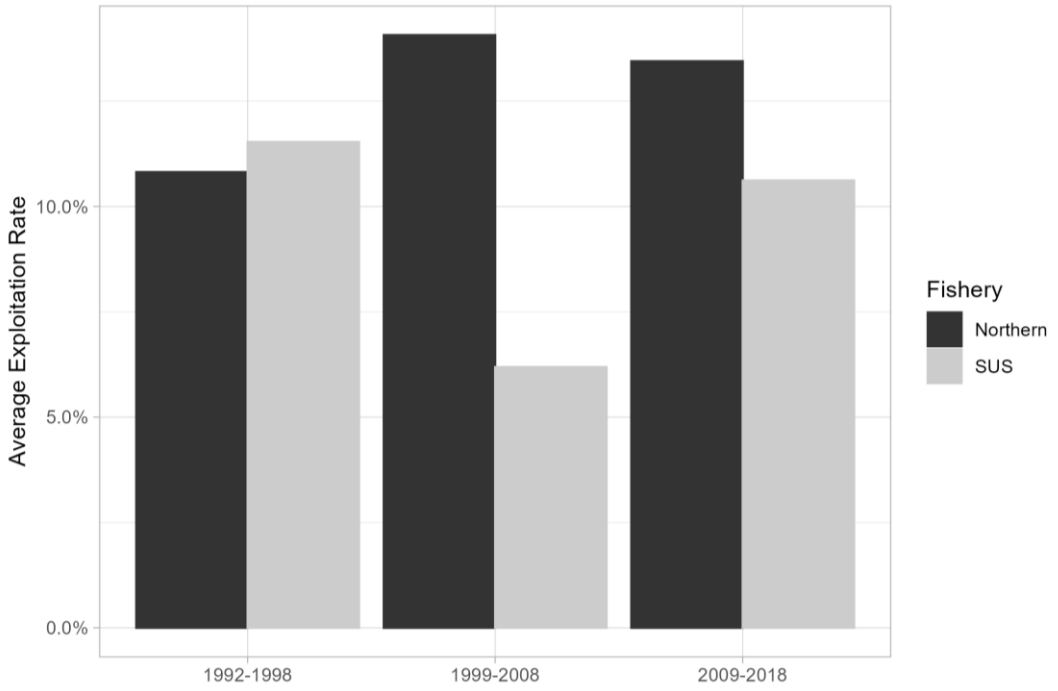


Figure 27. Average exploitation rates on the Skagit Spring MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

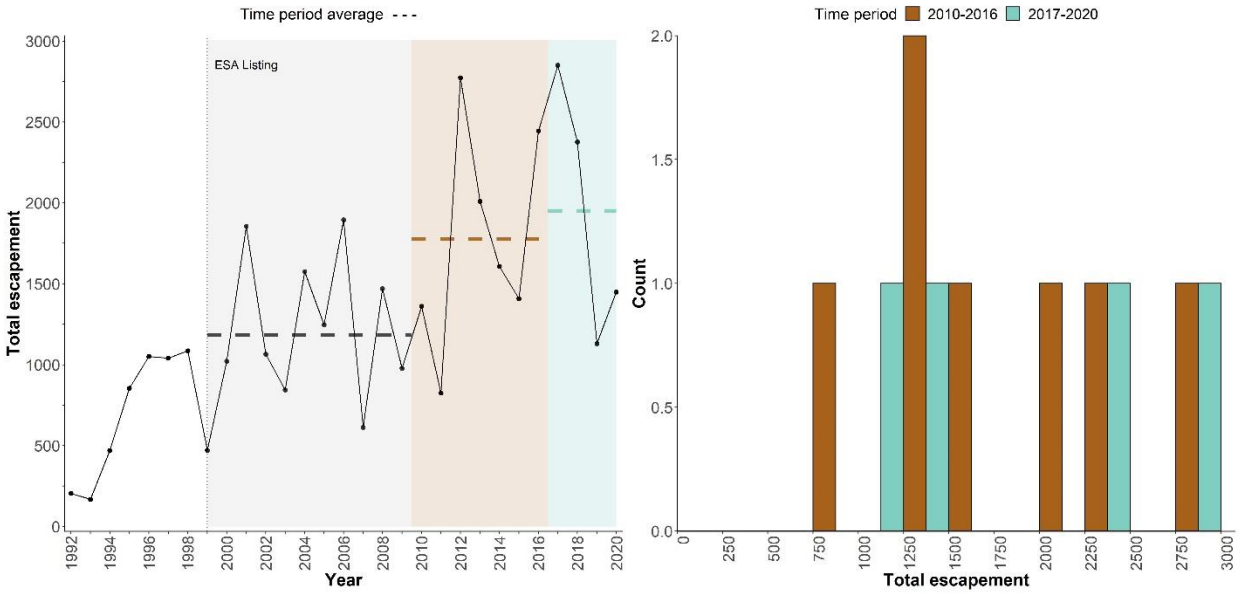


Figure 28. Estimated number of spawners for the Skagit Spring MU.

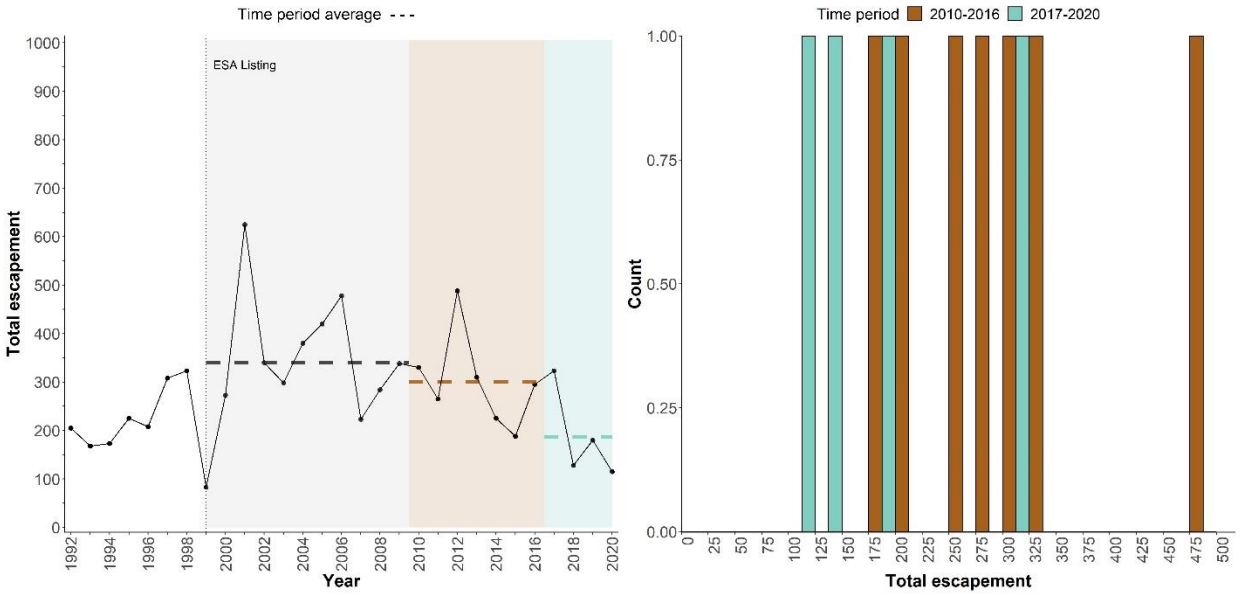


Figure 29. Estimated number of spawners for the Cascade population.

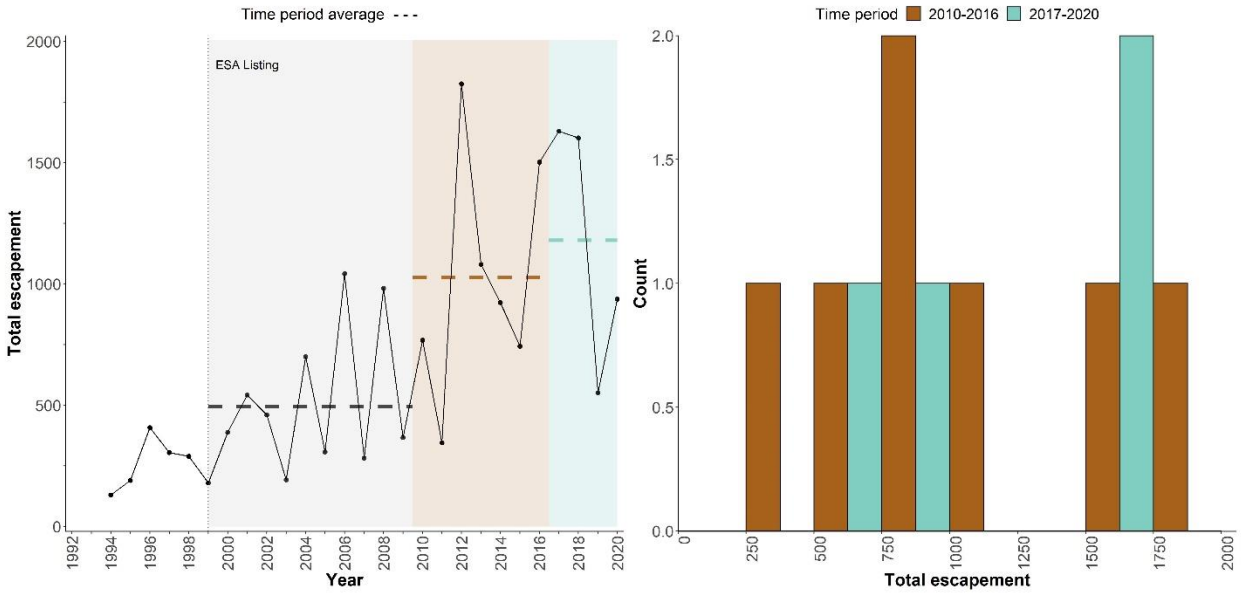


Figure 30. Estimated number of spawners for the Upper Sauk population.

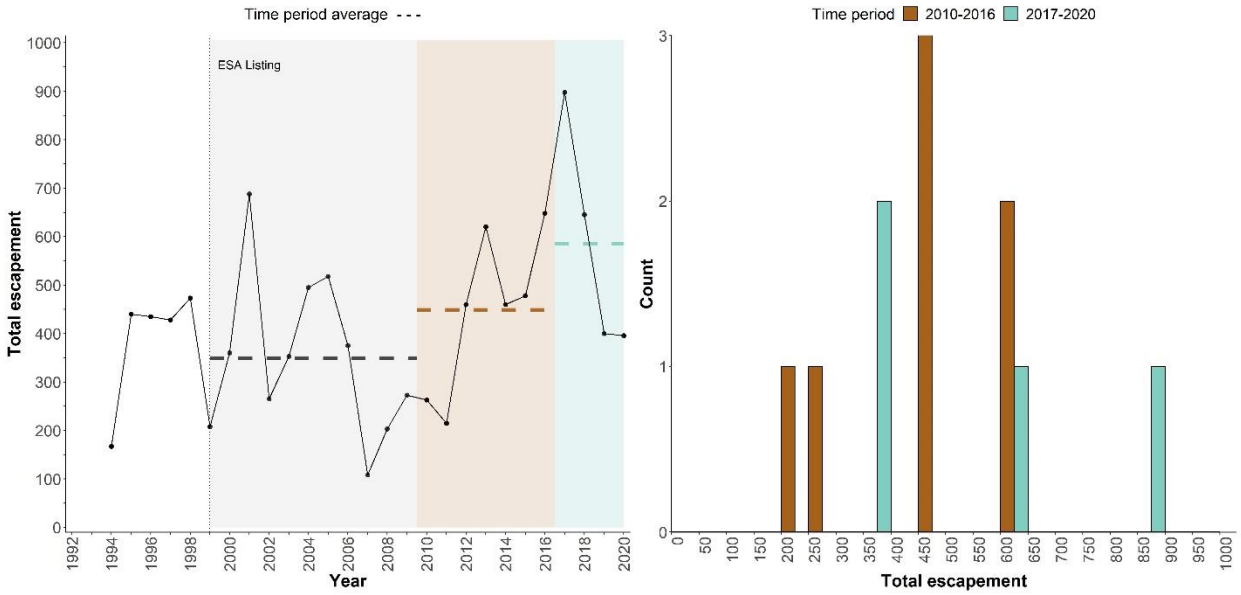


Figure 31. Estimated number of spawners for the Suiattle population.

12.3. Skagit Summer/Fall

Videos: Skagit

Synopsis:

NMFS Tier Designation

Upper Skagit: 1
Lower Skagit: 1
Lower Sauk: 1

Fishery Exploitation Rates

NMFS RER:

Upper Skagit: 0.46
Lower Skagit: 0.53
Lower Sauk: 0.50

PST SUS Exploitation Rate Limit: 2009-2015 average (0.21 as assessed by FRAM)
% Fishery Mortality in SUS Fisheries: 41% (2009-2018)
Average Total Exploitation Rate: 0.44 (2009-2018)
Average SUS Exploitation Rate: 0.18 (2009-2018)

Average Total Spawners (2017-2020)

Skagit Summer/Fall MU: 11,504
Upper Skagit: 9,037
Lower Skagit: 1,942
Lower Sauk: 526

Chinook Salmon in the Skagit River basin are genetically distinct from Chinook Salmon in other Puget Sound rivers and have varying levels of genetic differentiation between the populations within the basin (Ruckelshaus et al. 2006). NMFS has designated each of the Skagit River summer and fall populations as Tier 1 because of their importance to the recovery of the Puget Sound Chinook ESU.

Habitat status and restoration priorities are discussed in the section on the Skagit River Spring MU (also see Swinomish Tribal Community, Upper Skagit Tribe, and Sauk-Suiattle Tribe sections of 2020 Watershed Status for a summary of habitat conditions and actions).

The United States is obligated under the Pacific Salmon Treaty to monitor fishery exploitation rates on Skagit Summer/Fall Chinook Salmon. Juvenile Chinook Salmon reared at the Marblemount Hatchery receive a CWT and subsequent recoveries of tagged fish in Canadian and U.S. fisheries are used to monitor compliance with the ISBM obligations of the Pacific Salmon Treaty (see Section 5.2). In addition to being tagged, the juvenile Chinook Salmon are identified by clipping the adipose fin clip so that they can be identified in fisheries, primarily in Canada, that rely upon this clip to identify tagged fish. When the Skagit Summer/Fall Chinook return results in less than 9,202 spawners, the Pacific Salmon Treaty limits the exploitation rates to the average rate from 2009-2015. This is equivalent to 0.21 when measured using the domestic fishery management model (FRAM).

Total fishery exploitation dropped from slightly greater than 0.60 in 1992 and 1993 to an average of 0.44 from 2009-2018 (Figure 32). This is less than the RERs (range of 0.46 to 0.53) that NMFS estimated for the Skagit summer/fall Chinook Salmon populations. Most (59%) of the mortality of the Skagit

Summer/Fall MU occurs in fisheries other than the SUS (Figure 33). Exploitation rates in the SUS fisheries averaged 0.18 from 2009-2018.

The number of spawners for the Skagit Summer/Fall MU averaged 11,504 from 2017-2020 (Figure 34). This is greater than the number of spawners prior to listing, and greater than the estimated number of spawners associated with the maximum sustainable yield (MSY) of 9,202 (PSIT and WDFW 2017). The number of spawners from 2017-2020 averaged 9,037 for the Upper Skagit, 1,942 for the Lower Skagit, and 526 for the Upper Sauk population (Figure 35 - Figure 37). Note that estimates of the proportion of the spawners in the Skagit River originating from hatchery releases are not available, although believed to be small.

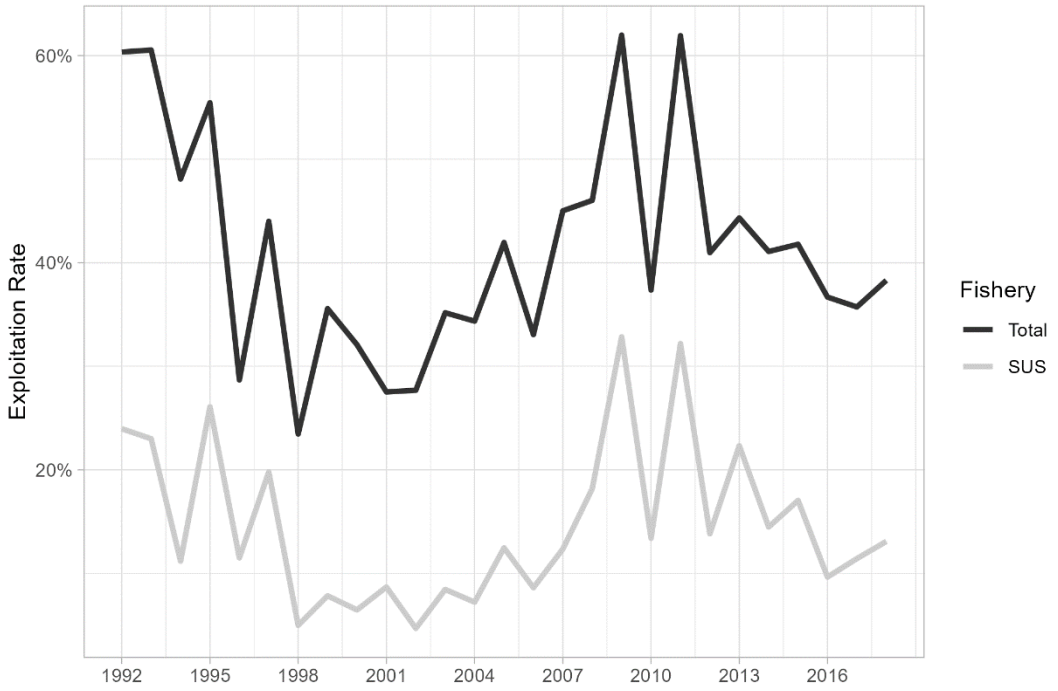


Figure 32. Fishery exploitation rates on the Skagit Summer/Fall MU in all fisheries (Total) and in the SUS, 1992-2018.

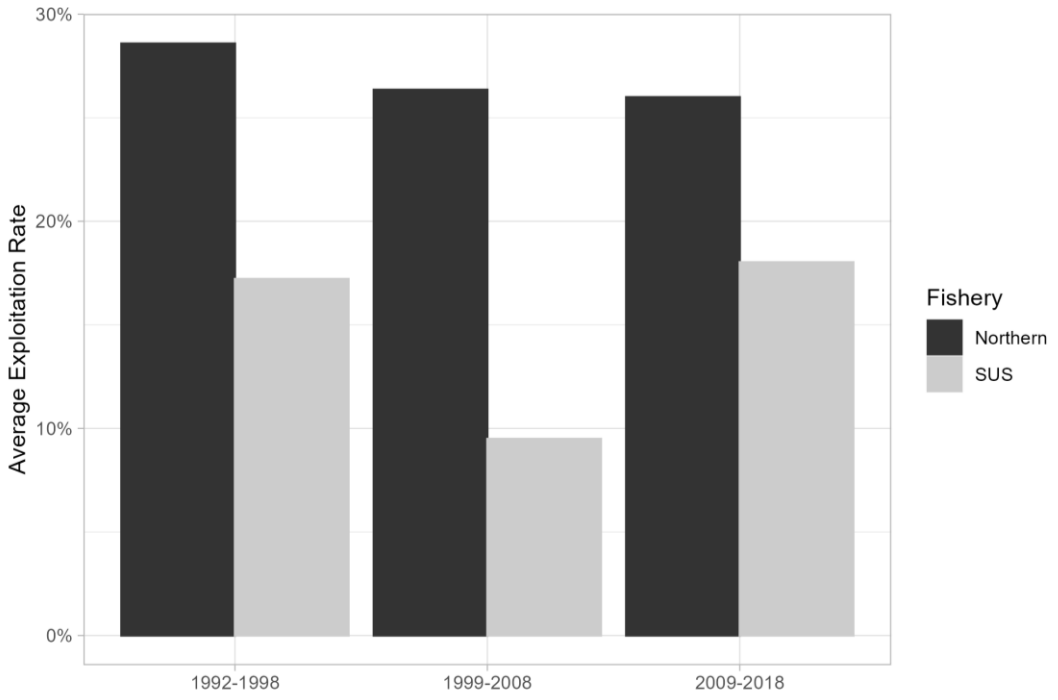


Figure 33. Average exploitation rates on the Skagit Summer/Fall MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

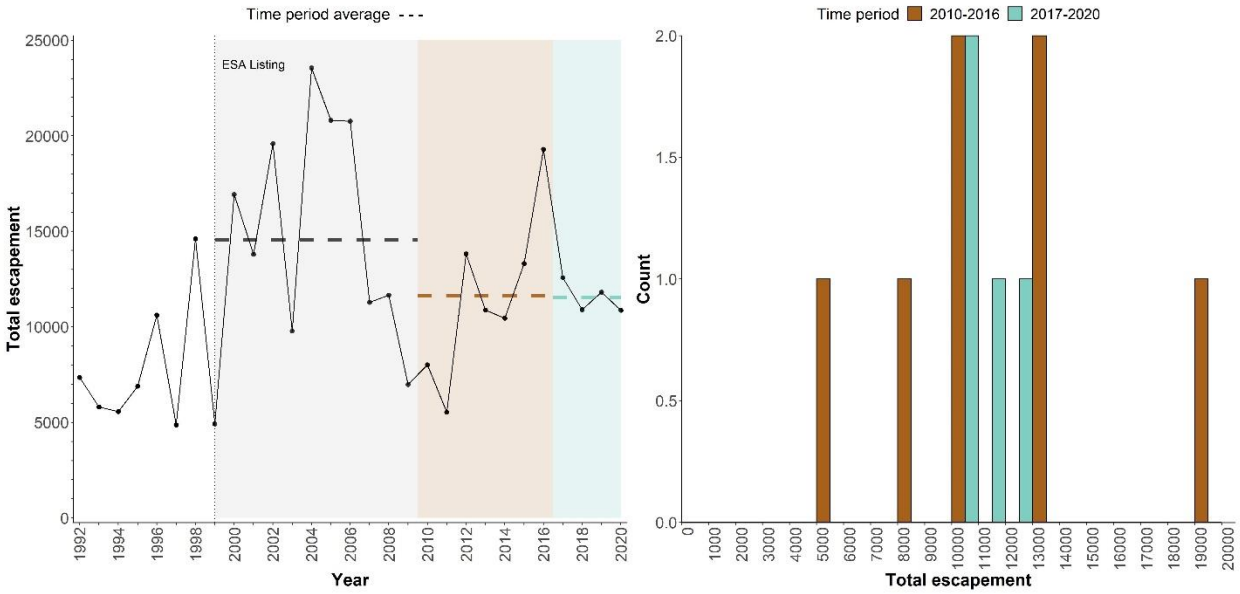


Figure 34. Estimated number of spawners for the Skagit Summer/Fall MU.

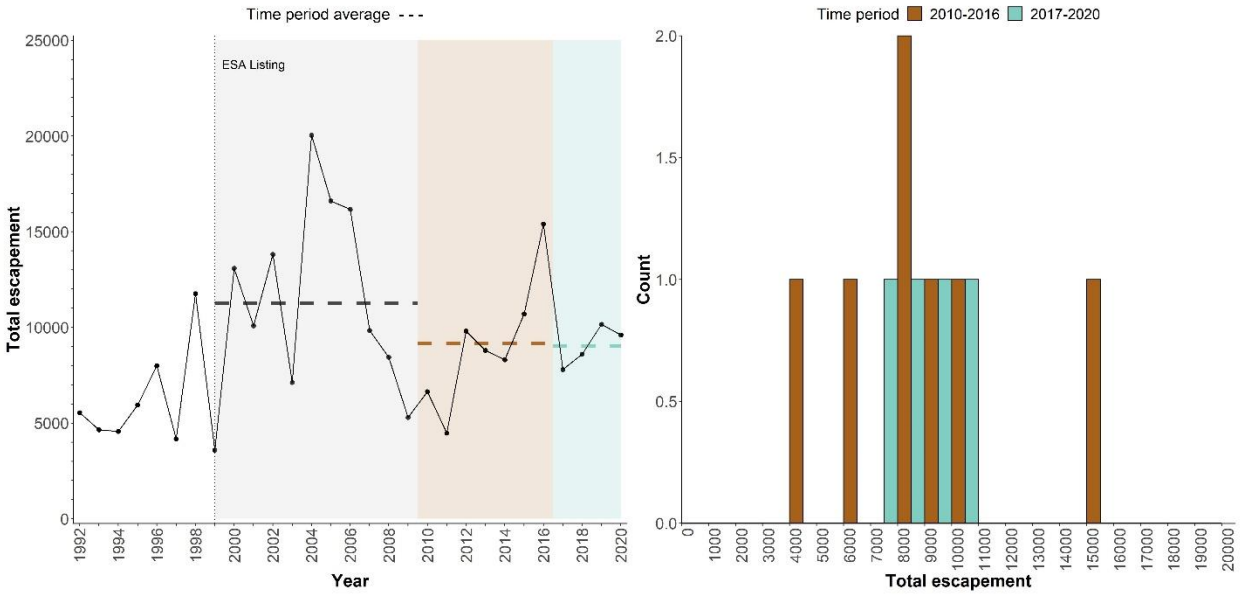


Figure 35. Estimated number of spawners for the Upper Skagit population.

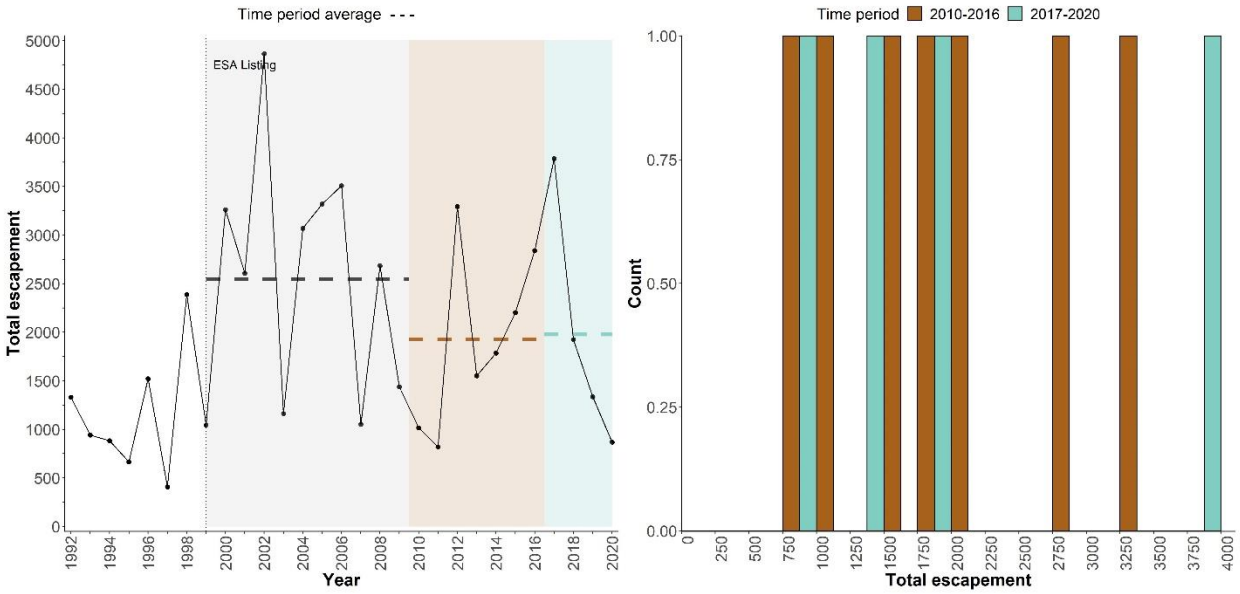


Figure 36. Estimated number of spawners for the Lower Skagit population.

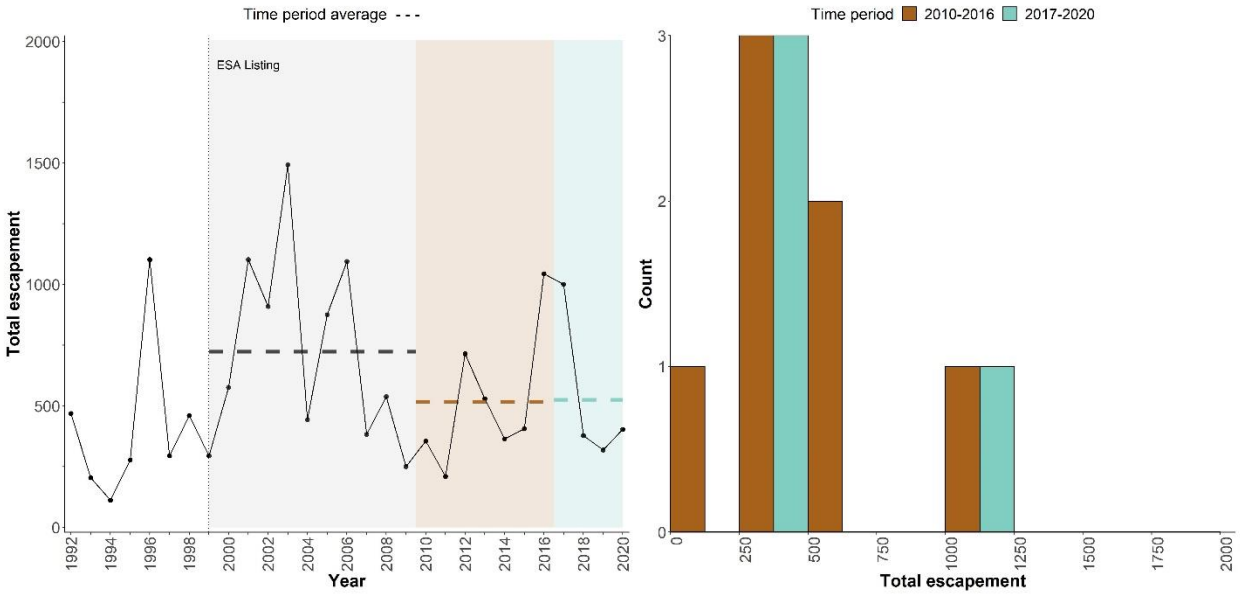


Figure 37. Estimated number of spawners for the Lower Sauk population.

12.4. Stillaguamish

Videos: Stillaguamish, Stillaguamish Estuary

Synopsis:

NMFS Tier Designation

North Fork Stillaguamish: 2

South Fork Stillaguamish: 2

Fishery Exploitation Rates

NMFS RER: 0.31

% Fishery Mortality in SUS Fisheries: 27% (2009-2018)

PST SUS Exploitation Rate Limit: 2009-2015 average (0.09 as assessed by FRAM)

Average Total Exploitation Rate: 0.31 (2009-2018)

Average SUS Exploitation Rate: 0.08 (2009-2018)

Average Spawners (2017-2020)

Total Spawners

Stillaguamish MU: 958

North Fork Stillaguamish: 873

South Fork Stillaguamish: 85

Natural-Origin Spawners

Stillaguamish MU: 319

North Fork Stillaguamish: 289

South Fork Stillaguamish: 30

The recovery plan identified two genetically differentiated populations of Chinook Salmon in the Stillaguamish, the North Fork Stillaguamish and the South Fork Stillaguamish. The importance of these populations was identified in the biological opinion associated with the 2019 update to the Pacific Salmon Treaty. The biological opinion identifies the Stillaguamish as one of the "weakest populations that are considered essential for recovery and those most affected by northern fisheries" (NMFS 2019c).

The ability of Chinook Salmon to successfully complete their life cycle and contribute progeny in the next generation has been significantly compromised by habitat degradation in the Stillaguamish River basin. The removal of trees along river banks has resulted in increased water temperatures that stress adults migrating upstream, levees along with disconnected side channels force high river flows through narrow channels and scour out eggs in the streambed, and the loss of much of the estuary limits rearing locations for juvenile Chinook Salmon as they transition from river to marine residence (see Stillaguamish Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions).

Substantial restoration efforts are underway through the efforts of the Stillaguamish Tribe, Stillaguamish Watershed Council, Snohomish County, WDFW, and other salmon recovery partners. The Acquisition Strategy of the Implementation of the Stillaguamish Chinook Recovery Plan (SWC 2020) provides a summary of the habitat restoration strategy. The strategy identifies a "corridor" of lands along the major Chinook Salmon to allow for restoration of natural riverine processes and protection of habitat:

> "The corridor approach (also known as "process based restoration") is supported by the literature as having the most certainty of restoring riverine-floodplain ecosystems and the species that depend on them (Beechie et al. 2010). Without work to restore floodplain forests and the ability of channels to migrate, Puget lowland riverine ecosystems tend to be mired in a stable state of reduced biogeomorphic complexity (i.e. reduced salmonid production; Collins et al. 2012). There is little expectation that salmon populations will improve significantly from their severely depressed state in the absence of broadly implemented projects that restore these critical natural processes, and on a scale that is plainly visible on an aerial photograph.
>
> Process based restoration is not fast, however. Even rapid growing tree species require 80- 100 years before they reach a functional size for the large channels of the Stillaguamish (Collins and Montgomery 2002, Collins et al. 2012). Therefore, the SWC acquisition strategy is a long term approach to correct ecosystem problems lacking expedient solutions. It is essential to continue constructing instream wood structures until riparian planting, armoring removal, and dike setback can create and sustain healthy instream habitats. Especially in the case of armoring removal and dike setback, acquisition of the underlying land and adjacent channel migration zone will need to be accomplished as a first step."

This strategy was advanced in 2021 with the provision of $5 million of federal funding associated with implementation of the Pacific Salmon Treaty and $0.9 million from the state funded Estuary and Salmon Restoration Program.

While habitat restoration proceeds, hatchery conservation programs are in place for both the North Fork Stillaguamish and South Fork Stillaguamish populations. By bringing some of the returning adults into the hatchery and rearing the juveniles until they are ready to begin migration to marine waters, some of the primary sources of mortality that occur in the river can be avoided. With the current poor survival of juvenile Chinook Salmon in the river, these conservation programs are essential to supporting the next generation and to maintain the unique genetic characteristics of these populations. The South Fork Stillaguamish hatchery conservation program is funded through a federal grant associated with implementation of the Pacific Salmon Treaty.

The United States is obligated under the Pacific Salmon Treaty to monitor fishery exploitation rates on North Fork Stillaguamish Chinook Salmon. Juvenile Chinook Salmon reared at the Whitehorse Ponds Hatchery receive a CWT and subsequent recoveries of tagged fish in Canadian and U.S. fisheries are used to monitor compliance with the ISBM obligations of the Pacific Salmon Treaty (see Section 5.2). In addition to being tagged, the adipose fin of each juvenile Chinook Salmon is clipped so that it can be identified in fisheries, primarily in Canada, that rely upon this clip to identify tagged fish. The Pacific Salmon Treaty limits the SUS exploitation rates to the average rate from 2009-2015. This is equivalent to 0.09 when measured using the domestic fishery management model (FRAM).

Total fishery exploitation rates on the Stillaguamish MU dropped in the early 1990s from levels exceeding 0.55 to an average of 0.31 from 2009-2018 (Figure 38). Most (73% for unmarked fish) of the mortality for both marked and unmarked Chinook Salmon from the Stillaguamish MU occurs in fisheries outside of the SUS (Figure 39 and Figure 40). Exploitation rates in SUS fisheries on unmarked Chinook from the Stillaguamish MU averaged 0.08 from 2009-2018.

The number of natural-origin and total spawners has been declining for the Stillaguamish MU (Figure 41), the North Fork (Figure 42), and the South Fork (Figure 43). On average from 2017-2020, 958 Chinook Salmon spawned in the Stillaguamish River, of which 319 were produced from fish that spawned in the river in the previous cycle. Most of the Chinook Salmon spawners were North Fork Stillaguamish, with an average of 873 North Fork spawners (289 natural origin) and 85 South Fork Stillaguamish (30 of natural-origin).

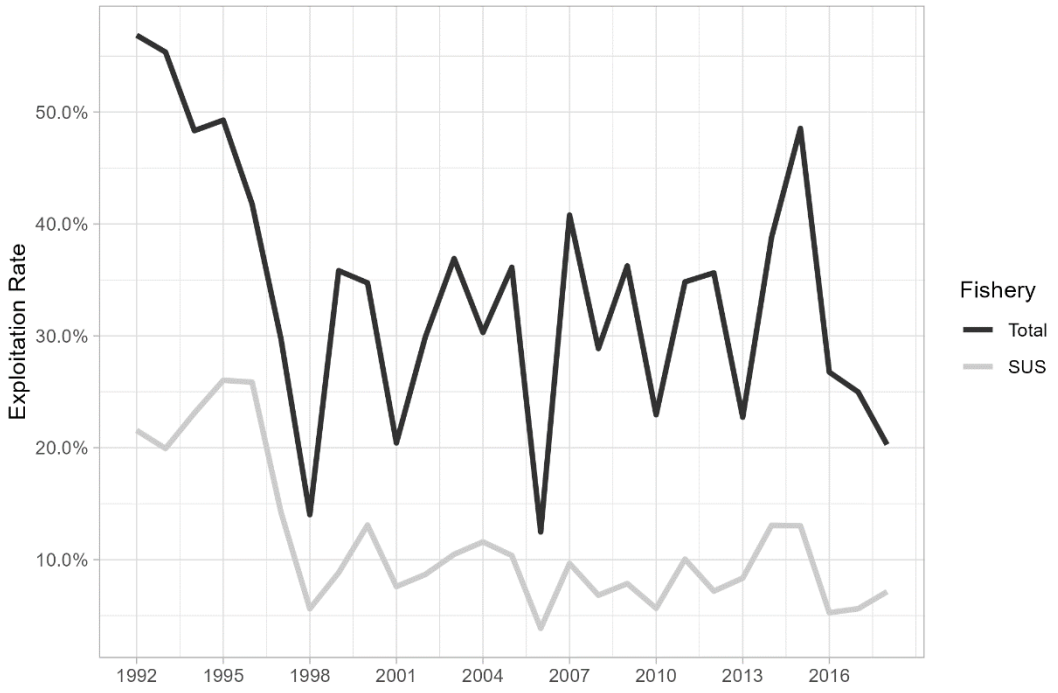


Figure 38. Fishery exploitation rates on the Stillaguamish MU (unmarked) in all fisheries (Total) and in the SUS, 1992-2018.

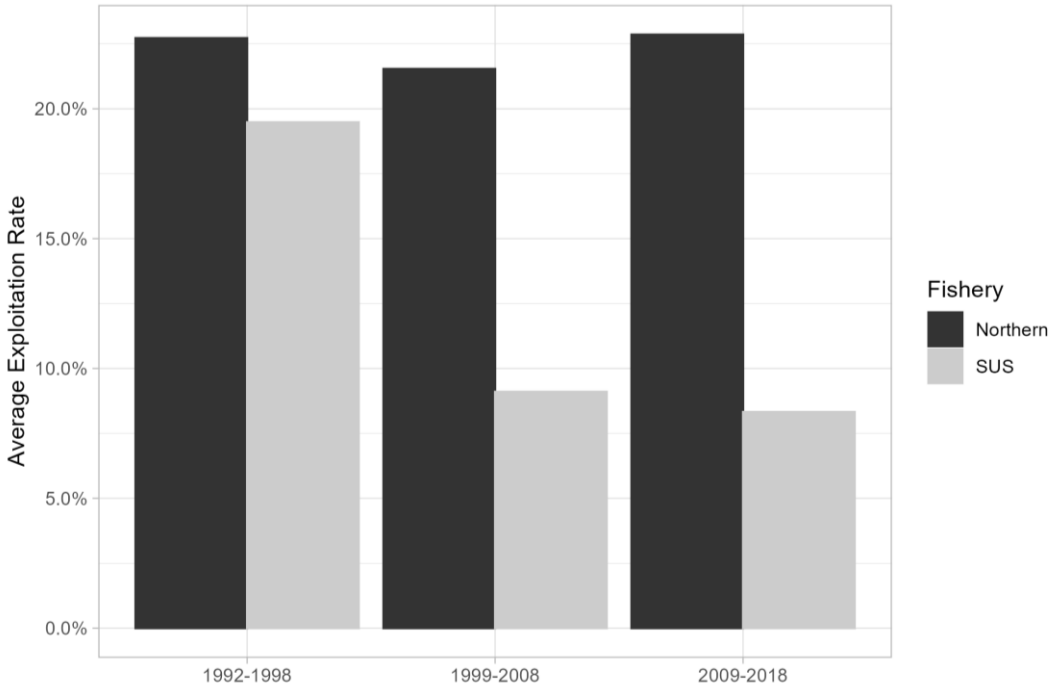


Figure 39. Average exploitation rates on the Stillaguamish MU (unmarked) in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

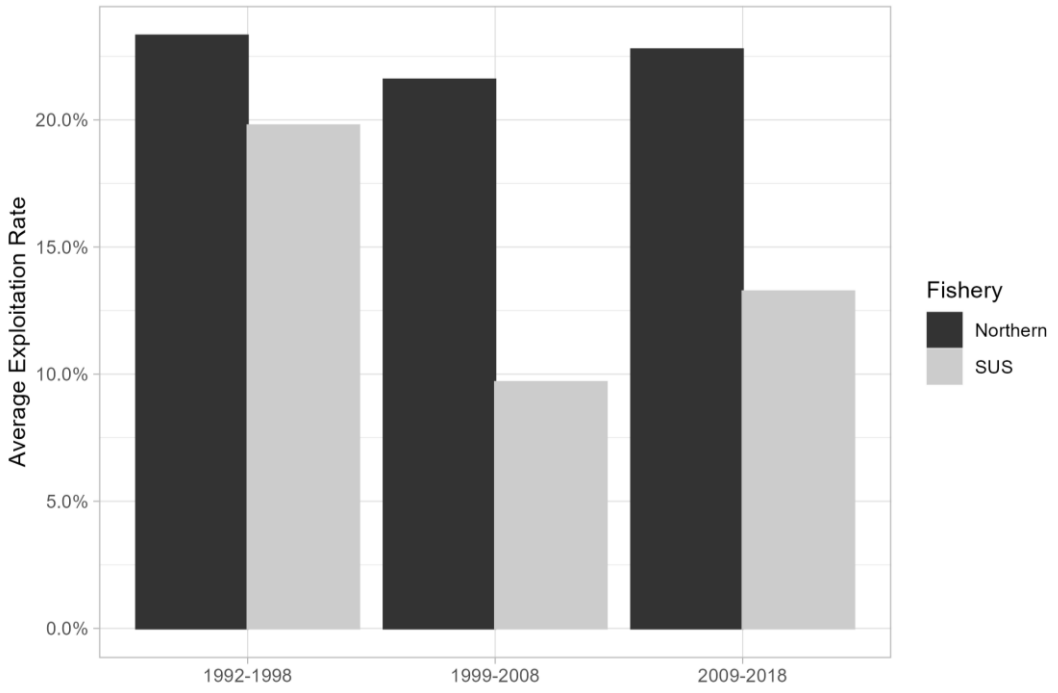
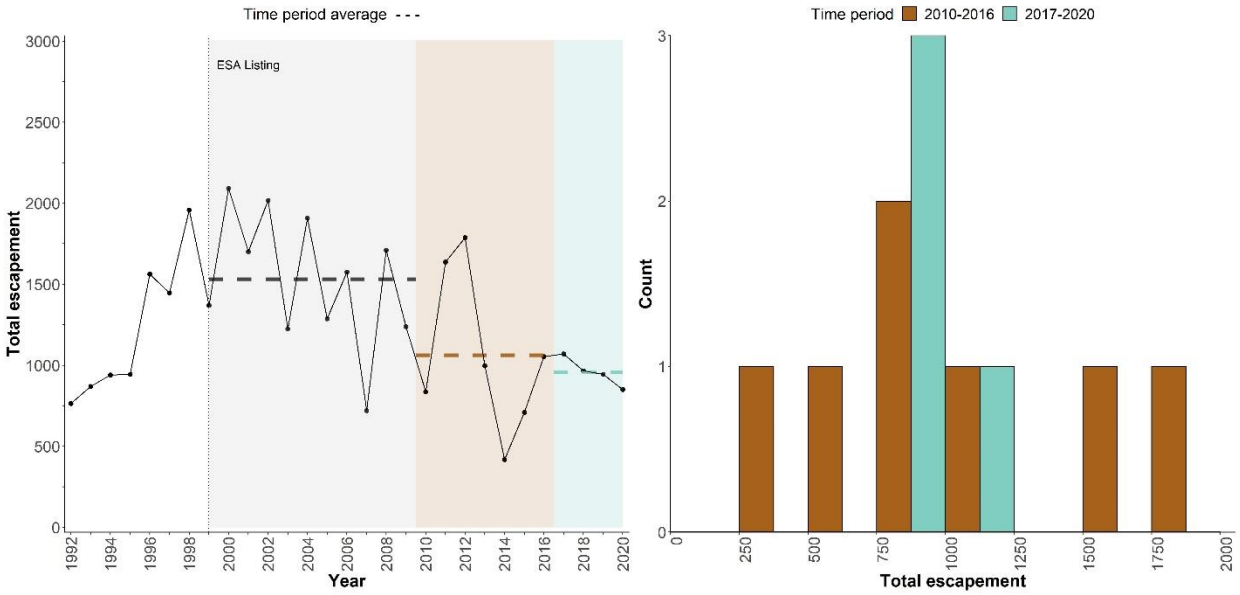


Figure 40. Average exploitation rates on the Stillaguamish MU (marked) in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

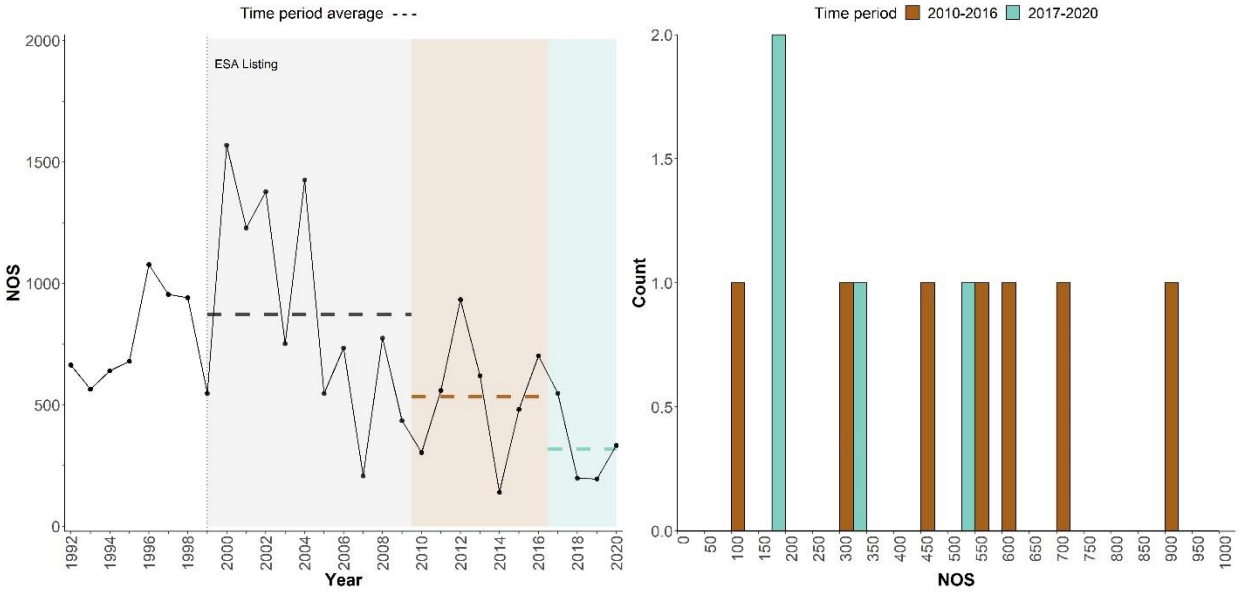
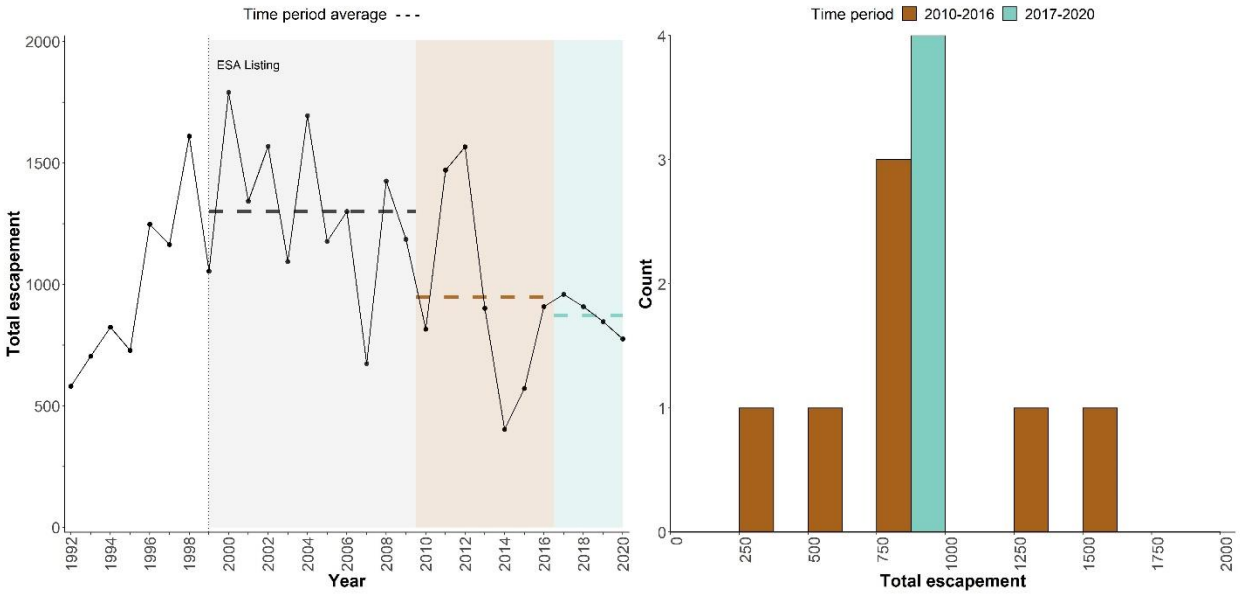


Figure 41. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Stillaguamish MU.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

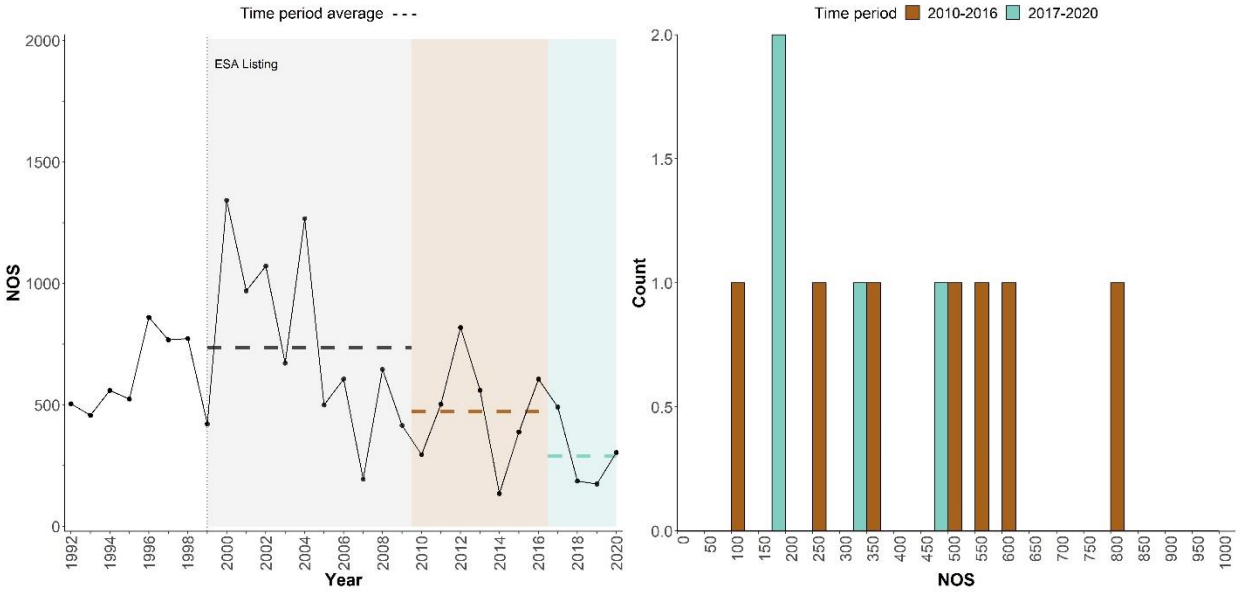
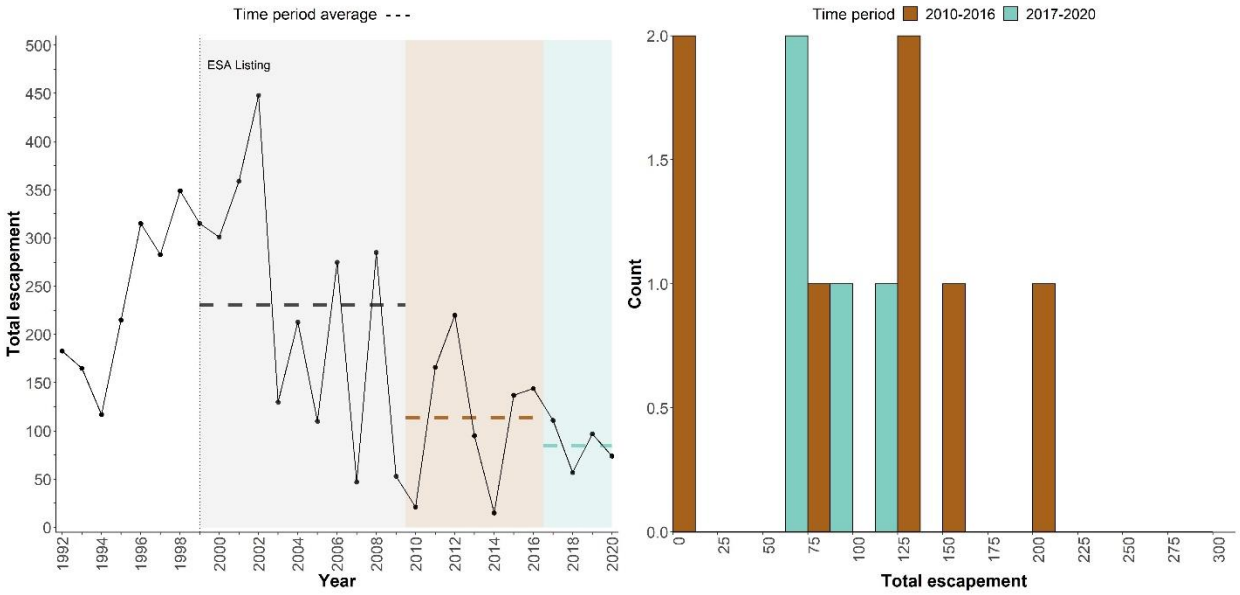


Figure 42. Total spawners (Panel A) and natural-origin spawners (Panel B) for the North Fork Stillaguamish population.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

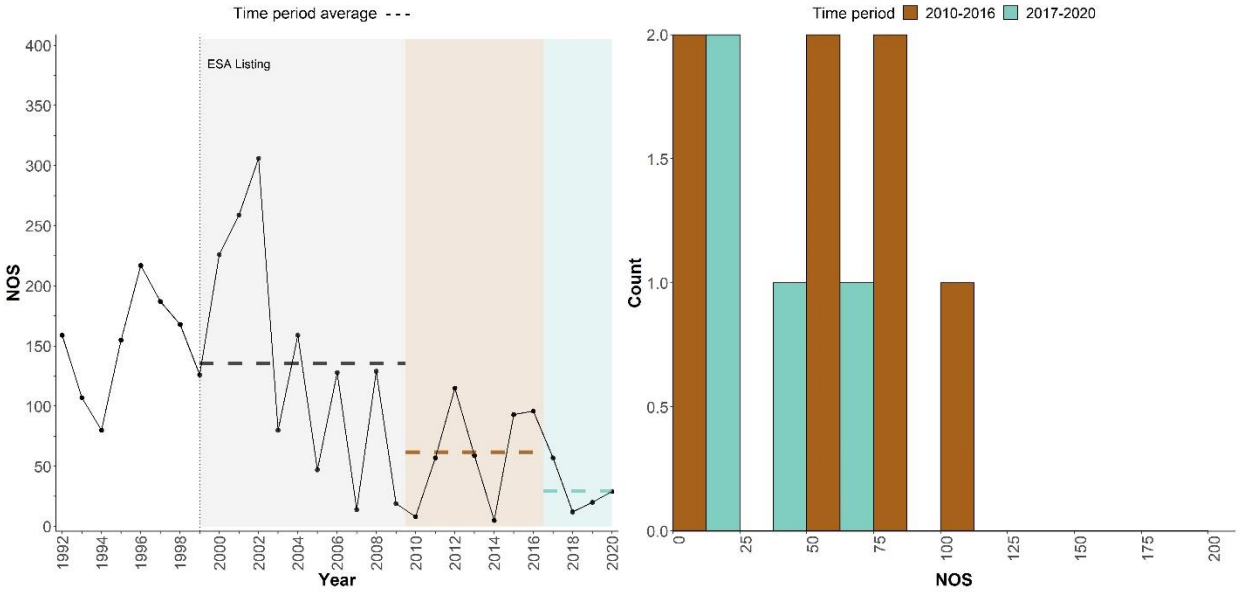


Figure 43. Total spawners (Panel A) and natural-origin spawners (Panel B) for the South Fork Stillaguamish population.

12.5. Snohomish

Videos: Smith Island**,** Pilchuck Dam,

Synopsis:

NMFS Tier Designation

Skykomish: 2

Snoqualmie: 3

Fishery Exploitation Rates

NMFS RER:

Skykomish: 0.23

Snoqualmie: 0.25

% Fishery Mortality in SUS Fisheries: 33% (2009-2018)

PST SUS Exploitation Rate Limit: 2009-2015 average (0.08 as assessed by FRAM)

Average Total Exploitation Rate: 0.24 (2009-2018)

Average SUS Exploitation Rate: 0.08 (2009-2018)

Average Spawners (2017-2020)

Total Spawners

Snohomish MU: 3,976

Skykomish: 2,778

Snoqualmie: 1,199

Natural-Origin Spawners

Snohomish MU: 2,768

Skykomish: 1,898

Snoqualmie: 870

The Puget Sound recovery plan identified the Skykomish and Snoqualmie Chinook Salmon populations in the Snohomish River basin, although limited genetic differentiation existed between them (Ruckelshaus et al. 2006). Habitat degradation has reduced the productivity of these populations at all life stages, including a) fish passage barriers prevent adults from reaching spawning areas; b) increases in impervious area that result in flashy stream flows that scour out eggs in the streambed; and c) the loss of more than 80% of the estuary through clearing and draining reduced rearing area for juvenile Chinook Salmon (see Tulalip Tribes section of 2020 Watershed Status for a summary of habitat conditions and actions).

Substantial habitat restoration projects are being implemented in the Snohomish River basin through the efforts of the Tulalip Tribes, Snohomish Basin Salmon Recovery Forum, Snohomish County, King County, WDFW, and other salmon recovery partners. Recent investments in habitat restoration include: 1) reconnecting over 350 acres of estuarine habitat near Smith Island; 2) providing access to 37 miles of habitat through the removal of the Pilchuck Dam (NMFS 2020b); and 3) the initiation of the $17 million Fall City Floodplain Restoration project (not yet fully funded).

The United States is obligated under the Pacific Salmon Treaty to monitor fishery exploitation rates on Snohomish Chinook Salmon. Juvenile Chinook Salmon reared at the Wallace River Hatchery receive a CWT and subsequent recoveries of tagged fish in Canadian and U.S. fisheries are used to monitor compliance with the ISBM obligations of the Pacific Salmon Treaty (see Section 5.2). In addition to being

tagged, the adipose fin of juvenile Chinook Salmon is clipped prior to release so that so that they can be identified in fisheries, primarily in Canada, that rely upon this clip to identify tagged fish. The Pacific Salmon Treaty limits the SUS exploitation rates to the average rate from 2009-2015. This is equivalent to 0.08 when measured using the domestic fishery management model (FRAM).

Total fishery exploitation rates on the Snohomish MU have dropped from over 0.60 in 1992 to an average of 0.24 from 2009-2018 (Figure 44). This is about equal to NMFS' estimates of the RER for the Skykomish (RER = 0.23) and the Snoqualmie (RER = 0.25). More than 65% of the fishery mortality occurs in fisheries outside of the SUS (Figure 45). Fishery exploitation rates in SUS fisheries averaged 0.08 from 2009 through 2018.

The number of natural-origin and total spawners has been declining for the Snohomish MU. The total number of spawners in the Snohomish MU from 2017-2020 averaged 3,976 of which 2,768 originated from Chinook Salmon spawning in the river in the previous generation (Figure 46). Most of the spawners occurred in the Skykomish River (average of 2,778 spawners) versus the Snoqualmie River (average of 1,199 spawners) (Figure 47 - Figure 48).

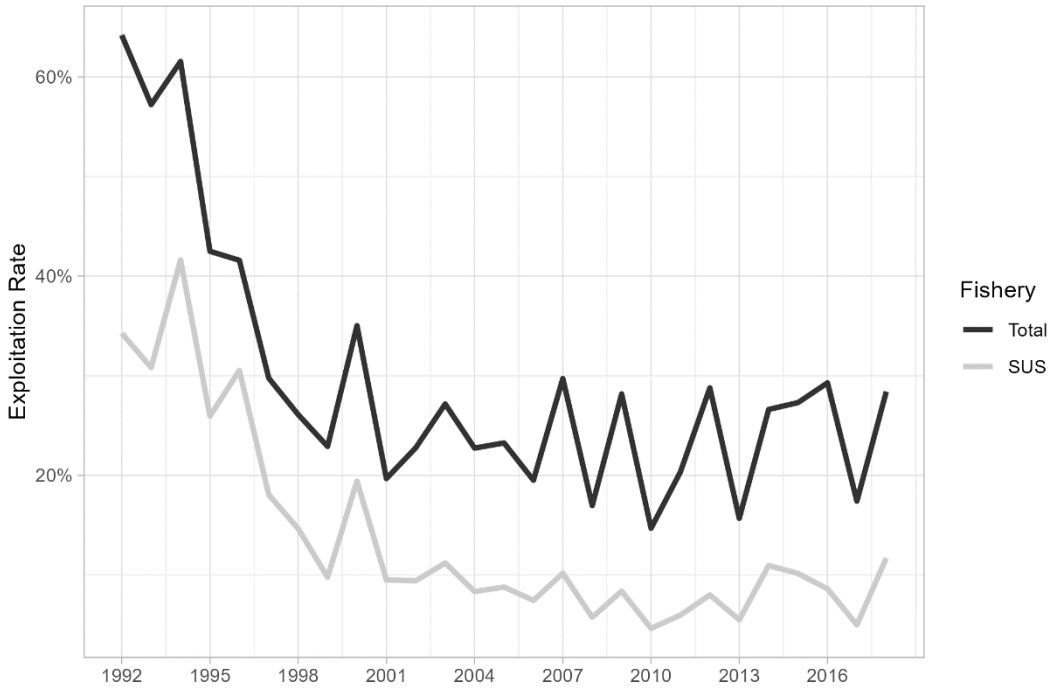


Figure 44. Fishery exploitation rates on the Snohomish MU in all fisheries (Total) and in the SUS, 1992-2018.

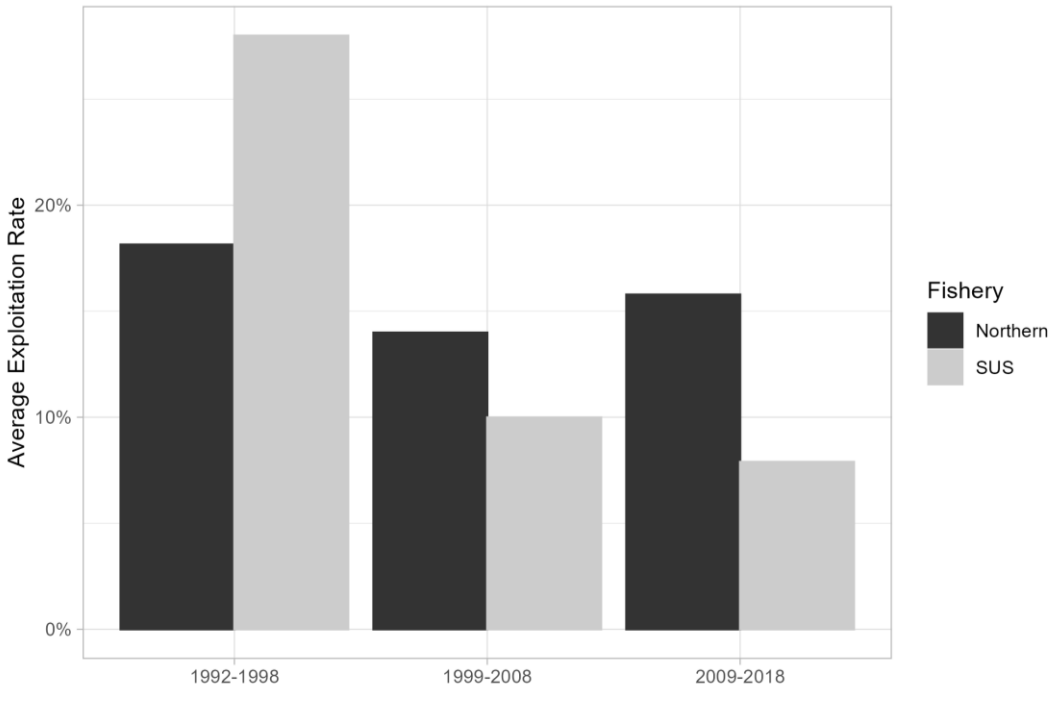
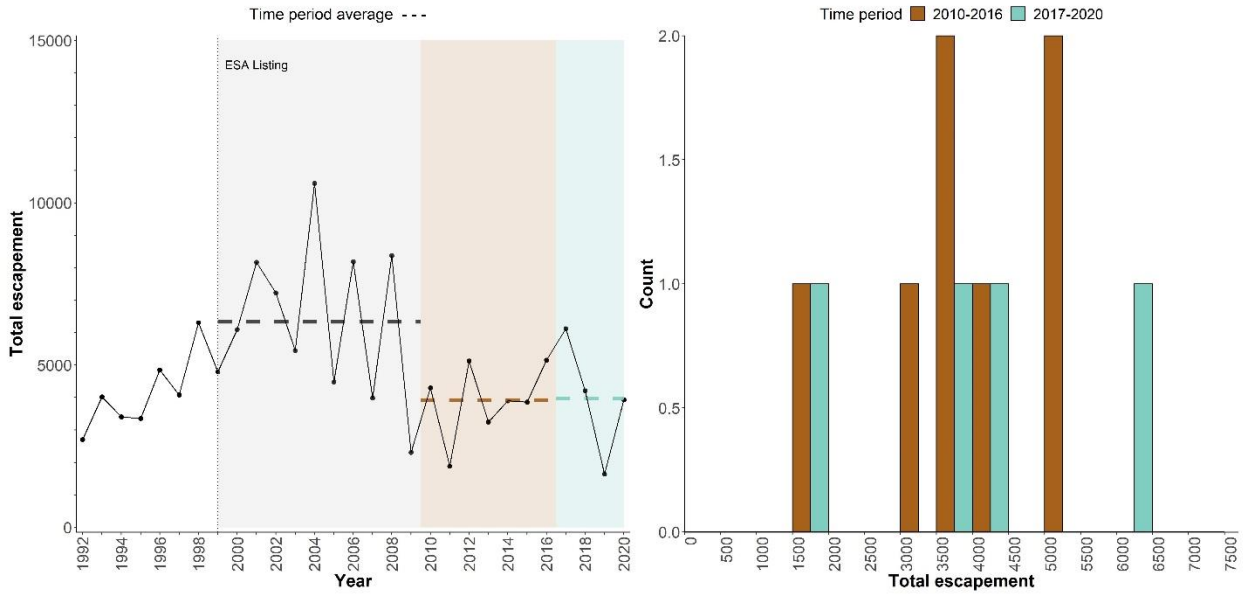


Figure 45. Average exploitation rates on the Snohomish MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

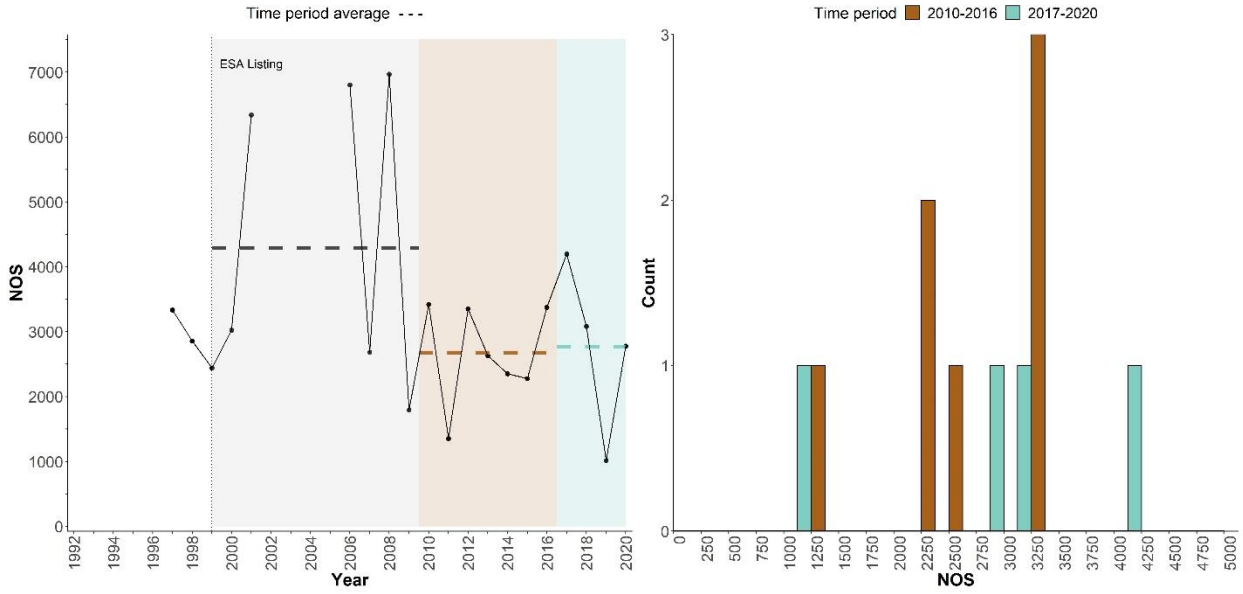
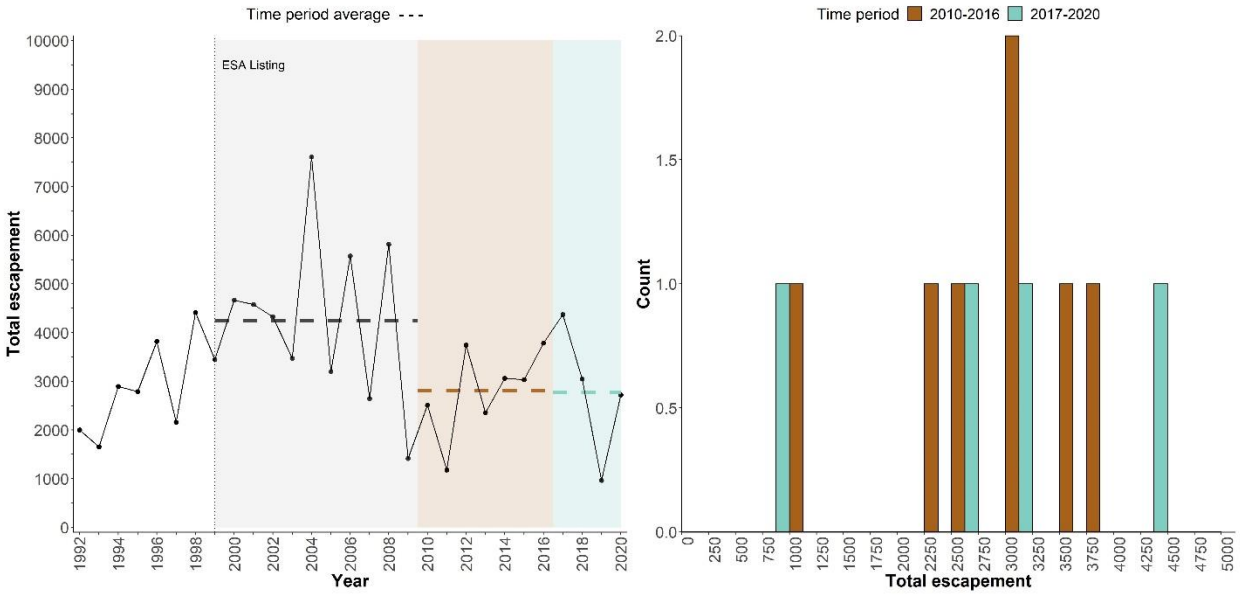


Figure 46. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Snohomish MU.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

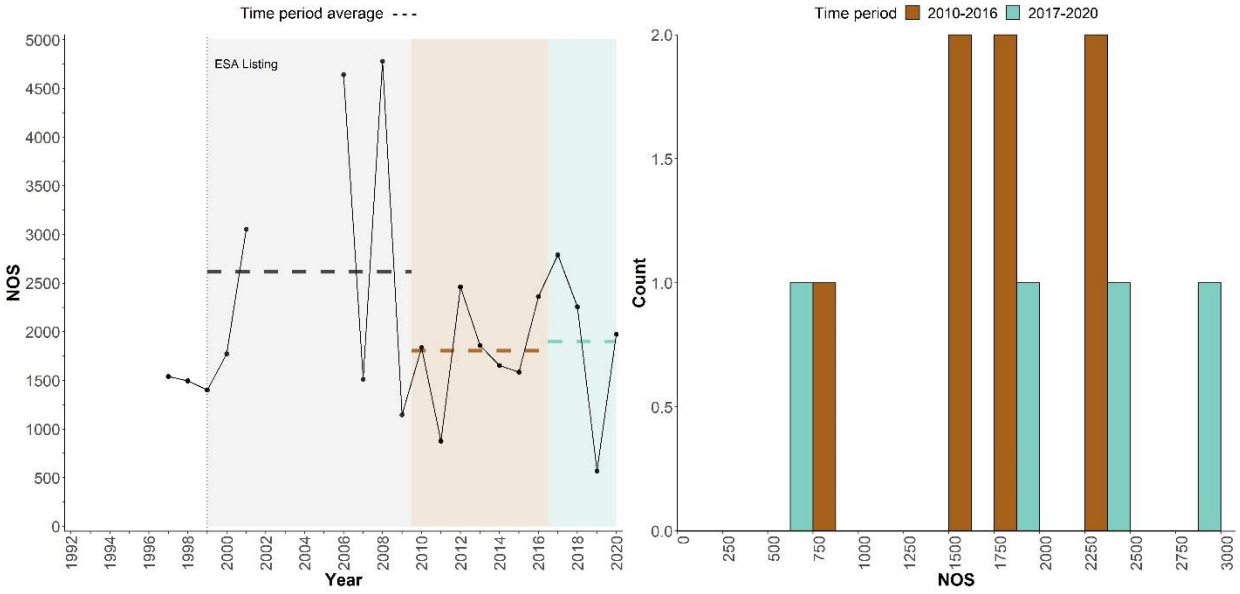
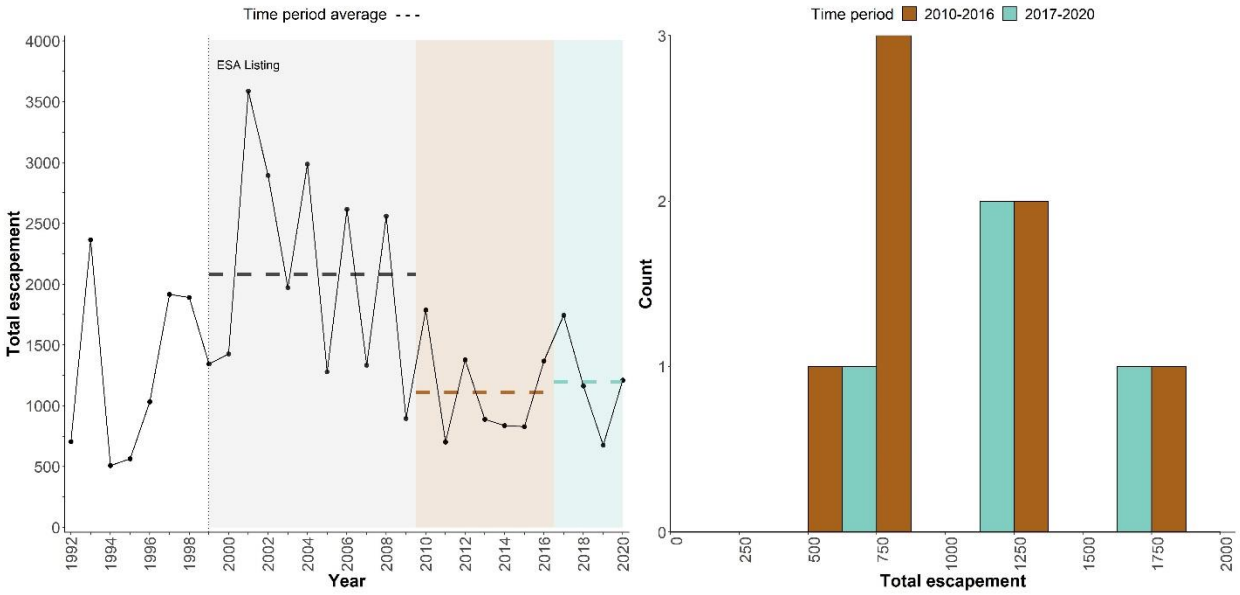


Figure 47. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Skykomish population.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

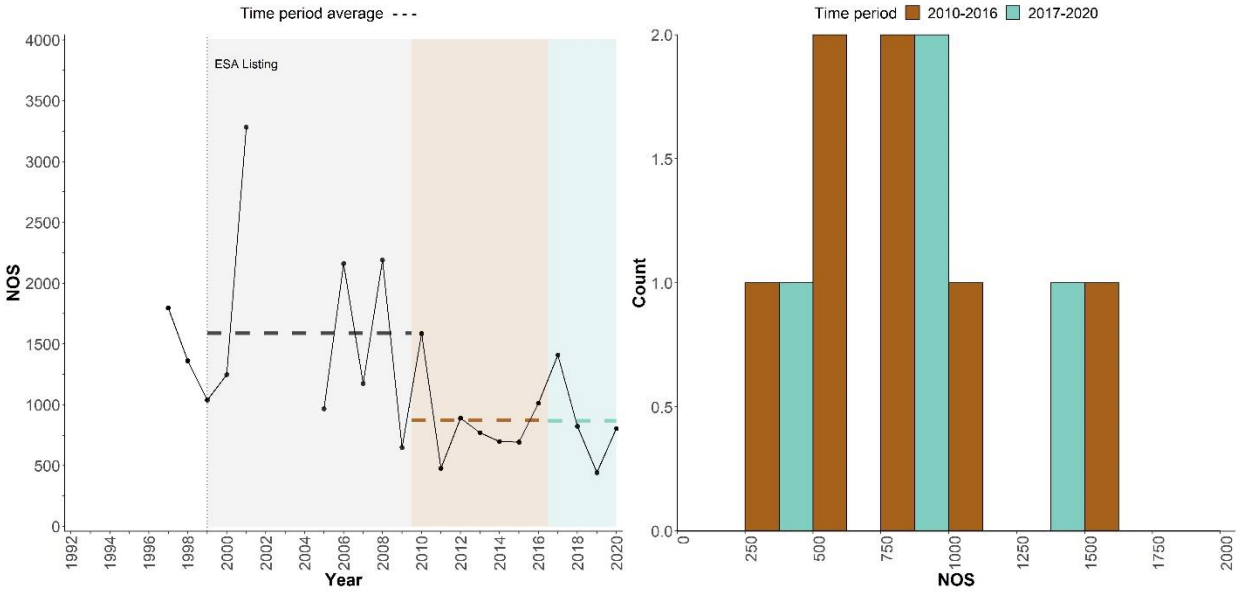


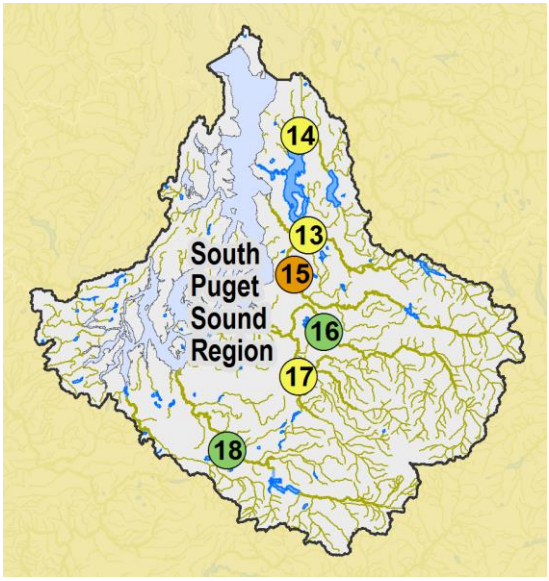
Figure 48. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Snoqualmie population.

Chapter 13. Central/South Sound MPG

Videos: South Prairie Creek, Nisqually Estuary, Mashel River

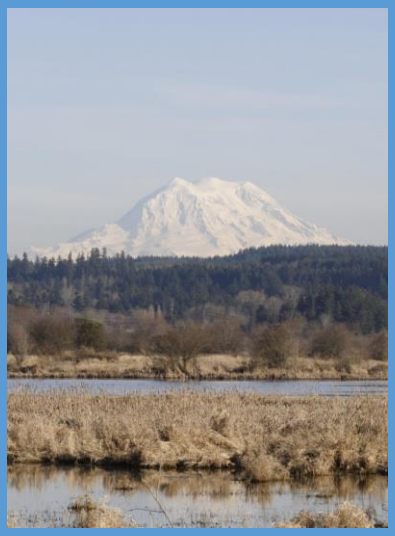
Key Points:

1) The Puget Sound recovery plan identified six historical populations in the Central/South Sound MPG (see map for locations): Cedar (13), Sammamish (14), Duwamish/Green (15), White (16), Puyallup (17), and Nisqually (18).
2) NMFS designated the White and Nisqually populations as Tier 1, indicating their importance for preservation, restoration, and ESU recovery.
3) Habitat degradation, including one or more dams in the Cedar, Green, Puyallup, and Nisqually River basins, have resulted in substantial reductions in the productivity of the rivers.
4) The historical populations have been extirpated from the Sammamish, Cedar, Puyallup, and Nisqually Rivers.
5) Most (52%-89%) of the fishery mortality on these management units occurs in fisheries in the SUS.
6) Total fishery exploitation rates have declined since the early 1990s. The 2009-2018 average total fishery exploitation rates on the summer/fall populations ranged from 29%-52%, with the SUS rate ranging from 15%-42%.
7) Although much remains to be done, the conservation and ongoing rebuilding of the White population is a substantial accomplishment. Together, hatchery conservation programs, habitat restoration, and reductions in fishery exploitation rates have resulted in increasing the number of Chinook Salmon passed upstream from less than 20 per year in the mid-1980s to nearly 2,000 per year from 2017-2020.
8) The trends in the number of spawners varied among the rivers, but the Puyallup MU showed a decline in the number of natural-origin spawners in recent years.



NMFS PRA Designation

Tier 1:
Tier 2:
Tier 3:



The $12 million restoration of the Nisqually River delta is one of the major actions underway to rebuild Puget Sound Chinook salmon runs.

13.1. Introduction

The Central/South Sound MPG encompasses the Lake Washington, Green, Puyallup, and Nisqually River basins. Basins within this MPG have been heavily impacted by habitat degradation. All historical populations have been extirpated except the Duwamish/Green and White (NMFS 2021a). NMFS has

designated the Nisqually and White populations as Tier 1, indicating their importance for preservation, restoration, and ESU recovery.

The correspondence between the populations and the management units used by the co-managers is summarized in Table 9.

Table 9. Correspondence of populations and management units in the Central/South Sound MPG.

River Basin	Historical Population	Tier	Management Unit
Lake Washington	Sammamish (extirpated)	3	Lake Washington
	Cedar (extirpated)	3	
Green	Duwamish/Green	2	Green
Puyallup	Puyallup (extirpated)	3	Puyallup
	White	1	White
Nisqually	Nisqually (extirpated)	1	Nisqually

13.2. Lake Washington

Synopsis:

NMFS Tier Designation

Sammamish: 3
Cedar: 3

Fishery Exploitation Rates

NMFS RER: not estimated
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 52% (2009-2018)
Average Total Exploitation Rate: 0.29 (2009-2018)
Average SUS Exploitation Rate: 0.15 (2009-2018)

Average Spawners (2017-2020)

Cedar Total Spawners: 1,057
Cedar Natural-Origin Spawners: 776

The Lake Washington basin is a heavily modified watershed. As we know it today, the watershed itself is non-natural and was created by the construction of a canal in 1916 that connected Lake Washington, Lake Union, and Salmon Bay. Prior to that time, the basin drained through the Black River at the south end of Lake Washington and into the Duwamish River. The Lake Washington basin is the most densely populated and urbanized region of Washington State. The majority of the watershed lies within King County and is home to almost a third of Washington State's population, with more than 1,000 people per square mile (OFM 2020). Shoreline modification and urbanization have resulted in more than 13% of the Sammamish floodplain to be impervious (King County 2012) and an estimated 82% of Lake Washington's shoreline is heavily modified with bulkhead and riprap (NWIFC 2020). Other impacts include: reduction and

degradation of riparian vegetation, increases in artificial lighting, altered natural flow regimes and lake levels, fish-blocking dams and culverts, reductions in number of side-channels, and poor water quality (see Muckleshoot Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions).

The updated conservation plan (WRIA 8 2017) identifies the following eight priority strategies:

Strategy 1. Protect and restore floodplain connectivity. Floodplains provide crucial habitat for juvenile salmon to rear and find refuge from floods and predators. Connected floodplains and associated riparian and instream habitat provide sources of large wood that slow fast-moving water and create channel complexity through braiding and formation of side channels, backwater channels, and off-channel wetlands.

Strategy 2. Protect and restore functional riparian vegetation. Protecting and restoring riparian trees is important throughout the watershed and offers direct and indirect benefits to Chinook Salmon via food web inputs, water quality protection (including reducing thermal, pollutant, and fine sediment inputs), and as a source of large wood for recruitment. This strategy mitigates some of the impacts of land conversion and urbanization, shoreline armoring, invasive plant infestations, polluted stormwater runoff and increased water temperature from climate change.

Strategy 3. Protect and restore channel complexity. Complex stream channels provide a range of habitats necessary for Chinook Salmon spawning, rearing, and survival. They provide pools and eddies where salmon can rest, feed, and find refuge from predators and floods.

Strategy 4. Restore shallow-water rearing and refuge habitat. Gently sloping sandy beaches maximize shallow-water habitat for lake-rearing juveniles outmigrating to Puget Sound, and can help provide refuge from native and non-native predators. Bulkheads or other shoreline hardening and nighttime lighting affect juvenile behavior in ways that may increase their susceptibility to predation.

Strategy 5. Reconnect and enhance creek mouths. The area where a creek enters a river or lake provides habitat for juvenile rearing and refuge from predators as juveniles migrate to marine waters. Daylighting or restoring creeks, reducing their gradient to make them available to juvenile salmon, and removing armoring near creek mouths should restore their ecological function and reduce the impact of land cover conversion for residential, commercial, or industrial use, as well as the effects of predation.

Strategy 6. Protect and restore cold-water sources and reduce thermal barriers to migration. Areas of water warmer than about 65 degrees F can delay migration, diminish spawning success, and contribute to pre-spawn mortality. While other strategies help protect and restore cold water sources (e.g., floodplain reconnection, riparian cover and forest retention throughout the watershed), this strategy focuses specifically on key areas known to be migratory bottlenecks (e.g., Ship Canal and Sammamish River), or where problems could develop for other life stages through climate change impacts.

Strategy 7. Improve juvenile and adult survival at the Ballard Locks. The primary fish passage barrier in the watershed is the Ballard Locks, which affects salmon survival and the timing of adult and juvenile passage into and out of the watershed. As a legacy land use impact that forever changed the hydrology of the watershed, the pressure exerted by the Ballard Locks can be mitigated but not

removed. Measures to improve fish passage conditions and survival through the Ballard Locks are of paramount importance.

Strategy 8. Reduce predation on juvenile migrants and lake-rearing. Predation of juvenile Chinook salmon by native and non-native species is a long-suspected issue affecting juvenile survival in the freshwater system, especially in Lake Washington, Lake Sammamish, and the Ship Canal. The magnitude of the problem is not well quantified, and ongoing research is attempting to clarify the relative impact of predation on freshwater juvenile survival in WRIA 8. Additionally, emerging research suggests that artificial nighttime lighting may alter juvenile fish behavior in a way that makes them more susceptible to predators and increases the length of time predators actively feed.

A major initiative was initiated in 2021 to address the temperature and dissolved oxygen conditions in the Lake Washington Ship Canal (Strategy 6). Building on the assessment completed in 2020 (Urgenson et al. 2020), WRIA 8 and Long Live the Kings have convened stakeholders, scientists, and governmental agencies with the goal of developing, evaluating, and implementing actions to reduce thermal barriers to salmon migration and improve juvenile and adult salmon survival (see LWSC Project).

The Puget Sound recovery plan identified two historical populations, Sammamish and Cedar. Both historical populations have been extirpated (NMFS 2021a) and NMFS categorized both populations as Tier 3. NMFS specifically excluded the entirety of the Lake Sammamish basin from designation as critical habitat because the economic benefits of no designation outweighed the conservation benefits of a critical habitat designation (NMFS 2005). Regarding excluded areas, NMFS (2005) stated "We have concluded that exclusion of any of these areas alone or of all areas in combination, would not significantly impede conservation of the Puget Sound Chinook ESU."

Co-manager fishery management focuses on Cedar River because NMFS did not designate the Sammamish River as critical habitat and because a Chinook population is not currently sustainable due to habitat degradation in that basin (PSIT and WDFW 2017). Total fishery exploitation rates on the Lake Washington MU exceeded 0.70 in the early 1990s but averaged 0.29 from 2009-2018 (Figure 49). Fishery mortality is split approximately equal between northern (Canada and Southeast Alaska) and SUS fisheries (Figure 50). Exploitation rates in SUS fisheries averaged 0.15 from 2009-2018.

The average number of spawners in the Cedar River from 2017-2020 was 1,057, of which 776 originated from Chinook Salmon spawning in the river in the previous generation (Figure 51).

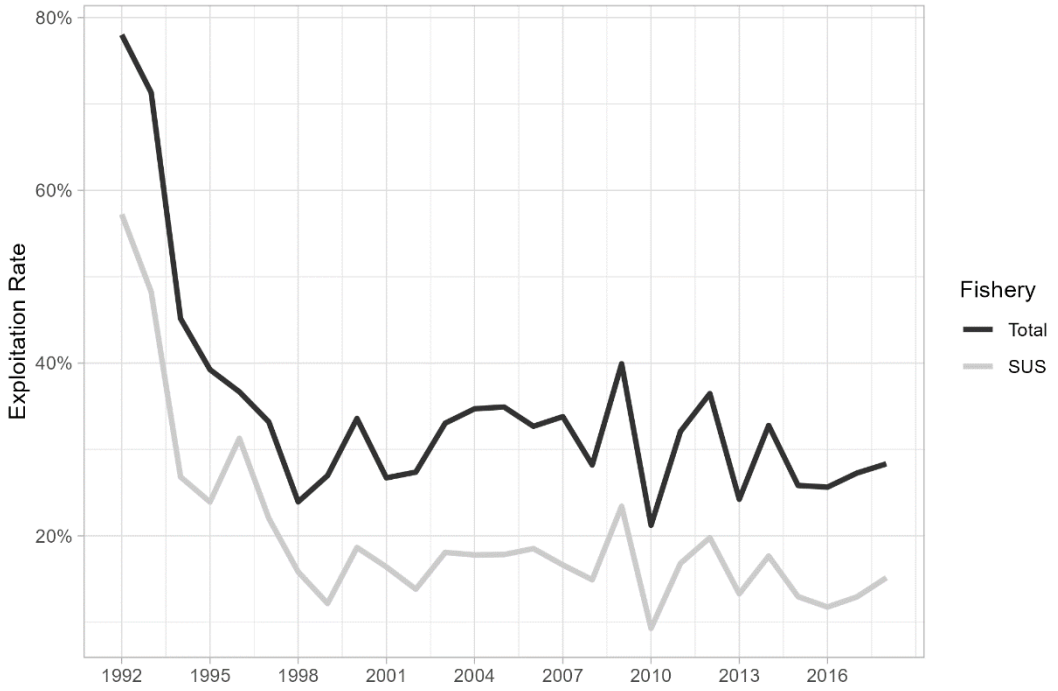


Figure 49. Fishery exploitation rates on the Lake Washington MU in all fisheries (Total) and in the SUS, 1992-2018.

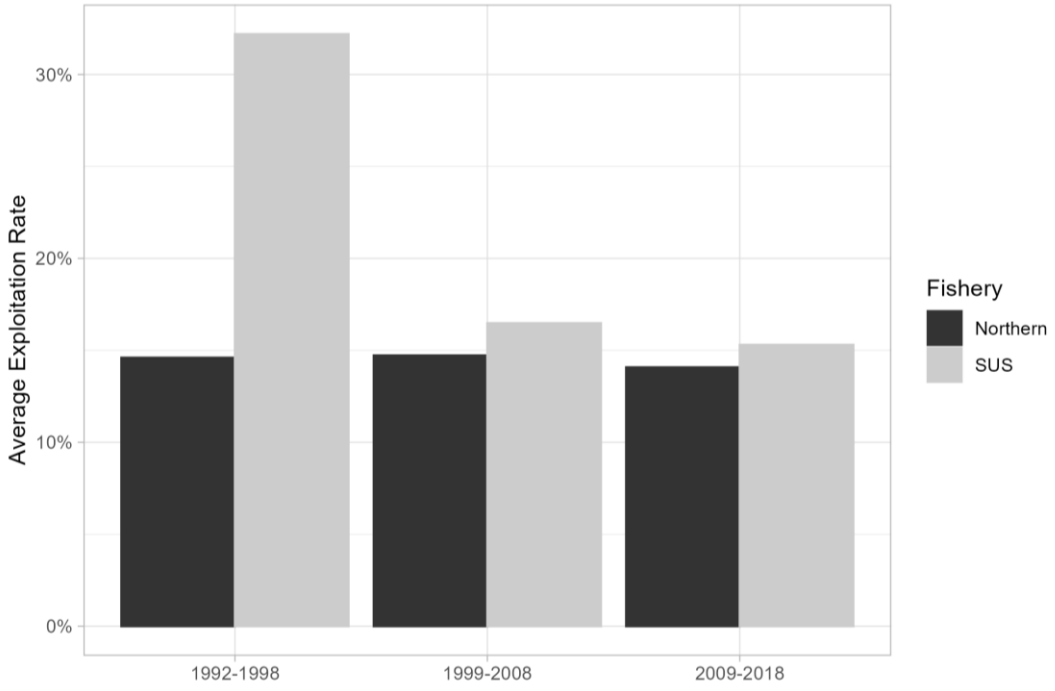
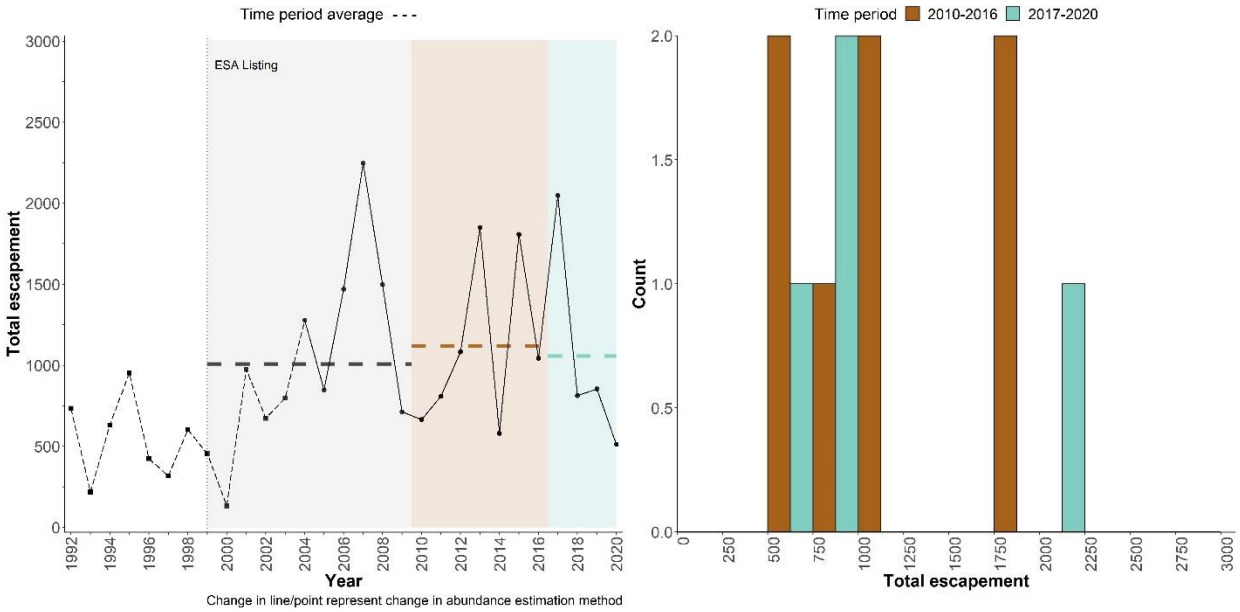


Figure 50. Average exploitation rates on the Lake Washington MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

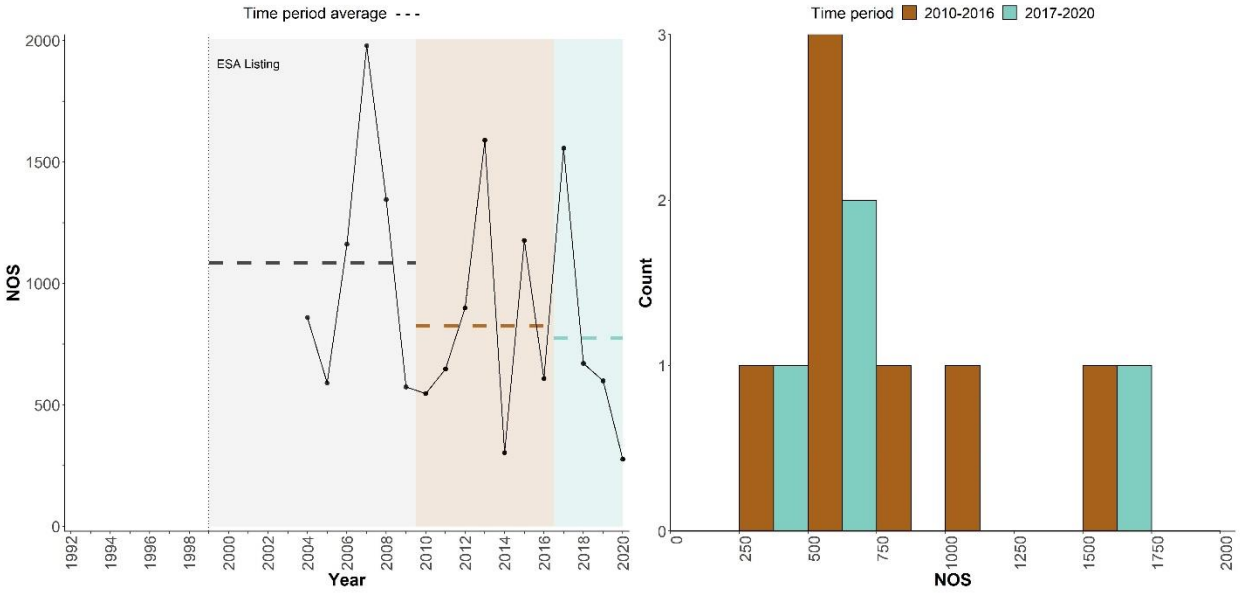


Figure 51. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Cedar population. Spawner estimation method changed beginning in 2004; estimates from before and after that date may not be comparable.

13.3. Green

Synopsis:

NMFS Tier Designation:

Green: 2

Fishery Exploitation Rates

NMFS RER: 0.17
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 61% (2009-2018)
Average Total Exploitation Rate: 0.36 (2009-2018)
Average SUS Exploitation Rate: 0.22 (2009-2018)

Average Spawners (2017-2020)

Green Total Spawners: 5,631
Green Natural-Origin Spawners: 1,884

The Green MU is one of two historical populations in the Central/South Sound MPG that has not been extirpated (the other being the White River). This is likely due to the presence of the Soos Creek Hatchery, which has provided an ongoing boost to spawners in this heavily degraded basin. More than 68% of the historical basin area was lost when the Cedar River (to Lake Washington) and White River (to the Puyallup River) were diverted, 98% of the historical marsh and intertidal areas have been replaced by commercial and industrial development, and the Howard Hanson Dam was constructed by the Army Corps of Engineers without fish passage facilities (see Muckleshoot Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions).

The updated conservation plan (WRIA 9 2021) identifies the following eight priority habitat strategies:

Strategy 1: Restore and Improve Fish Passage (all subwatersheds). Fish passage barriers block access to important spawning and rearing habitat and can exacerbate localized flooding issues. Legacy transportation and flood control infrastructure were not regularly designed for fish passage and/or elevated flood flows associated with climate change.

Strategy 2: Protect, Restore and Enhance Floodplain Connectivity (Lower and Middle Green River). The process of channel migration within the floodplain creates side channels, back-water sloughs, and other off-channel habitats that are critical for juvenile salmon rearing and refuge. Floodplains also facilitate an exchange of nutrients and organic material between land and water, and provide important flood storage capacity that can mitigate flood damages to adjacent communities.

Strategy 3: Protect, Restore, and Enhance Channel Complexity and Edge Habitat (Lower, Upper, and Middle Green River). Flood protection facilities (e.g., Howard Hanson Dam, revetments, and levees) and loss of riparian habitat have disrupted sediment transport, simplified habitat complexity, contributed to a loss of rearing and refuge habitat, and impeded natural recruitment of spawning gravels. Although process based restoration is preferred, ongoing intervention is necessary to replace/mimic natural processes where they cannot be restored.

Strategy 4: **Protect, Restore, and Enhance Riparian Corridors (all subwatersheds)**. Healthy riparian corridors provide a critical role in providing cool and clean water for salmon. Riparian vegetation

shades instream habitat and moderates water temperatures; reduces erosion by stabilizing streambanks; captures rainwater and filters sediment and stormwater pollutants; provides terrestrial nutrient and food inputs; and is a source of large wood, which is critical to habitat complexity.

Strategy 5: Protect, Restore, and Enhance Sediment and Water Quality (all subwatersheds). Clean, cold water is essential for salmon growth and survival. A growing body of evidence suggests cleanup of legacy industrial contamination and stormwater pollution control may improve early marine survival and increase Chinook productivity. Recent scientific literature suggests contaminant exposure pathways (e.g., legacy industrial contamination, stormwater runoff, municipal wastewater discharges, etc.) are having sublethal and lethal impacts on juvenile Chinook Salmon.

Strategy 6: Protect, Restore and Enhance Marine Shorelines (marine nearshore areas). Marine nearshore habitats, including beaches, pocket estuaries, eelgrass beds, inlets, and deltas, provide important rearing and migration habitat for juvenile Chinook Salmon and many other animals in Puget Sound. They are also critical spawning habitat for forage fish – a key prey species for Chinook Salmon.

Strategy 7: Protect, Restore and Enhance Estuarine Habitat (Duwamish River). The Duwamish estuary provides critical rearing habitat for juvenile salmon as they make the physiological transition from fresh to saltwater habitats. Industrial development within the Duwamish valley drove extensive fill of tidal wetlands, armoring of shorelines, and navigational dredging. The modifications straightened the estuary and eliminated 98 percent of the historic wetlands.

Strategy 8: Protect, Restore and Enhance Instream Flows and Cold Water Refugia (Lower, Middle, and Upper Green River). Green River flows are regulated to support both flood control and water supply needs. The Tacoma Water Habitat Conservation Plan requires maintenance of minimum instream flows during summer months. Although water capture and storage behind Howard Hanson Dam (HHD) support maintenance of minimum instream flows and periodic flow augmentations during summer and early fall, it can also reduce the frequency of high flow events that drive lateral channel migration (i.e., habitat forming flows) and availability of juvenile Chinook rearing habitat throughout spring.

The total fishery exploitation rate on the Green MU averaged 0.36 from 2009-2018 (Figure 52). Most (61%) of the fishery mortality occurs in SUS fisheries (Figure 53), where the exploitation rate averaged 0.22 from 2009-2018.

The total number of spawners, and natural-origin spawners, has increased since 2009-2011. The average number of spawners from 2017 to 2020 was 5,631, of which 1,884 were estimated to have originated from spawning in the river in the previous generation (Figure 54).

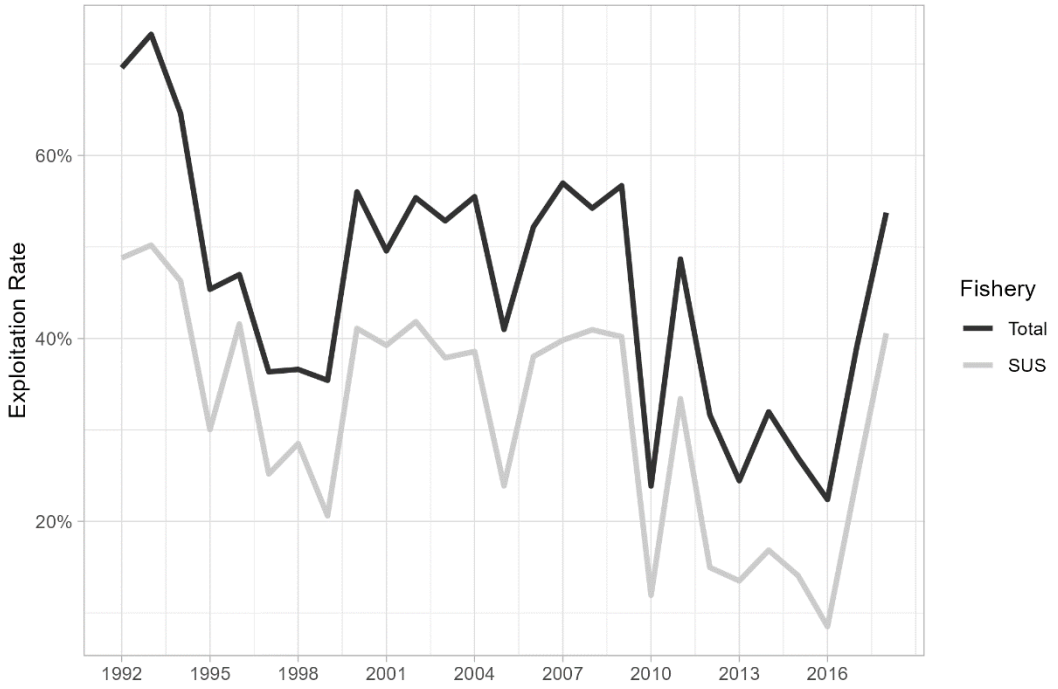


Figure 52. Fishery exploitation rates on the Green MU in all fisheries (Total) and in the SUS, 1992-2018.

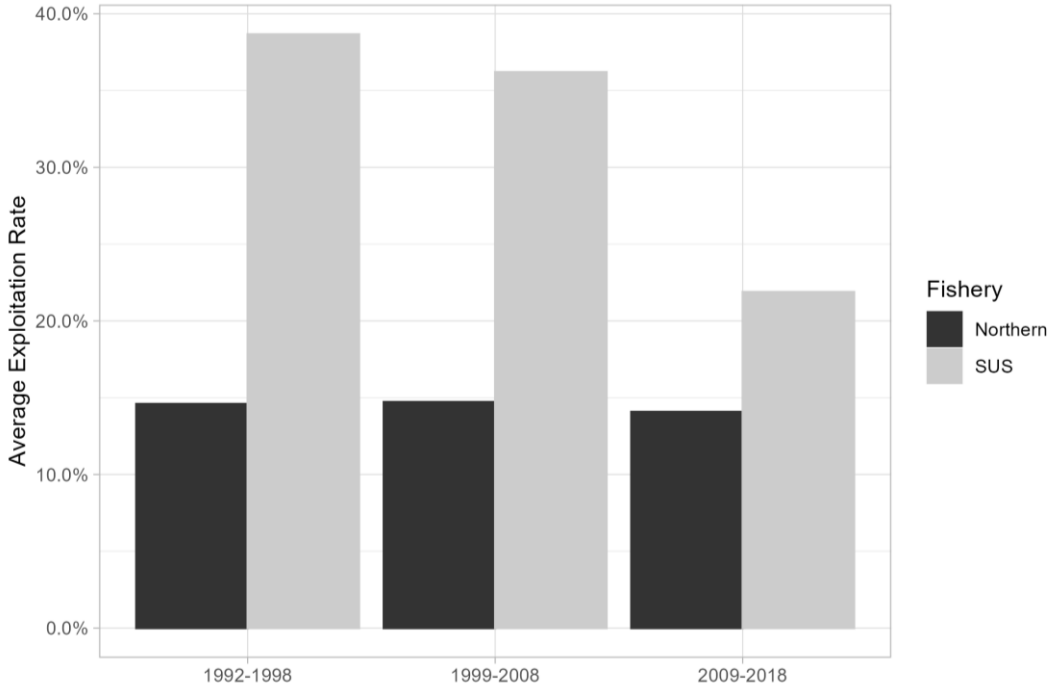
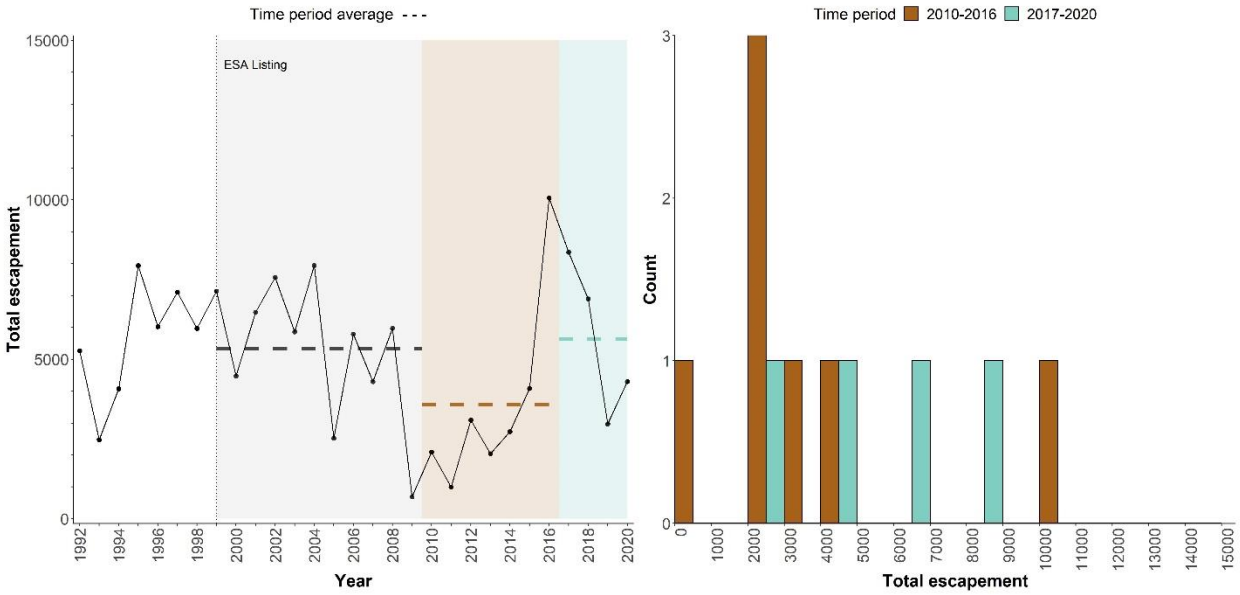


Figure 53. Average exploitation rates on the Green MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

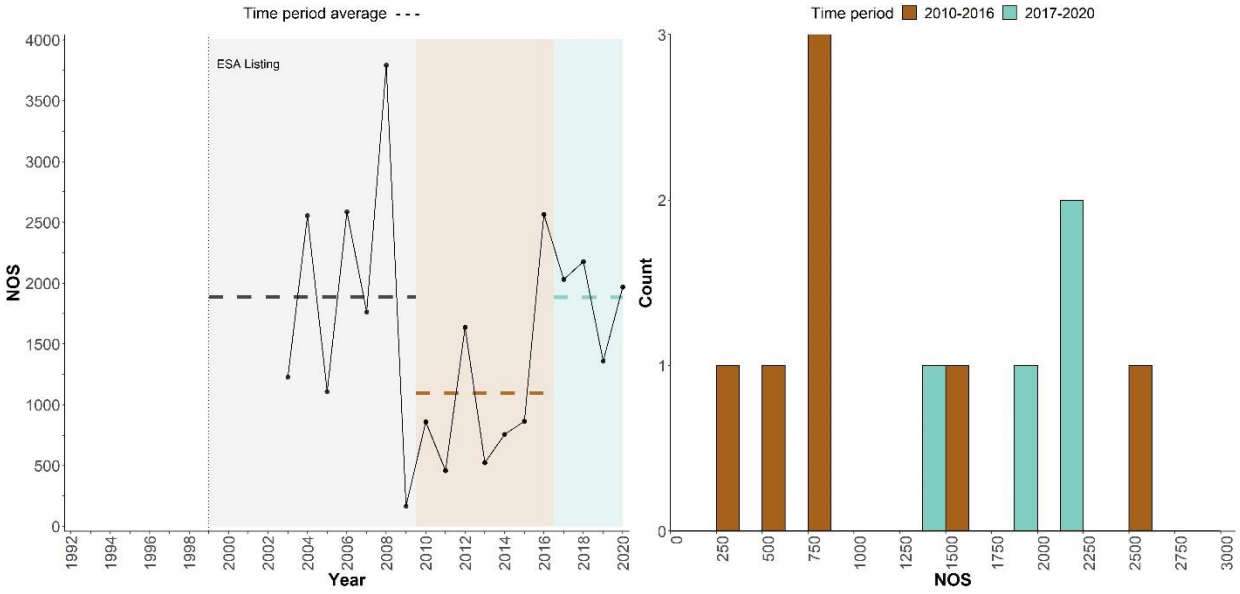


Figure 54. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Green MU.

13.4. Puyallup

***Video*:** South Prairie Creek

Synopsis:

NMFS Tier Designation:

Puyallup: 3

Fishery Exploitation Rates

NMFS RER: not estimated
PST SUS Exploitation Rate Limit: none established
% Fishery Mortality in SUS Fisheries: 70% (2009-2018)
Average Total Exploitation Rate: 0.47 (2009-2018)
Average SUS Exploitation Rate: 0.33 (2009-2018)

Average Spawners (2017-2020)

Puyallup Total Spawners: 1,837
Puyallup Natural-Origin Spawners: 515

Much like the Lake Washington and Green River basins, the productivity of Chinook Salmon in the Puyallup River basin has been substantially reduced by habitat degradation. The mouth of the Puyallup River flows through the City of Tacoma, Washington's third largest city, the size of the estuary has been reduced by 97%, and 96 miles of levees constrain the river channel (SSDC 2006)(see Muckleshoot Tribe and Puyallup Tribe sections of 2020 Watershed Status for a summary of habitat conditions and actions). Although the recovery plan identified a historical Puyallup Chinook Salmon population, it has been extirpated. The remaining Chinook Salmon are of Green River origin, likely introduced and maintained by hatchery programs within the basin. NMFS has designated the Puyallup as a Tier 3 population.

The following habitat protection and restoration strategies have been identified (WRIA 10 & 12 2018):

Strategy 1: Protect Highly Productive Tributary and Mainstem Areas. This includes implementing existing priority plans and developing new studies related to identifying, acquiring, prioritizing, and protecting land throughout the watersheds.

Strategy 2: **Reconnect Mainstem River Channels to Their Floodplains.** This strategy includes levee setbacks, revetment removal, road decommissioning, culvert replacements/improvements in floodplain areas, Engineered Log Jams (ELJs) designed to promote over bank flow (increase bed elevations), and removal of pinch points such as bridge pilings.

Strategy 3: Remove Physical Barriers to Fish Movement and Migration. Includes culvert replacement or removal, bridge replacement or removal, dam upgrades for passage, addressing instream structures impeding flow, flow restoration, modified flow regulation at dams, thermal regime restoration, and modified thermal regime regulation related to flow at dams.

Strategy 4: Restore Habitat in Highly Productive Tributaries and Mainstem Areas. This includes the following (other restoration methods may be identified): riparian restoration; in-channel ELJs and debris fencing; side channel and off-channel habitat restoration including enhancement for spawning and rearing; redirecting stream channels to their historic location; and large wood and nutrient enhancement.

Strategy 5: Restore and Maintain Hydrologic Regime. This includes considering all activities that influence the hydrologic regime, including land management, impervious surfaces, stormwater management, dam regulation, preventing conversion of and protecting forest lands, creating a Community Forest Program.

Strategy 6: Restore Estuarine Habitats. This includes identifying and prioritizing areas for restoration throughout the estuarine area, in the Lower Watershed, from the confluence of Clarks Creek to the mouth of the Puyallup River.

Strategy 7. Restore Nearshore Areas. This includes identifying and prioritizing areas for restoration along the nearshore zone of the watersheds.

Strategy 8: Coordinate Regulatory and Incentive Programs. This includes working with regulatory agencies in the watershed to ensure that existing rules, regulations, permits, enforcement, and frameworks are coordinated with salmon.

Strategy 9: Develop and Implement Salmon-Safe Farming Practices. This includes coordinating with the agricultural community, Stewardship Partners, and other groups to develop and implement salmon-safe farming practices and identify buffer areas available for restoration and protection.

Strategy 10: Conduct Outreach and Education. This includes developing, implementing, and supporting outreach and education to stakeholders, including the public, throughout the watersheds, including coordinating with the Environmental Education Community of Interest in the Puyallup Watershed.

Strategy 11: Improve Water Quality. This includes working with stakeholders, including the public, and regulatory agencies in the watersheds to improve water quality and address impacts to salmon related to stormwater runoff and other non-point pollution sources.

The total fishery exploitation rate has averaged 0.47 (Figure 59) and most (70%) of the mortality occurs in SUS fisheries (Figure 60).

The average escapement of the Puyallup MU from 2017-2020 was 1,837, of which 515 originated from Chinook Salmon spawning in the river in the previous generation (Figure 58).

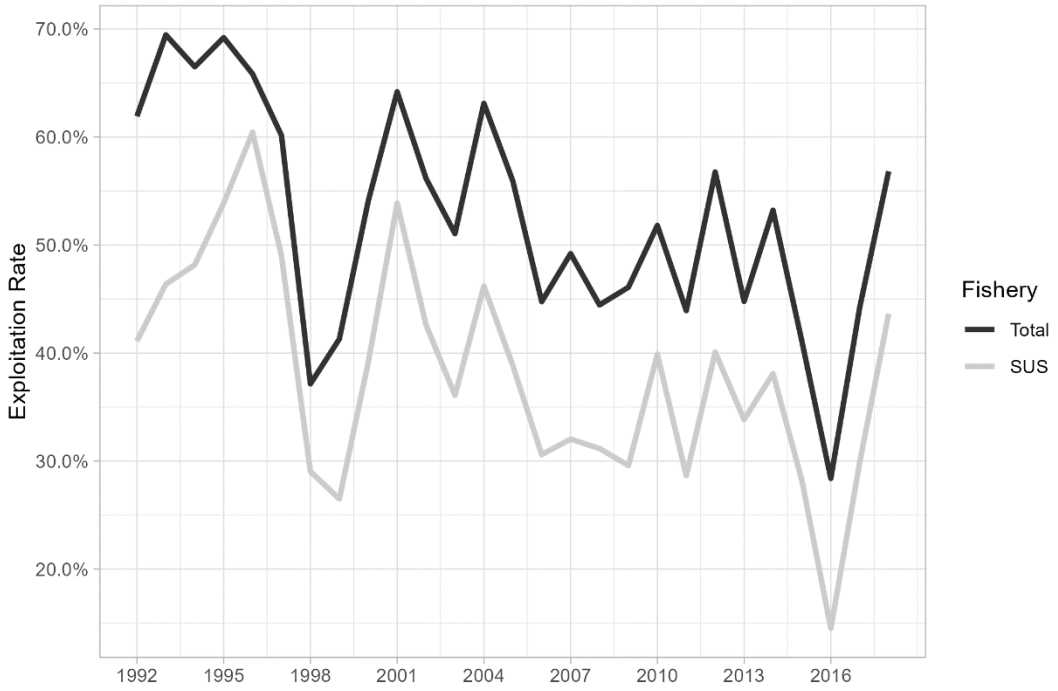


Figure 55. Fishery exploitation rates on the Puyallup MU in all fisheries (Total) and in the SUS, 1992-2018.

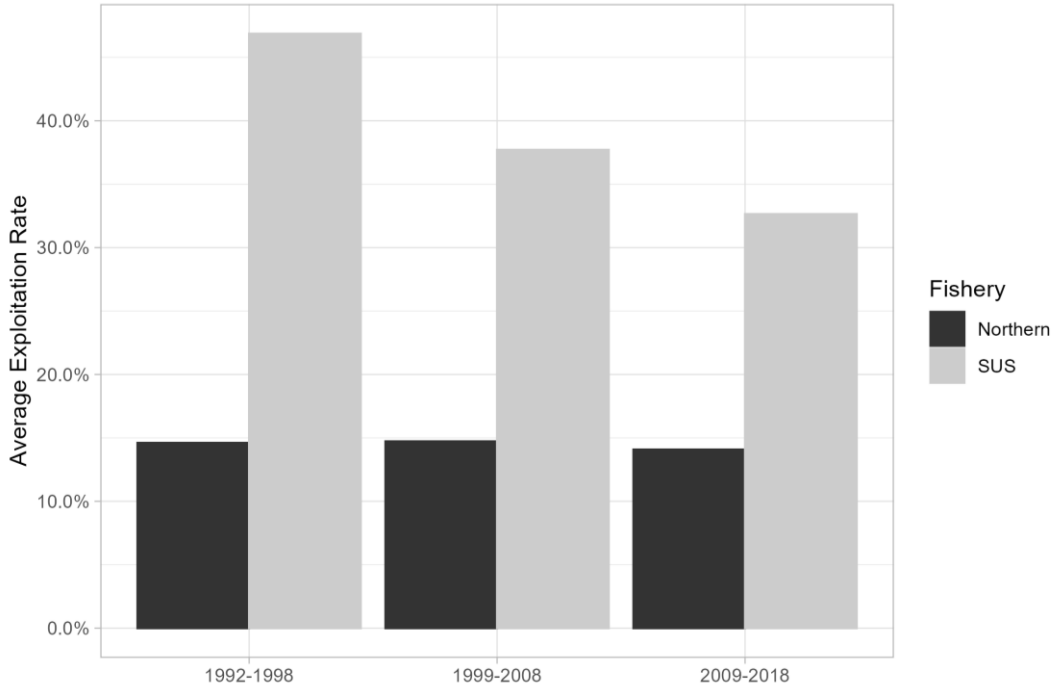
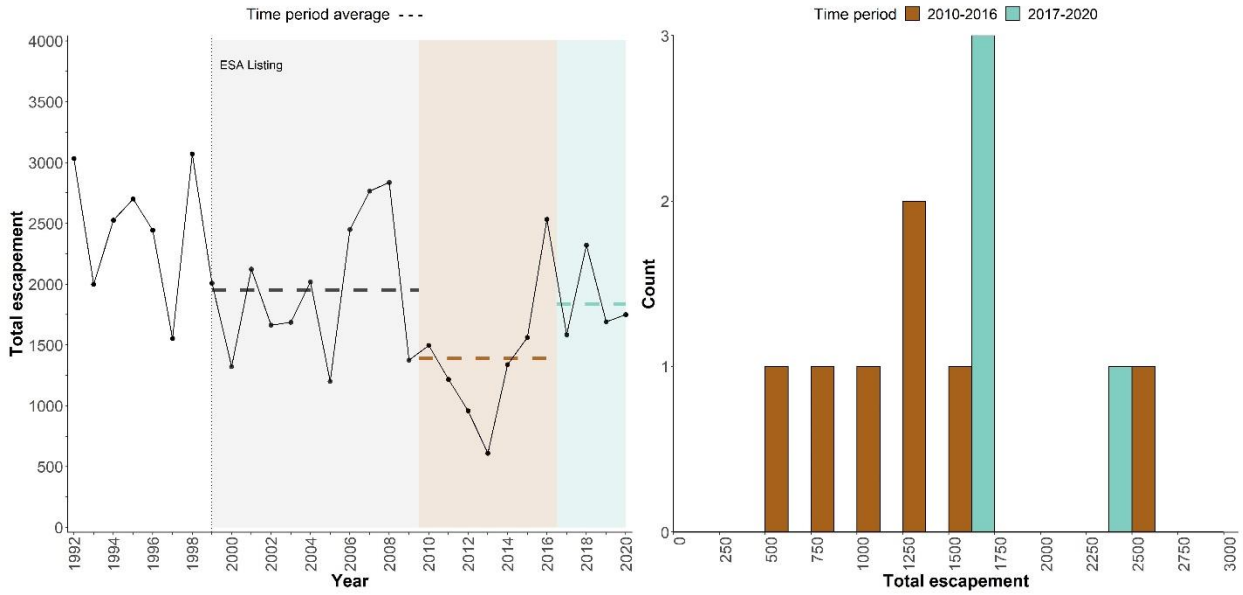


Figure 56. Average exploitation rates on the Puyallup MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

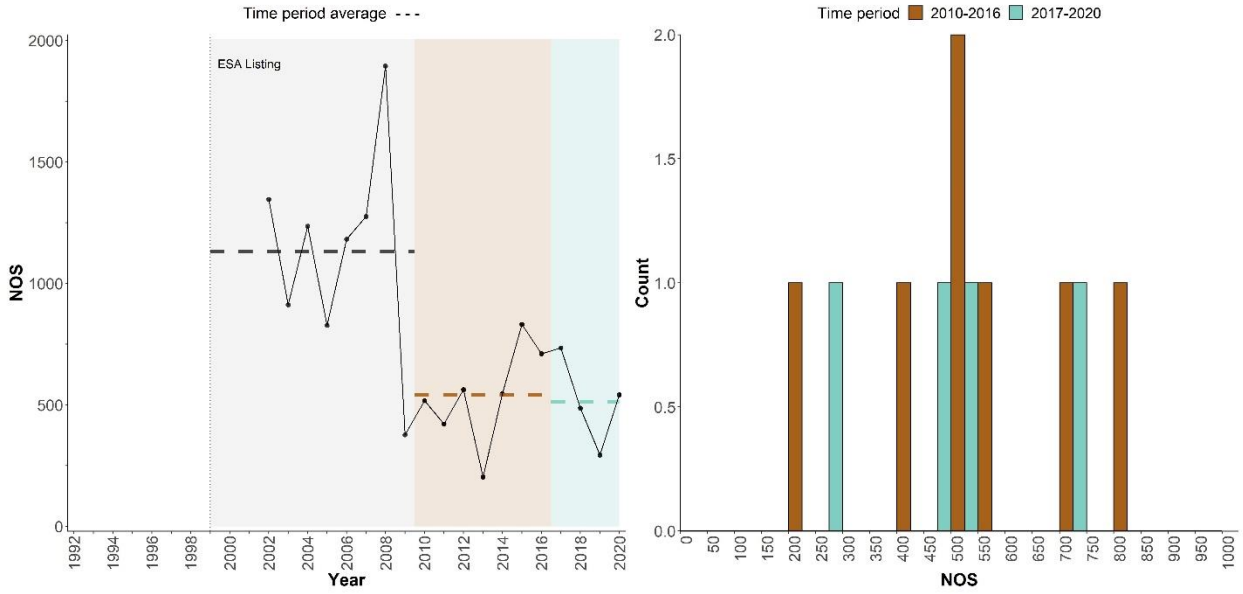


Figure 57. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Puyallup MU.

13.5. White

Synopsis:

NMFS Tier Designation:

Puyallup: 1

Fishery Exploitation Rates

NMFS RER: not estimated

PST SUS Exploitation Rate Limit: none established

% Fishery Mortality in SUS Fisheries: 74% (2009-2018)

Average Total Exploitation Rate: 0.24 (2009-2018)

Average SUS Exploitation Rate: 0.18 (2009-2018)

Average Spawners (2017-2020)

Total Passed Upstream at Mud Mountain Dam: 1,943

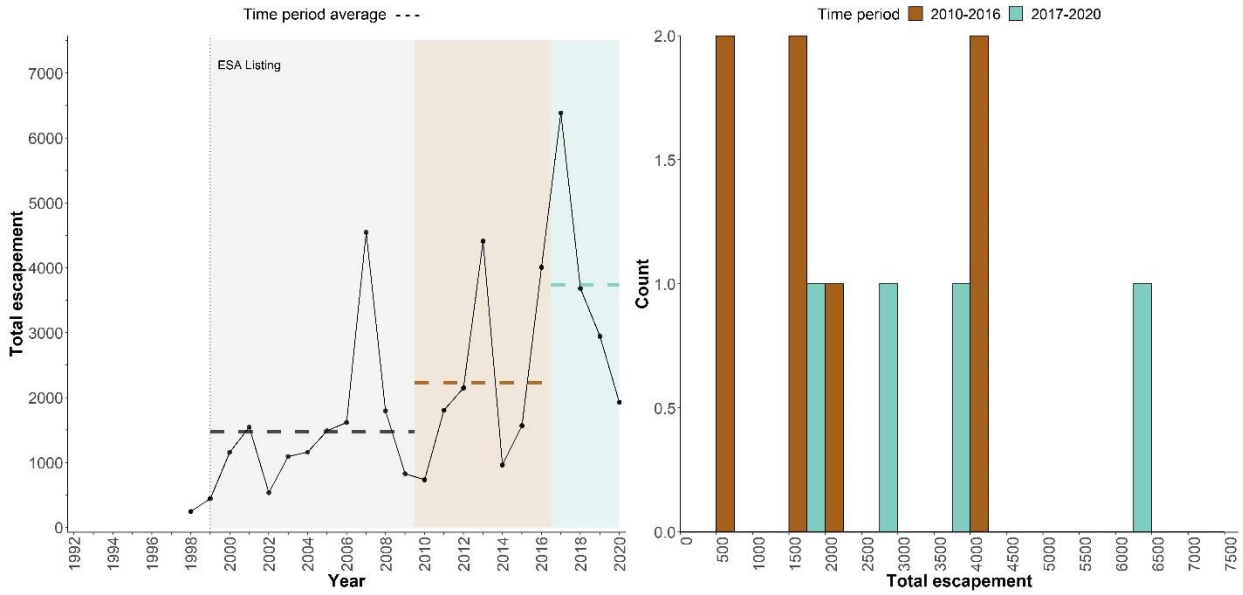
Natural-Origin Passed Upstream at Mud Mountain Dam: 497

The White is a genetically unique, early-timed Chinook population that has been brought back from the verge of extirpation through the combined efforts of the Muckleshoot Indian Tribe, Puyallup Tribe, WDFW, and NMFS. Declining returns led to the initiation of two hatchery conservation programs in 1977. Although returns averaged less than 20 fish per year from 1982-1985, the hatchery programs eventually proved to be successful in conserving and rebuilding this unique population (Shaklee and Young 2003). From 2017-2020, an average of 1,943 Chinook Salmon from the White MU were passed upstream at the Mud Mountain Dam, 497 of which were progeny of Chinook Salmon that spawned in the river during the previous cycle (Figure 58Figure 58).

The ongoing rebuilding of the White MU has occurred amid the extensive habitat degradation in the Puyallup River basin (see previous section), diversion of water to Lake Tapps, and mortalities of Chinook Salmon at the trap used to collect and transport Chinook Salmon upstream (NWIFC 2020).

Total fishery exploitation rates on the White MU averaged 0.24 from 2009-2018 (Figure 59) with 74% of the fishery mortality occurring in SUS fisheries (Figure 60). The fishery exploitation rate in SUS fisheries averaged 0.18 from 2009 through 2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

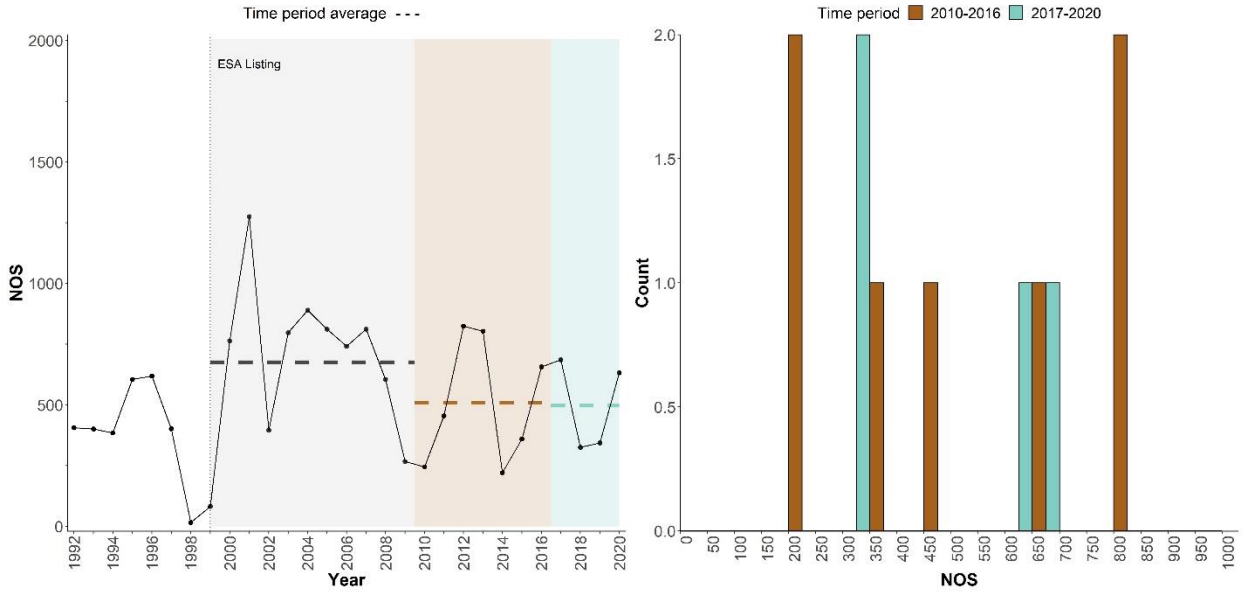


Figure 58. Estimated total (Panel A) and natural-origin (Panel B) Chinook Salmon for the White MU at passed upstream of Mud Mountain Dam.

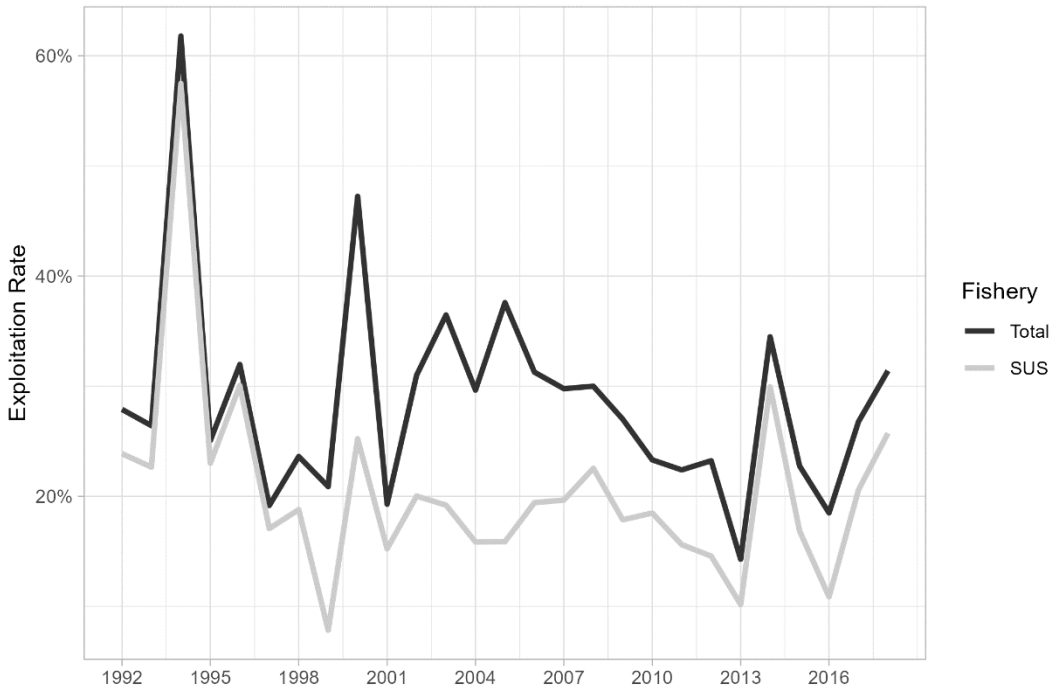


Figure 59. Fishery exploitation rates on the White MU in all fisheries (Total) and in the SUS, 1992-2018.

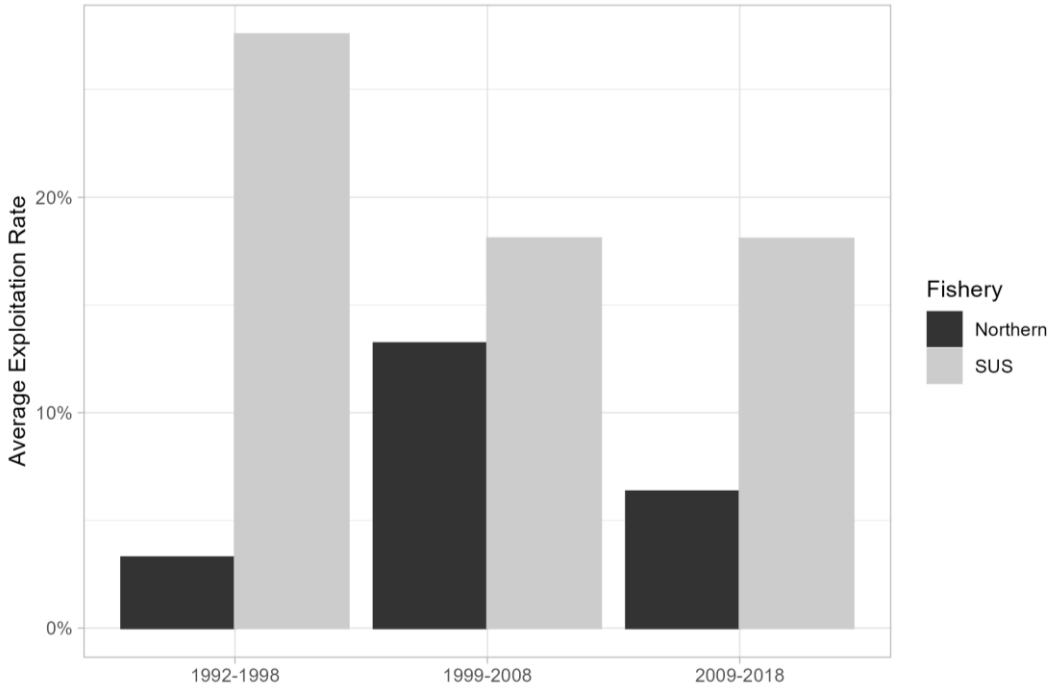


Figure 60. Average exploitation rates on the White MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

13.6. Nisqually

***Video*:** Nisqually Estuary, Mashel River

Synopsis:

NMFS Tier Designation:

Nisqually: 1

Fishery Exploitation Rates

NMFS RER: not estimated
% Fishery Mortality in SUS Fisheries: 81% (2009-2018)
Average Total Exploitation Rate: 0.52 (2009-2018)
Average SUS Exploitation Rate: 0.42 (2009-2018)

Average Spawners (2017-2020)

Total Spawners: 2,166
Natural-Origin Spawners: 676

The historical population of Chinook Salmon that existed in the Nisqually River has been extirpated due to habitat loss, hatchery introductions, and high harvest rates (SSDC 2006). However, NMFS categorized the Nisqually population as Tier 1 due to the extensive habitat protection and restoration efforts that are occurring in the Nisqually River basin, resulting in one of the least developed and most pristine major rivers in Washington State (see Nisqually Tribe section of 2020 Watershed Status for a summary of habitat conditions and actions).

Habitat protection and restoration priorities in include the following (NWIFC 2020):

1) Seek planning and construction funding to complete NEPA process for complete reconfiguration of I-5 across the Nisqually Delta and begin construction within 6 years.
2) Work on crafting a long-term management plan for the delta under a new I-5 configuration and the opportunity for significant restoration work.
3) Develop plans for addressing substantial impacts to the habitat-forming processes in the delta, especially magnitude and delivery mechanisms of sediment.
4) Continue research and monitoring in the delta restoration effort.
5) Investigate effects of climate change induced sea level rise and how it will impact delta structure and function if habitat-forming processes are not restored or enhanced.
6) Continue building the size and ecological impact of our Community Forest project.
7) Prepare for upcoming FERC relicensing of the Tacoma projects to better account for climate change, sediment delivery and salmon recovery.
8) Using the I-5 as a case study, continue to advocate for a shift in the current mitigation model to one aligned with improving the environmental baseline as a deliverable for publicly funded projects.

Total fishery exploitation rates exceeded 0.75 in the early 1990s but were reduced to an average of 0.52 from 2009-2018 (Figure 61). Over 80% of the fishery mortality occurs in SUS fisheries (Figure 62). From 2017 through 2020, an average of 2,166 Chinook Salmon spawned in the Nisqually River, of which 676 originated from spawning in the river in the previous generation (Figure 63).

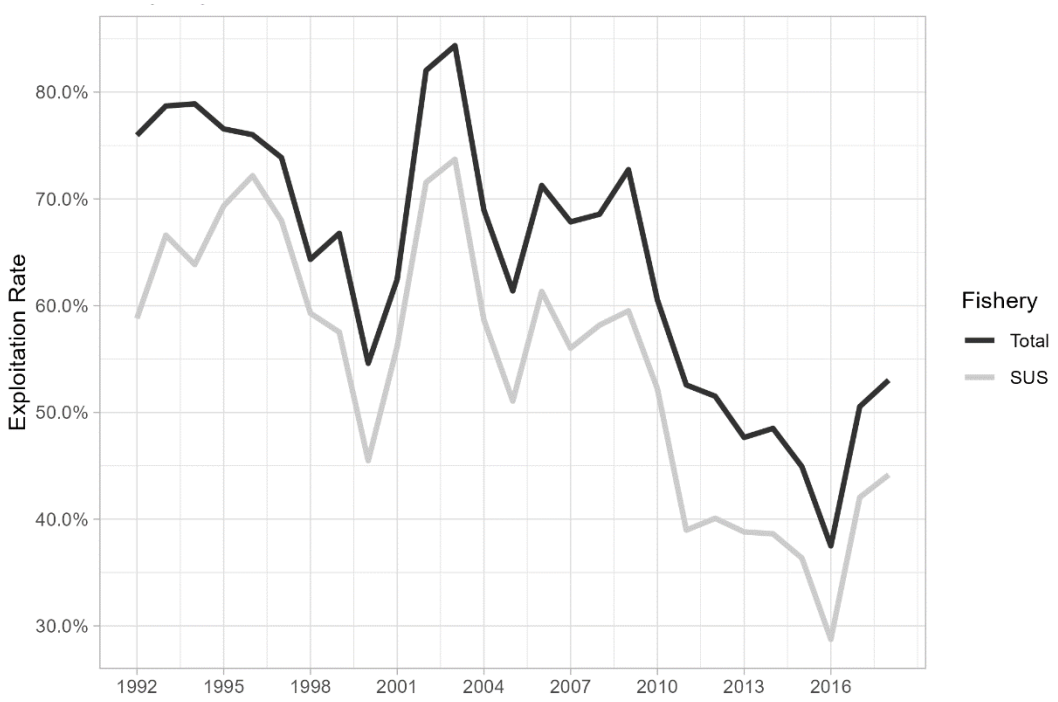


Figure 61. Fishery exploitation rates on the Nisqually MU in all fisheries (Total) and in the SUS, 1992-2018.

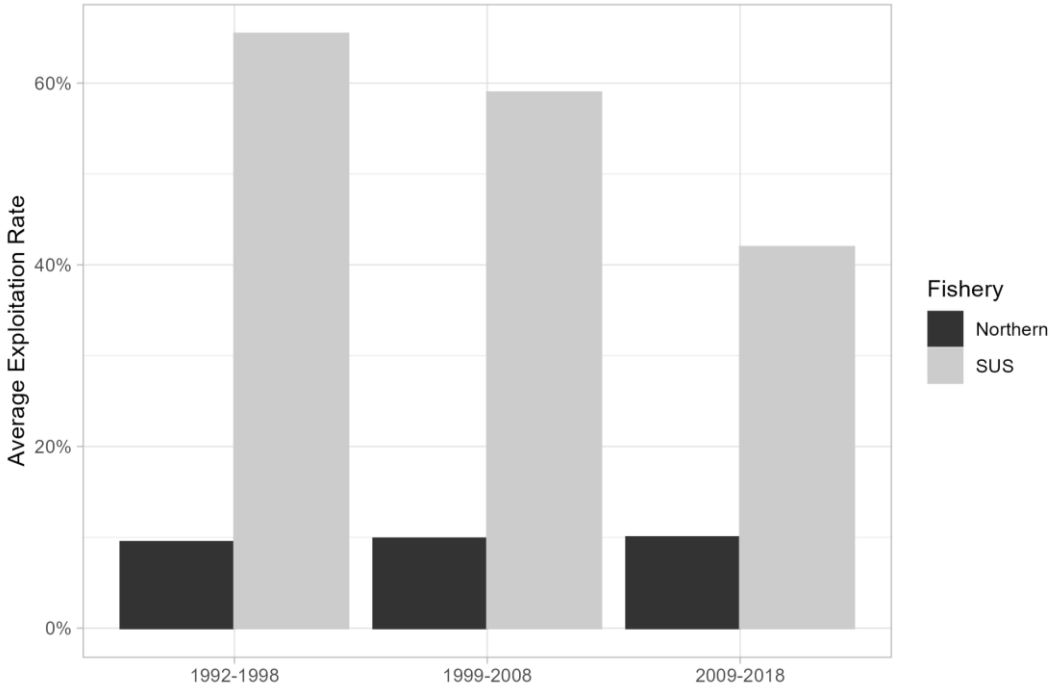
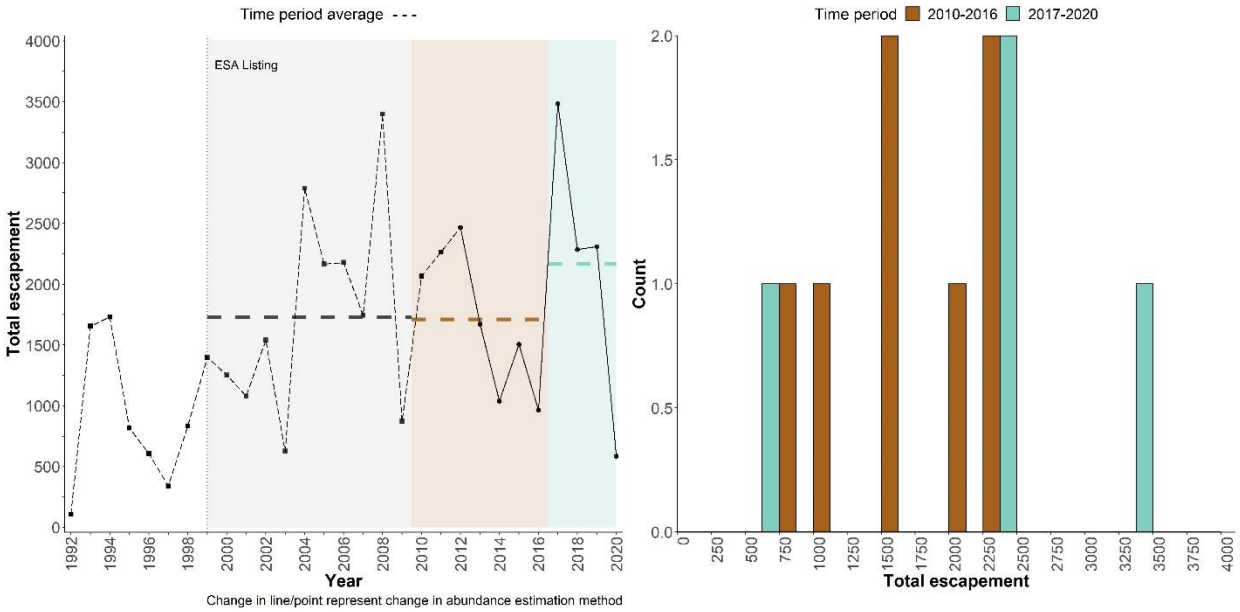


Figure 62. Average exploitation rates on the Nisqually MU in Northern (Canada and Southeast Alaska) and SUS fisheries in 1992-1998, 1999-2008, and 2009-2018.

Panel A. Total (Natural- and Hatchery-Origin) Spawners



Panel B. Natural Origin Spawners

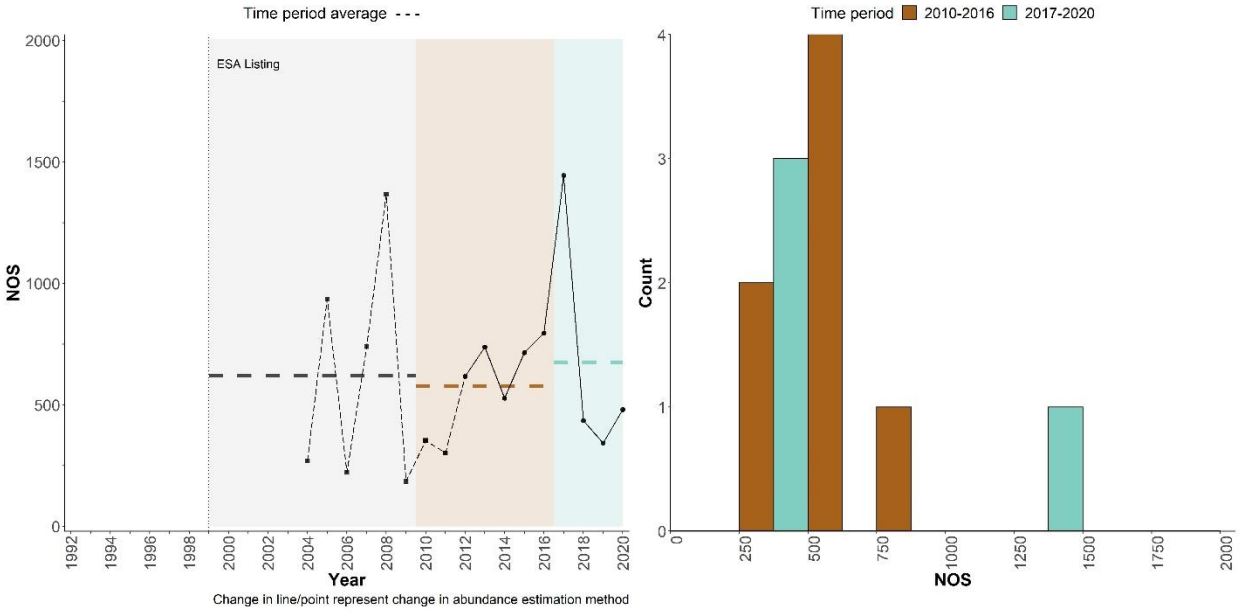


Figure 63. Total spawners (Panel A) and natural-origin spawners (Panel B) for the Nisqually MU. Spawner estimation method changed beginning in 2012; estimates from before and after that date may not be comparable. Estimates for 2017-2019 include Chinook Salmon released from the hatchery to the Nisqually River.

Chapter 14. Southern Resident Killer Whales

Key Points:

1) SRKW will be an important consideration in the development of the RMP due to their reliance on Chinook Salmon for prey.
2) SRKW were listed as an endangered species in 2005. The number of SRKW has declined since 1995 and, as of August 2021, is 74 individuals.
3) The Southern Resident Orca Task Force identified four broad strategies in 2019 to recover SRKW: 1) increasing Chinook Salmon abundance;2) decreasing disturbance via vessels and noise; 3) reducing the exposure of SRKW and their prey to contaminants; and 4) ensuring that funding, information, and accountability systems are in place to support effective implementation.
4) In 2021 the PFMC adopted an amendment to the Pacific Coast Salmon Management Plan to address the effect of Council-area fisheries on SRKW. In years when Chinook Salmon abundance is predicted to be below a threshold level, a number of management actions intended to reduce potential effects of fisheries will be implemented through annual regulations. Those actions include additional limits to quotas North of Cape Falcon as well as area fishery closures in times and places that may be important to SRKW.

"With only 73 individuals remaining, there is no time to waste — the road to sustained Southern Resident recovery is through swift, bold and impactful solutions."

Dr. Les Purce and Stephanie Solien
Southern Resident Orca Task Force
November, 2019

SRKW will be an important consideration in the development of the RMP due to their reliance on Chinook Salmon for prey.

14.1. Introduction

Southern Resident Killer Whales (SRKW) are one of three ecotypes of killer whale found in Washington's coastal waters and are the only population of killer whales designated as endangered by NMFS. SRKW will be an important consideration in the development of the RMP due to their reliance on Chinook Salmon for prey, and the potential for fisheries to reduce the number of Chinook Salmon. Noise and disturbance from vessels, including fishing boats, has also been identified as a concern.

14.2. Biology

SRKW populations have fluctuated in recent decades, with the lowest recorded abundance of 68 individuals in the early 1970s (Figure 64) being caused by removals from the wild for aquaria display in preceding decades. Populations increased from the

early 1970s to 1995, peaking at 98 individuals. However, since 1995, SRKW have experienced a decreasing population trend with 74 living individuals recorded as of August 2021. SRKW population trends have garnered increasing concern as demographic modeling exercises suggest populations are likely to continue to decrease in the near future (NMFS 2016).

There are three recognized pods of SRKW (J, K, and L) that differ in spatial distribution and habitat usage. All three pods utilize the Salish Sea in the summer period (May through September; Olson et al. 2018), with most time typically spent around the San Juan Islands and the Strait of Juan de Fuca. Early winter (October through December) distributions vary annually, with most days being spent off the coast of Washington or in Puget Sound. In the late winter (January through April), K and L-pods typically use coastal areas near the mouth of the Columbia, Grays Harbor, and Neah Bay and can travel as far south as central California in some years (Hanson et al. 2018). However, J-pod tends to remain in the Salish Sea, distributing between Neah Bay and North Texada Island (Hanson et al. 2017).

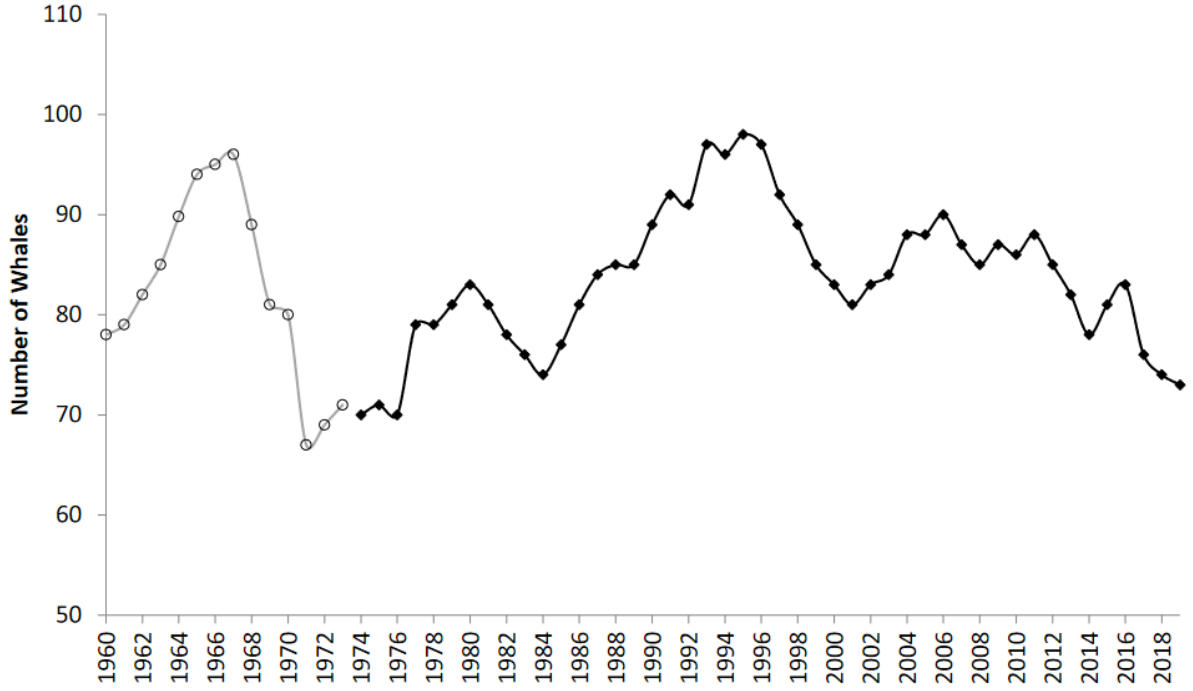


Figure 64. Population size and trend of Southern Resident killer whales, 1960-2019.
Data from 1960-1973 (open circles, gray line) are number projections from the matrix model of Olesiuk et al. (1990). Data from 1974-2019 (diamonds, black line) were obtained through photo-identification surveys of the three pods (J, K, and L) in this community and were provided by the Center for Whale Research (unpublished data) and NMFS. Data for these years represent the number of whales present at the end of each calendar year. Figure originally prepared for and presented in PFMC 2020a.

SRKW are piscivorous and what they eat can vary throughout the year and the foraging location (Hanson et al. 2021). Seasonally, Coho (September and October) and Chum (October through February) salmon comprise large percentages of the SRKW diet, and other species (lingcod, steelhead, rays, and flatfish) are consumed occasionally (Hanson et al. 2021). However, Chinook Salmon are the primary source of

nutrition for SRKW ranging from comprising an estimated 40% of the diet in the winter to greater than 90% of the diet during the summer. SRKW consumption of specific Chinook stocks can vary spatially and temporally , with summer diets (San Juan Islands and Juan de Fuca) being comprised primarily of Fraser stocks (Hanson et al. 2010), early winter diets (Puget Sound) being comprised primarily of Puget Sound stocks (Hanson et al. 2021), and late winter/spring diets (coastal) being comprised primarily of Columbia River stocks (Hanson et al. 2021).

Photogrammetry studies have suggested that decreasing body condition, indicated by lean appearance, is associated with higher risk of mortality (Fearnbach et al. 2018). Additionally, SRKW total body size has decreased in recent decades, which some studies have suggested may be indicative of nutritional stress (Fearnbach et al. 2011; Groskreutz et al. 2019).

14.3. Southern Resident Orca Task Force

Governor Jay Inslee established the Southern Resident Orca Task Force in March 2018 via Executive Order 18-2, appointing approximately 50 representatives from a diverse array of backgrounds to the Task Force. The primary goal of the Task Force was to identify and recommend actions to support SRKW recovery. In the Year One Report produced by the Task Force, four broad strategies were identified to recover SRKW, including: 1) increasing Chinook Salmon abundance; 2) decreasing disturbance via vessels and noise; 3) reducing the exposure of SRKW and their prey to contaminants; and 4) ensuring that funding, information, and accountability systems are in place to support effective implementation.

The Final Report produced by the Task Force assessed progress and actions resulting from the Year One report and identified two additional threats to the recovery of SRKW, climate change and human population growth. $1.1 billion was allocated in the 2019-21 biennial budget to support recommendations by the task force and a full list of past, current, and future recommendations of the Task Force is available in the Final Report. In brief, a few key actions implemented by the Task Force include:

- Increasing hatchery production by 26.8 million smolts annually.
- $40 million allocated to make capital improvements to state hatcheries.
- $458 million allocated to salmon restoration programs.
- Increased bag limits on several species of predatory fish species that consume salmon.
- Congress passed the federal Endangered Salmon Predation Prevention Act (PL 115-329), allowing greater flexibility to manage sea lion impacts on salmon in the Columbia River.
- $275 million was allocated to the Washington Department of Transport to correct and/or remove fish passage barriers.
- $141 million was allocated to clean up toxic sites and contaminants that may impact SRKW.

14.4. Pacific Salmon Treaty

As discussed in Chapter 6, the Pacific Salmon Treaty (PST) provides a framework for the two countries to cooperate on the management, research, and enhancement of Pacific salmon. The 2019-2028 update to the agreement includes harvest reductions of up to 15% in Oregon and Washington (relative to 2009-2015 exploitation rates), 12.5% in British Columbia (relative to 2009-2015 exploitation rates), and 7.5% in southeast Alaska (relative to 2009-2018 quotas). While intended to address conservation concerns for

Chinook Salmon, the reductions are also anticipated to increase the number of Chinook Salmon available as prey for SRKW.

The biological opinion associated with the updated to the PST (NMFS 2019c) identified a funding initiative to further increase prey:

> "…the third element of the funding initiative was specifically designed to increase the production of hatchery Chinook salmon to provide an immediate and meaningful increase in prey availability for SRKWs. A preliminary design of the SRKW hatchery production program was developed, and is described below, in order to provide cost estimates and further definition for how the program should be designed and implemented to achieve the "meaningful increase" in prey availability that is intended. The preliminary design should be used as a benchmark for evaluating the program that will presumably be funded and implemented. However, there is flexibility to adjust the design to account for new information so long as the key objective of the program is met. By key objective we focus in particular on the intention to increase prey availability by 4-5 percent in areas that are most important to SRKWs as described below.
>
> "The new production should be distributed broadly to supplement prey abundance in Puget Sound in the summer and offshore areas in the winter, times and areas that have been identified as most limiting. The hatchery production program would operate each year at a cost of no less than $5.6 million per year including an adjustment for administrative overhead. The goal of the hatchery production initiative for supplementing prey abundance is to provide a "meaningful" increase in the abundance of age 3-5 Chinook salmon in the times and areas most important to SRKWs. It would be prioritized to increase abundance in inside areas (Puget Sound) in the summer and outside areas (coastal) during the winter where we believe prey abundance is most limiting (Dygert et al. 2018). For the estimated cost per year an additional 20 million Chinook salmon smolts could be expected. Five or six million smolts should come from facilities in Puget Sound with the remainder from the Washington coast and Columbia River. This disproportionate distribution results from the fact that the abundance of Chinook salmon in the ocean is about three times higher than it is in the Puget Sound. Increasing production by 20 million smolts with the above described distribution is expected to increase prey abundance by 4-5 percent in inside areas in the summer and coastal areas in the winter (Dygert et al. 2018)."

The U.S. Commissioners allocated $5.6 million of the PST federal appropriation for FY20, and $7.35 million for FY21, to implement this initiative. As a result of the FY20 PST funds, 750,000 hatchery-origin Chinook Salmon were released in 2020, 8.25 million are expected to be released in 2021, and 3.9 million Chinook Salmon are expected to be released in 2022 (NMFS 2021b). Release numbers associated with the FY21 funding are not yet available.

14.5. PFMC Management Action

Given the decreasing population status of SRKW, potential spatial-temporal overlap with salmon fisheries, and high dietary reliance on Chinook Salmon, the PFMC established the Southern Resident Killer Whale Workgroup in 2019 to evaluate the impacts of coastal Chinook Salmon fisheries on SRKW. The workgroup included representatives of NMFS, PFMC, Washington coastal treaty tribes, and state fish and wildlife agencies from Washington, Oregon, California and Idaho. The workgroup built on existing knowledge of whale and Chinook Salmon abundance and distribution to develop new modeling tools for evaluation of

relationships between SRKW demography and indices of regional Chinook abundance. The workgroup undertook that work through a number of public meetings in 2019 and 2020, with periodic progress reports provided to PFMC throughout that time.

Two primary documents were produced by the workgroup. The first was a risk assessment document that provides background on PFMC fisheries and SRKW, and presents the modeling and analysis approach that was developed by the workgroup and used to evaluate potential times and areas where Chinook Salmon abundance (and corresponding fishery removals) could potentially affect SRKW population demographics (PFMC 2020a)

The second document presented a range of management alternatives and recommendations that were developed for the Council's consideration (PFMC 2020b). Although no strong statistical links between Chinook Salmon abundance and SRWK demographics were found in the risk assessment, the workgroup recommended measures designed to be precautionary and conservative in years of low Chinook Salmon abundance given observed trends in SRKW populations.

In November 2020, the PFMC adopted a final preferred alternative to address the effect of Council-area fisheries on SRKW (available at PFMC SRKW Decision). This alternative included a management threshold for Chinook abundance in the area North of Cape Falcon. In years when abundance is predicted to be below that threshold, a number of management actions intended to reduce potential effects of fisheries will be implemented through annual regulations. Those actions include additional limits to quotas North of Cape Falcon as well as area fishery closures in times and places that may be important to SRKW. These actions are under review by NMFS and are being incorporated into PFMC's Pacific Coast Salmon Management Plan.

14.6. WDFW Actions

As the status of SRKW is considered in the Puget Sound Chinook Salmon RMP, WDFW intends to use previous technical work conducted by the Southern Resident Killer Whale Workgroup to guide analyses and potential management actions in Puget Sound. In addition to evaluating potential management actions, Washington State is engaged in several initiatives unrelated to fishery management designed to improve the status of SRKW, including the following:

1) WDFW has implemented the commercial whale watching license program and adopted rules for commercial viewing of SRKW, as recommended by Governor Inslee's Orca Task Force. The rules adopted in December 2020 were designed to increase the number of SRKW foraging hours without commercial whale watching vessel presence. The new rules include the following reductions in vessel noise and disturbance from commercial whale watching:
    - limiting the commercial whale watching season to three months/year for viewing of SRKW at closer than one-half nautical mile,
    - limiting commercial whale watching activity in the vicinity of SRKW to four hours per day during the specified season,
    - limiting commercial whale watching vessels to three within one-half nautical mile of SRKW, with an exclusion from approaching within one-half mile of a group containing a calf, and

- year-round closure of the no-go zone on the west side of San Juan Island to commercial whale watching vessels save a hundred-yard corridor along the shoreline for commercial kayak tours.

2) WDFW continues to promote and enforce the 2019 restrictions on speed and buffer distance around SRKW for all vessels.

3) WDFW has increased outreach efforts to promote messaging about boating regulations, "Be Whale Wise" guidelines, the voluntary no-go zone, and the adjustment or silencing of sonar in the presence of SRKWs. In terms of outreach efforts, WDFW is creating video content to support Be Whale Wise messaging, expanding online and print advertising targeting recreational boaters, developing materials for pump-out and re-fueling stations along Puget Sound, and producing print materials for handout during Enforcement orca patrols. Other efforts include on-site signage at Washington State Parks and WDFW water access sites along Puget Sound, radio advertising, and targeted social media advertising. In addition, State Parks has integrated educational materials regarding whale watching regulations and guidelines in their boating safety education program. This ensures that all boaters taking the course are aware of current vessel regulations and best practices for SRKW protection. Finally, both WDFW and the "Be Whale Wise" partnership are coordinating with U.S. and Canadian governments and organizations on regulatory changes and education and outreach, ensuring transboundary benefits for SRKWs.

4) WDFW has coordinated with partners to encourage the use of the Whale Report Alert System (WRAS) in Puget Sound. Developed by the Ocean Wise Research Institute, the system uses on-the-water reporting to alert large ships (ferries, barges, etc.) when whales are nearby. Reporting SRKW locations to the WRAS is a requirement for commercial whale watching license holders, and WDFW is training on-the-water staff like Enforcement personnel to contribute sightings as well.

5) WDFW will continue to promote adherence to the voluntary "No-Go" Whale Protection Zone along the southwest portion of San Juan Island in MA7 for all recreational vessels (Figure 3). The geographic extent of this area stretches from Eagle Point in the southeast to Mitchell Point in the north and extends offshore ¼ mile between these locations and ½ mile centered on Lime Kiln Lighthouse. This area is consistent with that already promoted by San Juan County, proposed by NOAA Fisheries as *Alternative 4* in the 2009 Environmental Assessment on New Regulations to Protect SRKWs from Vessel Effects in Inland Waters of Washington, and represents the area most frequently utilized for foraging and socialization in the San Juan Islands. WDFW will continue to work with San Juan County and will plan to adjust outreach on a voluntary zone to be consistent with any outcomes of current marine spatial planning processes. As mentioned, the area is now closed to commercial whale watching activities, save a hundred-yard corridor along the shoreline for commercial sea kayak tours.

6) Currently, WDFW enforcement conduct coordinated patrols with the U.S. Coast Guard, NOAA Office of Law Enforcement, San Juan County Sheriff's Office, Sound Watch, and other partners year-round. These patrols include monitoring and enforcement of fisheries and the Marine Mammal Protection Act related to vessel operation in the presence of marine mammals throughout Puget Sound. Patrols in the marine areas of northern Puget Sound, particularly MA7,

are specifically targeted to enforce regulations related to killer whales. These patrols increase in intensity at times when SRKW calves are present.

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