Final Environmental Assessment

Environmental Assessment to Analyze Impacts of NOAA's National Marine Fisheries Consideration of the Skagit River Steelhead Fishery Resource Management Plan under Limit 6 of the 4(d) Rule of the Endangered Species Act (ESA)

Prepared by the
National Marine Fisheries Service, West Coast Region

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Cover Sheet
Final Environmental Assessment

Title of Environmental Review: Skagit River Steelhead Fishery Resource Management Plan (Skagit RMP)

Distinct Population Segments: Puget Sound Steelhead DPS

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Legal Mandate: Endangered Species Act of 1973, as amended and implemented – 50 CFR Part 223

Location of Proposed Activities: Skagit River Basin including Skagit Bay and Mainstem Skagit River in Puget Sound, Washington

Activity Considered: The proposed resource management plan includes steelhead fisheries and associated activities in the Skagit Basin

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List of Abbreviations and Acronyms

BIA	Bureau of Indian Affairs
BRT	Biological Review Team
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
DAO	Departmental Administrative Order
DDT	dichloro-diphenyl-trichloroethanes
DIP	demographically independent population
DOI	Department of the Interior
DPS	Distinct Population Segment
EA	Environmental assessment
EFH	Essential fish habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
Fed. Reg.	Federal Register
FRAM	Fishery Regulation Assessment Model
LOAF	List of Agreed Fisheries between Washington State and Puget Sound Treaty Tribes
MPG	Major Population Group
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWIFC	Northwest Indian Fisheries Commission
PAH	polycyclic aromatic hydrocarbon
PDBE	polybrominated diphenyl ether
PFMC	Pacific Fishery Management Council
PCB	polychlorinated biphenyl
PSSTRT	Puget Sound Steelhead Technical Review Team
RCW	Revised Code of Washington
SMU	Skagit Steelhead Management Unit
SFD	Sustainable Fisheries Division
SRKW	Southern Resident Killer Whale
U.S.	United States
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WDOH	Washington Department of Health

1. Purpose Of And Need For The Proposed Action

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) is the lead agency for administering the Endangered Species Act (ESA) as it relates to ESA-listed salmon and steelhead. On July 10, 2000, NMFS issued a final rule pursuant to ESA section 4(d) (4(d) Rule), adopting regulations necessary and advisable to conserve threatened species (50 CFR 223.203). The 4(d) Rule applies the take prohibitions in section 9(a)(1) of the ESA to salmon and steelhead listed as threatened, and sets forth specific circumstances when the take prohibitions would not apply, known as 4(d) limits. There are 13 limits in the 4(d) rule. Limit 6 is for Joint Tribal/State resource management plans developed under the *United States v. Washington* (*U.S. v. Washington* 1979) or *United States v. Oregon (U.S. v. Oregon* 2009*)* settlement processes. A central goal of the 4(d) rule is to encourage tribes, state and local governments to step forward and assume leadership roles in saving these species by providing the means for NMFS to approve these efforts and to limit liability under the ESA. Therefore, the 4(d) rule can *limit* the situations to which the take prohibitions apply.

Limit 6 recognizes that non-tribal salmonid management is profoundly influenced by the fishing rights of numerous Indian tribes and must be responsive to the court proceedings that interpret and define those tribal rights. Various orders of the *United States v. Washington* court mandate that many aspects of fishery management, including but not limited to harvest and artificial production actions, be jointly coordinated by the State of Washington and the Western Washington Treaty Tribes (*U.S. v. Washington* 1979). NMFS reviews plans under Limit 6 consistent with the government-to-government processes outlined in the 4(d) rule for Tribal resource management plans (50 CFR 223.204). Under Limit 6 of the 4(d) Rule, the section 9 take prohibitions do not apply to activities carried out under a resource management plan (RMP), when NMFS determines that the RMP meets the Limit 6 requirements. As described in Section 3.3.1, *Listed Salmon and Steelhead*, the Puget Sound steelhead distinct population segment (DPS) is listed as a threatened species under the ESA. NMFS developed a Policy on the Definition of Species under the ESA (56 FR 58612-58618; November 20, 1991). This policy applies only to species of salmonids native to the Pacific Ocean. Under this policy, a stock of Pacific salmon is considered a DPS if it represents an evolutionarily significant unit (ESU) of a biological species. A stock must satisfy two criteria: (1) It must be substantially reproductively isolated from other populations, and (2) It must represent an important component in the evolutionary legacy of the species. Later, the U.S. Fish and Wildlife Service and NMFS jointly adopted NMFS' policy to clarify their interpretation of the phrase "distinct population segment of any species of vertebrate fish or wildlife" for the purposes of listing, delisting, and

reclassifying species under the ESA (61 FR 4722-4724; February 7, 1996). Additional information about the 4(d) rule, exemptions, and scientific concepts that NMFS uses to evaluate programs can be found at http://www.westcoast.fisheries.noaa.gov/permits/section_4d.html.

On November 18, 2016, NMFS received an RMP for the proposed Puget Sound steelhead fisheries in the Skagit River basin from the Sauk-Suiattle Tribe, Swinomish Tribe, Upper Skagit Tribe, Skagit River Cooperative, and the Washington Department of Fish and Wildlife (WDFW), referred to as the co-managers in this EA, under Limit 6 of the 4(d) rule. The Skagit River Steelhead Fishery Resource Management Plan (Skagit RMP) is a plan for fishery management activities for Skagit River basin steelhead, which are all natural-origin fish.

1.2 Description of the Proposed Action

As described in Section 1.1, *Background*, NMFS must determine whether the Skagit RMP meets the requirements of Limit 6 of the 4(d) rule, including whether the RMP would appreciably reduce the likelihood of survival and recovery of the Puget Sound steelhead distinct population segment (DPS) (50 CFR 223.203(b)(6)(i)). This determination is a federal action that triggers review under the National Environmental Policy Act (NEPA) and this Environmental Assessment (EA) documents NMFS' NEPA analysis. In this EA, NMFS analyzes the environmental effects of the Skagit RMP on the human environment.

The objectives of the Skagit RMP (Sauk-Suiattle Indian Tribe et al. 2016) are to:

1) manage Skagit-origin steelhead (*Oncorhynchus mykiss*) as an independent component of the Puget Sound steelhead DPS for harvest management purposes; and

2) conduct Skagit terminal area (marine and freshwater) fisheries pursuant to *U.S. v Washington* in a manner that would not appreciably reduce the likelihood of survival and recovery of ESA-listed Puget Sound salmon and steelhead.

The Skagit RMP would allow fishing for Skagit-origin steelhead only in the Project Area (see Section 1.3 for a description of the Project Area). The fisheries would include tribal and non-tribal commercial and recreational Skagit steelhead fisheries as well as tribal ceremonial and subsistence (C&S) fisheries. The Skagit RMP would not govern management of ongoing fisheries that incidentally catch Puget Sound steelhead (i.e., fisheries for Puget Sound salmon and unlisted hatchery steelhead). However, in establishing the permissible harvest rates for Skagit-origin steelhead, the Skagit RMP accounts for all sources of landed and non-landed Skagit steelhead (i.e., the proposed direct steelhead harvest and anticipated incidental take of steelhead in ongoing Puget Sound fisheries) (Sauk-Suiattle Indian Tribe et al. 2016). The RMP

provides a harvest management strategy for the proposed steelhead fisheries that would include implementation, monitoring, and evaluation procedures (Sauk-Suiattle Indian Tribe et al. 2016).

The Skagit RMP proposes fishery management and monitoring for a period of five years. In year five, the co-managers would apply lessons learned through an adaptive management process to revise and submit a new RMP (Sauk-Suiattle Indian Tribe et al. 2016). Depending on whether the revised RMP included substantial changes, or whether there were significant new information relevant to the environmental impacts, NMFS could use this EA in support of its decision on a subsequent RMP, decide to prepare a new NEPA document, or supplement this EA.

Currently, no fishing targeting listed Puget Sound steelhead is authorized or is covered under the ESA. However, listed steelhead are incidentally caught in Puget Sound fisheries targeting salmon and unlisted hatchery steelhead. In recent years, the state and tribal co-managers have annually agreed to a plan for management of the Puget Sound fisheries for salmon and unlisted steelhead, and NMFS has carried out consultation under ESA section 7(a)(2) to evaluate the plan's effects to ESA-listed species. Under section 7(a)(2), NMFS determines whether a proposed action is likely to jeopardize the continued existence of any listed species or to destroy or adversely modify their critical habitats. To 'jeopardize the continued existence of' means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 401.22). At the close of consultation, NMFS issues a biological opinion documenting our analysis and conclusions. For the 2017 Puget Sound salmon and steelhead fisheries, NMFS engaged in ESA consultation and issued a biological opinion finding that the fisheries were unlikely to jeopardize any listed species, including the Puget Sound steelhead DPS (NMFS 2017b).

The Skagit RMP proposes creating a Skagit Steelhead Management Unit (SMU) as a separate management unit from the Puget Sound DPS and allowing directed fishing for Skagit basin steelhead. This proposal would not alter the composition of the Puget Sound steelhead DPS for ESA purposes. The Puget Sound Steelhead DPS was listed as threatened under the ESA on May 11, 2007 (72 FR 26722). In 2011 and 2015, NMFS carried out required 5-year reviews for the species under ESA section 4(c) and determined that the "threatened" categorization remained appropriate (NWFSC 2015). The Puget Sound Steelhead DPS consists of 3 Major Populations Groups (MPGs): (1) Northern Cascades, (2) Central and South Sound, and (3) Hood Canal and Strait of Juan de Fuca. There are 32 demographically independent populations (DIPs) within the 3 steelhead MPGs (Myers et al. 2014). The following six steelhead artificial propagation programs included in the ESA listing are: (1) Green River Natural Program; (2) White River Winter Steelhead Supplementation Program; (3) Hood Canal Steelhead Supplementation Off-Station Project in the Dewatto River; (4) Hood Canal Steelhead Supplementation Off-Station

Project in the Skokomish River; (5) Hood Canal Steelhead Supplementation Off-Station Project in the Duckabush River; and (6) Lower Elwha Fish Hatchery Wild Steelhead Recovery Program.

The Skagit Basin contains four DIPs from the Northern Cascades steelhead MPG. The proposed Skagit SMU would include the four DIPs originating from the Skagit River basin, in consideration of the historical management of these DIPs as an aggregated stock. Prior to the listing of Puget Sound steelhead, the Skagit Basin was managed independently from other river systems in the Puget Sound for harvest purposes. Historically, the Skagit SMU has maintained the largest natural origin populations and has been one of the most productive steelhead basins of the Puget Sound Steelhead DPS (Busby et al. 1996; Hard et al. 2007).

The Puget Sound Salmon Management Plan (1985) defines a management unit as "A stock or group of stocks which are aggregated for the purpose of achieving a desired spawning escapement objective." The Skagit RMP proposes a Skagit River "Steelhead Management Unit (SMU)" containing all extant steelhead populations in the Skagit Terminal Area. The SMU would include the following four steelhead DIPs:

1) Mainstem Skagit River summer- and winter-run
2) Sauk River summer- and winter-run
3) Nookachamps Creek winter-run
4) Baker River summer- and winter-run

Myers et al. (2015) stated that some members of the Puget Sound Steelhead Technical Review Team (PSSTRT) considered the Baker River summer- and winter-run DIP to have been extirpated. Resident *O. mykiss* have been observed in the Skagit River in downstream passage structures and these fish migrations may have contributed to anadromous population productivity (Sauk-Suiattle Indian Tribe et al. 2016).

NMFS is actively working with our federal, state, tribal, local, and private partners to develop a draft recovery plan, under section 4(f) of the ESA, for the Puget Sound steelhead DPS. The draft plan is currently scheduled to be issued in December 2018, with a final plan to be completed at the end of 2019. There are currently no hatchery programs for steelhead in the Skagit River. Within the Skagit River Basin, co-managers are evaluating the possible role of an integrated hatchery program for the Skagit SMU. Any hatchery program, if proposed in the future, would require review under NEPA and the ESA.

1.3 Purpose and Need for the Action

The purpose for the Proposed Action is to determine whether the Skagit RMP, submitted by the Skagit Basin Indian Tribes and WDFW for review, complies with the requirements of the ESA under Limit 6 of the 4(d) Rule, and meets NMFS' tribal trust responsibilities, and if so, to approve the Skagit RMP under the 4(d) rule. Compliance with the 4(d) Rule criteria, under Limit 6, would help ensure that the proposed steelhead fishery plan is adequate to conserve and protect the ESA-listed Puget Sound steelhead DPS. The need for the Proposed Action is to respond to the Tribes and WDFW's request for approval under the 4(d) rule for the Skagit RMP, which would provide for the meaningful exercise of treaty tribal fishing rights as well as fishing opportunities for citizens of the State of Washington. The goal of the Skagit RMP is to implement harvest management activities through (1) conservation of steelhead populations in the Skagit Basin; (2) meeting tribal ceremonial, religious, and spiritual values, (3) providing tribal subsistence; and (4) sustaining commercial fishery values.

1.4 Project Area and Analysis Area

The project area is the geographic area where the Proposed Action (Skagit RMP) would take place. It includes places where steelhead would be harvested or studied through monitoring and evaluation under the proposed Skagit RMP. The Skagit River project area (collectively referred to as the Skagit Terminal Area), is shown in Figure 1-1.

The Skagit Bay and Skagit River are located in North Puget Sound. The Project Area is the Skagit Terminal Area that consists of the following areas (McClure 2017):

Treaty Fisheries:

1) Marine Area 8.1
2) Freshwater Areas 78C; 78D-1, 78D-2, 78D-3, and 78D-4 to the mouth of the Baker River; 78O Baker River from the Skagit River to Hwy 20 bridge; 78B Sauk River from the Skagit River to the Sauk Prairie Road bridge; 78P Cascade River from the Skagit River to the Rockport/Cascade bridge.

The marine catch area (MCA) included in the proposed action is located in Skagit Bay (MCA 8.1). Freshwater catch areas are subdivided into sections (78C, 78D1, 78D2, 78D3, 78D4, and 78O) for the proposed treaty fisheries. The marine treaty fishing area is identified in gray and freshwater treaty fishing areas are identified by the solid black line in Figure 1-1.

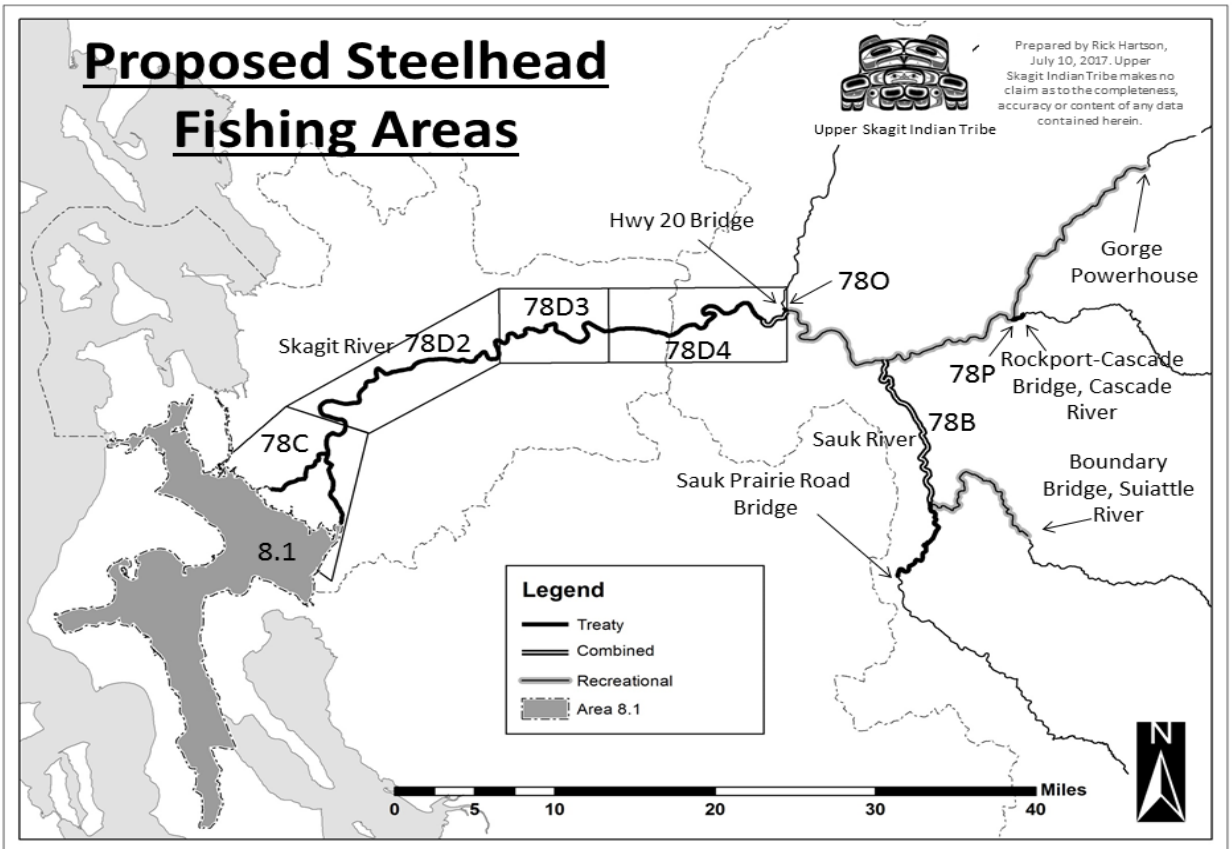

Figure 1-1. Project Area for the Skagit River RMP. Source: (Hartson 2017 *in* McClure 2017). The analysis area for each resource is the same as the Project Area unless noted in Chapter 3.

Non-treaty Fisheries:

1) Skagit River mainstem – Dalles Bridge (approximately river mile 54) in Concrete upstream to Gorge Powerhouse (approximately river mile 94.3).
2) Sauk River – mouth (enters Skagit River mainstem at river mile 66) to Sauk Prairie Road Bridge.
3) Suiattle River – mouth (enters Sauk at river mile 13) upstream to Boundary Bridge (intersection of Forest Road 26 and 25, river mile 12).

The proposed recreational fishing areas are identified by river reach, and not freshwater catch areas (i.e., 78C, 78D, etc. as identified by the treaty fisheries), and are identified by the gray line in Figure 1-1. The proposed recreational fishery would not occur in other tributaries than those described above.

Proposed steelhead fishing areas that include both treaty and non-treaty fisheries (i.e., where fisheries overlap) are identified by the double black line in Figure 1-1.

The analysis area is the geographic extent that is being evaluated for a particular resource. The Skagit Basin, including Skagit Bay and its tributaries, encompass the overall project area for this EA analysis (Figure 1-1). The project area impacting each resource is analyzed in Chapter 3, *Affected Environment*. Direct and indirect impacts for resources are analyzed in Chapter 4, *Environmental Consequences* and the evaluation of cumulative effects is described in Chapter 5, *Cumulative Effects*.

1.5 Relationship to Other Plans, Regulations, Agreements, Laws, Secretarial Orders and Executive Orders

Other plans, regulations, agreements, treaties, laws, and Secretarial and Executive Orders also affect fisheries activities in the Skagit River Basin and their effects on resources in the project area. These are summarized below to provide additional context for the following evaluation of the Skagit RMP and its effects on the environment.

1.5.1 North of Falcon Process

The Bureau of Indian Affairs (BIA) would continue to evaluate effects of incidental take of the Skagit SMU populations as part of the overall List of Agreed Fisheries (LOAF) (or annual fisheries agreement) in the annual Puget Sound Salmon and Steelhead Fisheries Plan. The LOAF is based on the North of Falcon[1] process, an annual salmon and steelhead fishery management planning process that involves representatives from the Puget Sound Indian Tribes, Washington, Oregon, and the federal government. The LOAF covers the salmon and steelhead fishing season from May 1 to April 30 of the following year and provides specific details about individual anticipated commercial, ceremonial and subsistence, recreational and research-related salmonid fisheries in Puget Sound by location, gear, time, and management entity. Co-managers for each fishery then determine site-specific allocations and implementation of the fisheries.

1.5.2 Executive Order 12898

In 1994, the President issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations. The objectives of the Executive Order include developing Federal agency implementation strategies, identifying minority and low-income populations where proposed Federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process. Some fisheries plans have the potential to affect the extent of harvest available for minority and low-income populations that are the focus of

[1] The North of Falcon process is described in the Pacific Fishery Council's Fishery Ecosystem Plan (FEP), http://www.pcouncil.org/wp-content/uploads/FEP_FINAL.pdf.

Executive Order 12898, including the Skagit Basin Indian Tribes. These impacts are described in Section 3.6, *Environmental Justice*.

1.5.3 Treaty of Point Elliot

Prior to European contact, tribes governed their own affairs, and continue to do so today. The United States recognized tribes as sovereign nations and the rightful owners of their land through the signing of treaties that carried the weight of the U.S. Constitution. Beginning in the mid-1850s, the United States entered into a series of treaties with tribes in the Puget Sound region. The treaties were completed to secure the ceding of land by the tribes to the United States for settlement by its citizens. In the treaties, the tribes retained specific tracks of tribal lands as Indian reservations. In exchange for the Indian lands ceded, tribes received a guarantee of protection by the United States government, the promise to provide services and supplies, and small monetary payments. The cession of lands in the treaties did not cede tribal rights to fish, hunt, and gather as they had always done prior to the signing of the treaties. The treaties specifically reserved existing rights of the tribes to harvest fish at all usual and accustomed grounds and stations in common with all citizens of the United States, and to hunt and gather on all open and unclaimed lands. Marine and freshwater areas of the Strait of Juan de Fuca and Puget Sound were affirmed as the usual and accustomed fishing areas for treaty tribes under *United States v. Washington* (*U.S. v. Washington* 1974).

In 1855, the Treaty of Point Elliot was entered into by the United States and tribes of the mid and northern Puget Sound including Duwamish, Suquamish, Snoqualmie, Snohomish, Lummi, Skagit, and Swinomish Indian Tribes. Ensuring that the fishing rights of the Skagit Basin Indian Tribes (reserved under the Treaty of Point Elliot signed by the U.S. Federal Government) are protected is part of NMFS' tribal trust responsibilities and stewardship mandate. The Treaty affects determinations made in this document regarding Environmental Justice (Section 3.6), Cultural Resources (Section 3.7), and Socioeconomic (Section 3.8) resource effects of the proposed action and the alternatives.

1.5.4 *United States v. Washington*

United States v. Washington, Phase I, (*U.S. v. Washington* 1974) is a Federal court proceeding that enforces and implements reserved treaty fishing rights to salmon and steelhead returning to the usual and accustomed fishing grounds and stations of the treaty tribes. These fishing rights and attendant rights of access were reserved by the tribes in the treaties of the 1850s. The court in *U.S. v. Washington* (1974) Phase I ruled that the tribes were entitled to 50 percent of all of the harvestable fish destined for the tribes' usual and accustomed fishing places. The ruling vests the tribes with the obligation and authority to co-manage fisheries resources with the State of Washington and Federal resource agencies. In 1976, the United States initiated Phase II of the litigation, asking for a declaratory judgement clarifying the Tribes' rights with respect to hatchery fish (*U.S. v. Washington* 1979). Under Phase III of the litigation, the Federal Court of

Appeals decision held that hatchery fish must be included in determining the share of salmon to be allocated to the Tribes and that the tribes' treaty allocation includes both natural and hatchery origin fish (*U.S. v. Washington* 1985). The Skagit RMP would be implemented and enforced within the parameters set forth in *United States v. Washington* (U.S. v. *Washington* 1985; Sauk-Suiattle Indian Tribe et al. 2016).

1.5.5 Secretarial Order 3206 – American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA

Secretarial Order 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA, 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. Secretarial Order 3206 acknowledges the trust responsibility and treaty obligations of the United States towards tribes and tribal members, as well as its government-to-government relationship when corresponding with tribes. Under the order, NMFS and the U.S. Fish and Wildlife Service (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."

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 (Sec. 5, Principle 1)
- Recognize that Indian lands are not subject to the same controls as Federal public lands (Sec. 5, Principle 2)
- Assist Indian tribes in developing and expanding tribal programs so that healthy ecosystems are promoted and conservation restrictions are unnecessary (Sec. 5, Principle 3)
- In cases that involve the potential for incidental take under the ESA, the Services will analyze and determine whether conservation restrictions meet the following standard:
  (1) the restriction is reasonable and necessary for conservation of the species at issue;
  (2) the conservation purpose of the restriction cannot be achieved by reasonable regulation of non-Indian activities;
  (3) the measure is the least restrictive alternative available to achieve the required conservation purpose;
  (4) the restriction does not discriminate against Indian activities, either as stated or applied; and

(5) voluntary tribal measures are not adequate to achieve the necessary conservation purpose
(6) Be sensitive to Indian culture, religion, and spirituality (Sec. 5, Principle 4)

1.5.6 Federal Trust Responsibility

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 treaties, statutes, executive orders, judicial decisions, federal agency policies, and agreements. It 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, requires each Federal agency to establish procedures for meaningful consultation and coordination with tribal officials in the development of Federal policies that have tribal implications. The Department of Commerce (DOC) Administrative Order (DAO) 218-8 and the "Tribal Consultation and Coordination Policy of the U.S. Department of Commerce" together constitute DOC's "Tribal Consultation Policy". When working with our Native American tribal partners, NMFS enacts this policy outlined in our NOAA tribal consultation handbook: "NOAA Procedures for Government-to-Government Consultation with Federally Recognized Indian Tribes and Alaska Native Corporations" (NOAA 2013).

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This EA evaluates four alternatives:

1) Alternative 1 (No Action/Status Quo) – Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6
2) Alternative 2 (Proposed Action/Preferred Alternative) – Approve the Skagit RMP under the 4(d) Rule Limit 6
3) Alternative 3 (Intermediate Fixed Harvest Rate) – Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend a Fixed Harvest Rate
4) Alternative 4 (Escapement-Based Management) – Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend an Escapement-Based Management

Information about alternatives considered but eliminated from further consideration, including alternative harvest models, is presented in Section 2.3.

2.1 Alternative 1 (No Action/Status Quo) – Do Not Approve the Skagit RMP Under the 4(d) Rule Limit 6

Under this alternative, NMFS would not approve the Skagit RMP.

The status-quo, or the current baseline conditions, would continue under this no action alternative. The proposed Skagit steelhead SMU would not be independently managed for steelhead harvest and incidental take of listed Puget Sound steelhead would continue to be evaluated in context of the Puget Sound salmon and steelhead fisheries.

Harvest rates in the Puget Sound Steelhead DPS have varied extensively among the different watersheds but all have declined since the 1970s and 1980s (NWFSC 2015). Harvest rates on wild steelhead during the late 1970s averaged between 10% and 40%, with some populations in the central and south Puget Sound, such as the Green and Nisqually River populations, experiencing harvest rates of over 60% (NWFSC 2015) (Figure 2-1).

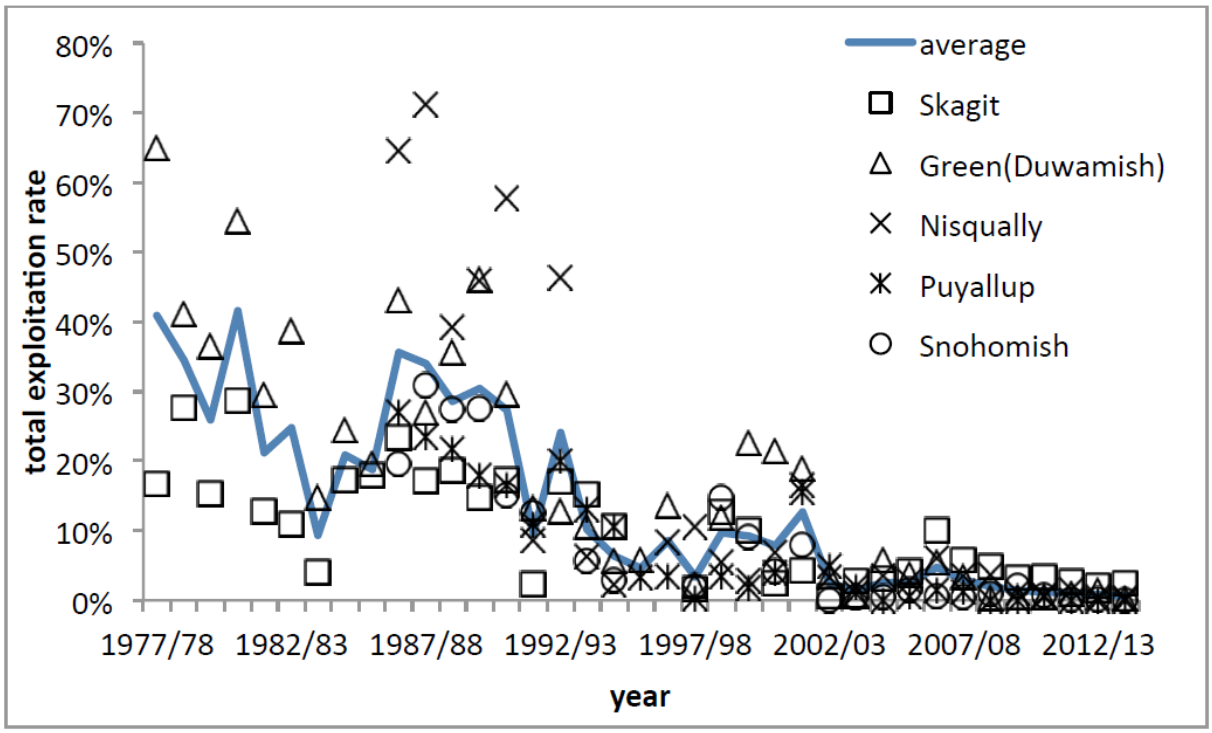

Figure 2-1. Historical terminal harvest rates on wild steelhead from Puget Sound rivers, 1977 – 2012 (NWFSC 2015).

Under this alternative, Puget Sound marine and freshwater commercial, recreational and ceremonial and subsistence (C&S) salmonid fisheries would continue to incidentally catch Puget Sound steelhead, including steelhead from the Skagit River. For 2017, NMFS estimated that the incidental take rate of listed natural origin steelhead in terminal treaty and non-treaty fisheries

would be no more than 4.2 percent of total listed natural-origin steelhead abundance. Additional steelhead encounters may occur in pre-terminal marine fisheries, but these encounters are negligible and data are insufficient to attribute them to individual populations (NWFSC 2015). Thus, steelhead encounters are reported as terminal harvest rates (NWFSC 2015). For pre-terminal marine fisheries, NMFS estimated that up to 325 steelhead would be incidentally taken, however, this number includes both listed Puget Sound steelhead and unlisted Puget Sound hatchery steelhead, as well as unlisted steelhead originating in Canada. Based on data available between 2007/08 and 2015/16, the actual listed natural-origin steelhead incidental take rate has averaged 3.1 percent in terminal areas and 176 natural origin and hatchery origin fish in per-terminal marine areas (NMFS 2017b) (Figure 2-2).

At the time of listing, NMFS observed that previous harvest management practices likely contributed to the historical decline of Puget Sound steelhead but concluded that the elimination of direct harvest of wild steelhead in the 1990s largely addressed this threat such that overutilization from harvest activities was not a limiting factor (72 FR 26732, May 11, 2007). Incidental steelhead harvest rates described above are currently below harvest rates at the time of listing and, therefore, are also considered not to be a limiting factor.

No directed steelhead fisheries are currently authorized or would be authorized for ESA-listed Puget Sound steelhead under No Action/Status Quo, Alternative 1. The status quo under the current Puget Sound salmon and steelhead fisheries would likely continue. All harvest would likely continue to be below 4.2 percent in terminal freshwater areas[2] and up to 325 steelhead (listed and unlisted) in marine areas and are likely to continue to decline for the near future based on current incidental steelhead harvest trends (NWFSC 2015; NMFS 2017b) (Figure 2-3).

[2] The 4.2% harvest rate is an average of the following Puget Sound basins for terminal (freshwater) fisheries: Skagit, Snohomish, Green, Puyallup, and Nisqually.

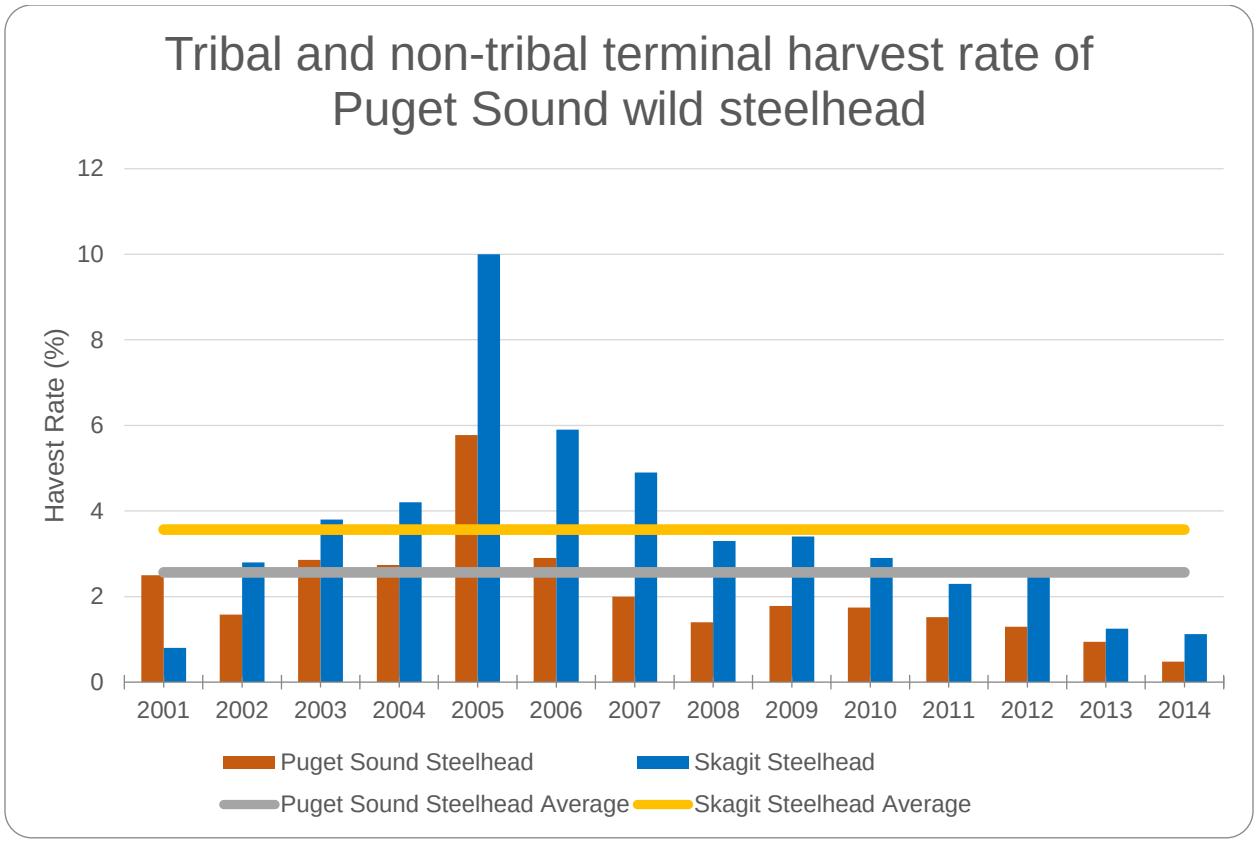

Figure 2-2. Recent tribal and non-tribal terminal harvest rate percentages for listed Puget Sound natural origin steelhead, 2001 – 2014 (NMFS 2017b).

Most Puget Sound streams have limited catch and escapement (abundance) data to calculate abundance or harvest rates for wild steelhead. Puget Sound basins with sufficient data include the Skagit (4 steelhead DIPs), Snohomish (5 steelhead DIPs), Green (1 steelhead DIP), Puyallup (2 steelhead DIPs), and Nisqually (1 steelhead DIP). The incidental harvest rate for the listed Puget Sound Steelhead DPS was estimated by NMFS at the time of listing as the average of estimated harvest of the winter-run portions of the populations occurring in these five basins. The winter-run steelhead from these five basins provide the only robust data sets for estimating steelhead harvest. Four summer-run steelhead DIPs occur in the Northern Cascades MPG (South Fork Nooksack, Deer Creek, Canyon Creek, and North Fork Skykomish) but there is not enough information on the summer-run components to include our the abundance estimates. There are other steelhead incidental catch estimates (< 100 fish) for other areas of Puget Sound, but they are based on limited catch and escapement (abundance) data, preventing an accurate calculation of total harvest for all watersheds. Thus, Figure 2-3 represents the best available data on Puget Sound listed steelhead incidental take (harvest rates), including the proposed Skagit Basin SMU. The data available for the Skagit River are sufficient to calculate incidental harvest rates at this time (NWFSC 2015), include illegal and unreported catch (NMFS 2017b), and represent the best available data for estimating harvest estimates for the broader Puget Sound Steelhead DPS (NWFSC 2015).

Recent historical escapement estimates for Skagit River listed natural origin steelhead abundance have ranged from a low of 4,113 fish in 2007 to a high of 9,084 fish in 2012. Escapement estimates for Skagit River listed natural origin steelhead from 2001 to 2014 are displayed in Figure 2-3. Listed or non-listed hatchery origin steelhead are not included in these estimates.

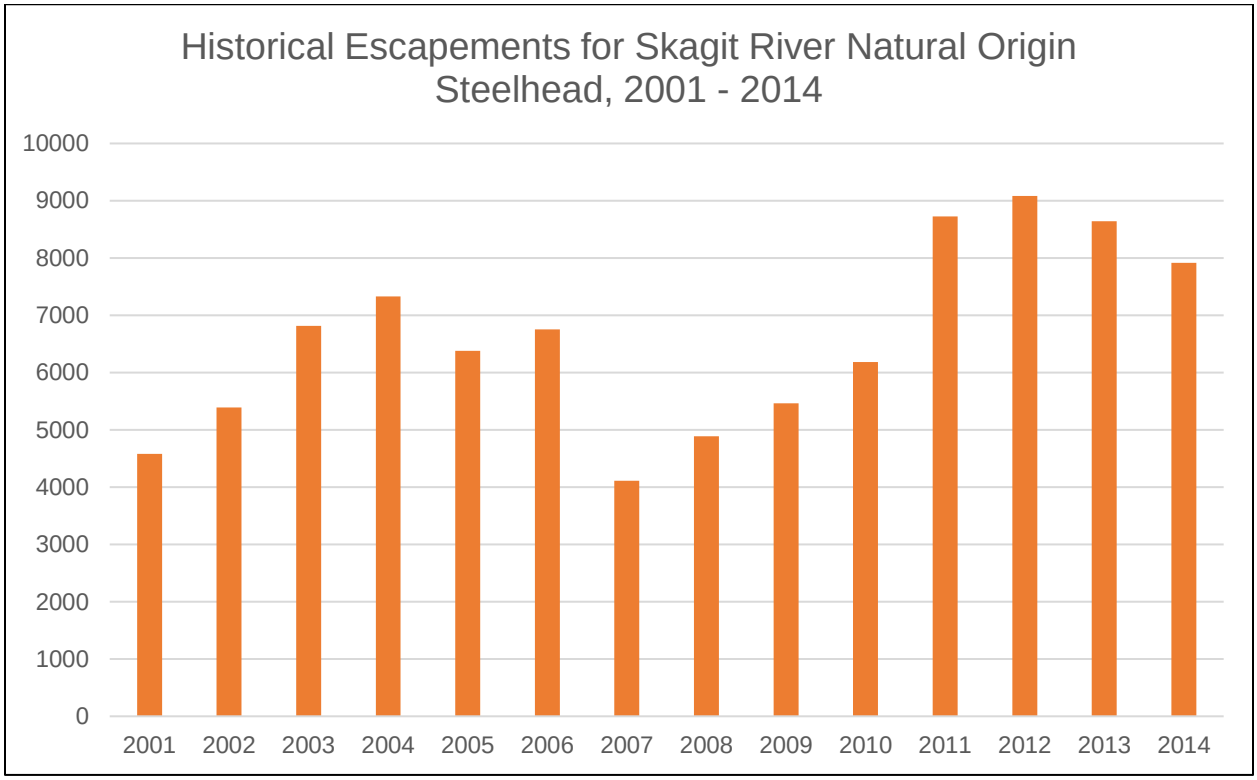

Figure 2-3. Historical Escapement Estimates for listed natural-origin steelhead in the Skagit River, 2001 – 2014. Source: (Leland 2018).

2.1.1 Bycatch of Steelhead in Puget Sound Fisheries

We are unable to predict the exact number of listed natural-origin steelhead that would be caught in marine and freshwater fisheries under the No Action/Status Quo, Alternative 1, as it depends on varying future run sizes and incidental harvest rates. Fisheries for salmon and unlisted steelhead across the five watersheds[3] in Puget Sound, for which abundance estimates are available, are conducted under the following:

- Treaty Commercial and C&S Fisheries: These fisheries, which may retain both natural origin and hatchery origin steelhead, comprise a marine commercial fishery and the C&S fishery. Between 2007/2008 and 2015/2016, an annual average of 72 listed natural origin steelhead were incidentally caught in these Puget Sound fisheries (NMFS 2017b). Hatchery origin steelhead are not included in this estimate.

[3] The five watersheds include Skagit, Snohomish, Green, Puyallup, and Nisqually.

- Non-Treaty Commercial Fisheries: These fisheries are prohibited from retaining steelhead (Revised Code of Washington RCW 77.12.760 1993). In marine areas of Puget Sound, an annual average of 4 steelhead were incidentally encountered annually between 2007/2008 and 2015/2016 (NMFS 2017b). The origin of these fish is unknown because the bycatch steelhead are not sampled; rather, they are returned to the water as quickly as possible. Therefore, this bycatch may be comprised of ESA-listed steelhead, unlisted hatchery origin steelhead, or hatchery or natural origin fish from Canada (NMFS 2017b).

- Non-Treaty Recreational Fisheries: The retention of natural origin fish in these fisheries is not permitted; natural origin steelhead must be released under WDFW fishing regulations. An annual average of 100 hatchery summer and winter steelhead were landed incidentally during salmon fisheries between 2007/2008 and 2015/2016 (NMFS 2017b) in all Puget Sound marine areas.

In total, marine catch of steelhead in treaty and non-treaty fisheries was 176 (treaty 72 + non-treaty 104 = 176) fish[4] from 2007/2008 to 2015/16 (NMFS 2017b). Under the No-Action/Status Quo, Alternative 1, all other fisheries would likely continue in the project area and may incidentally encounter Skagit River listed natural origin steelhead. These fisheries are described in the current Co-Managers' List of Agreed Fisheries (LOAF) (PSIT and WDFW 2017).[5]

Under this alternative, an incidental catch of 4.2 percent of the total terminal (freshwater) listed natural origin steelhead adult return and up to 325 adult listed natural origin and hatchery origin steelhead[5] in marine waters would occur as mentioned above (Table 2-1). Preseason forecasts would vary but the steelhead incidental take (harvest rate) for freshwater fisheries and number of steelhead in marine fisheries would not change (i.e., fixed) regardless of steelhead abundance.[6] The number of listed natural origin steelhead returning to the spawning grounds depends on the annual abundance of steelhead and how many steelhead that escape harvest would be equal to or greater than 95.8 percent. See Table 2-1.

[4] This number includes both listed natural origin steelhead and unlisted Puget Sound hatchery steelhead, as well as unlisted steelhead originating in Canada

[5] Located at: http://wdfw.wa.gov/fishing/tribal/.

[6] The current terminal harvest rate or marine harvest numbers is not reliant on a pre-determined steelhead abundance estimate(s).

Table 2-1. Fishing regime for incidental catch of listed Puget Sound natural origin steelhead, including the Skagit Basin.[7]

Preseason Forecast for Natural Origin Steelhead (Terminal Run)	Allowable Harvest Rate*		Maximum Natural Origin Steelhead Harvested (% + #)	Steelhead Returning to Spawning Grounds (%)
	Terminal (%)	Marine (#)		
Variable	4.2	325	Up to 4.2 + 325	≥ 95.8

*Harvest rates include total mortalities from incidental salmon fisheries as well as non-retention in the research fishery.

2.1.2 Fisheries Management

Each year, the co-managers develop a fishery plan for Puget Sound salmon and unlisted steelhead consistent with the preseason forecast developed under the provisions of *U.S. v. Washington* (Section 1.5.4, *U.S. v. Washington* 1974). The co-managers monitor encounters and retention of listed steelhead in these salmon directed fisheries. Depending on the forecasted return of listed natural origin steelhead to the Skagit SMU, fisheries are currently designed to limit the non-retention allowable incidental take rate in the terminal (freshwater) fisheries and marine fisheries per the estimates identified in Table 2-1. The tribes and WDFW also communicate regularly and share data on run size, timing, and catch to ensure appropriate co-management of steelhead. For example, if steelhead run sizes are lower than anticipated or incidental take is reached sooner than expected, the co-managers share information and may close fisheries early to remain within the anticipated harvest rates.

2.1.3 Reporting

The co-managers currently submit to NOAA Fisheries an annual report ("Puget Sound Steelhead Harvest Management Report") for compliance with ESA reporting requirements under the Puget Sound salmon and steelhead fisheries consultation (NMFS 2017b). The annual report provides pre-season management agreements describing fisheries included in the Puget Sound salmon and steelhead consultation, the observed landed catch and estimated mortality in tribal and recreational fisheries, terminal harvest rates, any information on illegal harvests, and other data collected that would be useful in the evaluation of the ongoing steelhead fisheries.

[7] The harvest rate for all Puget Sound Steelhead was calculated as an average across the five Puget Sound winter steelhead populations for which sufficient data are available (i.e., Skagit, Snohomish, Green, Puyallup and Nisqually River Basins only, combined).

2.1.4 Enforcement

The WDFW Law Enforcement Program enforces regulations enacted by the Fish and Wildlife Commission for non-treaty commercial and recreational fishing regulations. These officers assist city, county, other state, and tribal law enforcement agencies, and cooperate with Federal fisheries enforcement. High priority can be assigned to certain recreational fisheries and may be more intensively monitored. Officers work during open fishing days and restricted periods, and conduct additional checks during closed periods. Officers carry out bank and boat patrols to check and assist anglers and covert surveillance may also be conducted where reports of violations have been received.

Individual tribal governments, through Tribal Law Enforcement Programs, monitor and enforce their own commercial, subsistence, and ceremonial regulations for fisheries conducted on and off reservation. Tribal enforcement officers cooperate with other tribal, state, and Federal fisheries enforcement agencies and can be cross-deputized. Violations of tribal fishery regulations include fines or prosecution by tribal justice agencies. Officers are assigned to monitor all tribal usual and accustomed (U&A) fishing areas, fisheries compliance for gear, area, and retention specifics, and other tribally imposed regulations and requirements. Officers patrol these fisheries from shore and boat, where they can also assist tribal fishers, and patrol closed water for fishing out of season or in closed waters.

2.1.5 Management of Adults on the Spawning Grounds

Listed natural origin steelhead adults are not subject to harvest under the No Action/Status Quo, Alternative 1 in the Puget Sound Steelhead DPS. Current fisheries do not target listed steelhead, meaning only incidental take of listed steelhead occur during fisheries directed at other species of salmonids (i.e., Chinook, chum, coho, sockeye, pink salmon, and unlisted steelhead). Incidental take of listed natural origin Puget Sound steelhead of up to 4.2 percent of total wild steelhead abundance is currently exempt from the ESA's take prohibitions pursuant to NMFS' 2017 biological opinion for the Puget Sound salmon and steelhead fisheries (NMFS 2017b) so that the majority of natural origin steelhead (95.8%) can escape ongoing Puget Sound salmon and steelhead fisheries, including fisheries within the Skagit River proposed action area, and return to the spawning grounds to spawn.

2.1.6 Research, Monitoring and Evaluation

Biological opinions issued by NMFS may have terms and conditions requiring research, monitoring, and evaluation projects to gather information and to minimize the amount of take likely to be caused by the proposed action evaluated in the opinion. Research and monitoring activities may pose both benefits and risks. Under the current Puget Sound salmon and steelhead fisheries biological opinion for the No Action/Status Quo, Alternative 1, fisheries are monitored using best available science and measures. Fisheries are sampled for stock composition and other

biological information to inform fisheries management. NMFS recognizes that funding for the collection of steelhead data are limited and improvements in escapement monitoring for steelhead populations affected by the proposed action must be implemented using available resources (NMFS 2017b).

Given the limited landed catch of listed natural origin steelhead under the No-Action/Status Quo, Alternative 1, the co-managers cannot collect all the data they need in order to fully monitor the Skagit River steelhead populations. The Upper Skagit Tribe has implemented a non-retention tangle net test fishery to enable the collection of biological information. These fish are sampled and released. Hook-and-line sampling is also being conducted for genetic monitoring to provide information on steelhead recovery efforts. This research activity is covered under annual NMFS research permits (NMFS 2016b). Both of these research activities would continue under the No Action/Status Quo, Alternative 1.

2.2 Alternative 2 (Proposed Action/Preferred Alternative) – Approve the Skagit RMP Under the 4(d) Rule, Limit 6

Under this alternative, NMFS would approve the Skagit RMP under Limit 6 criteria of the 4(d) Rule.

The Skagit steelhead SMU would be managed independently for fishery-management purposes, and fishing under the Skagit RMP would not be subject to ESA section 9's take prohibition. The Skagit River co-managers[8] have proposed watershed-specific harvest rates (Table 2-2) tailored to the Skagit River steelhead populations identified by NMFS' Puget Sound Steelhead Technical Review Team (PSSTRT) (Myers et al. 2015) in their request for approval of the Skagit RMP under Limit 6 of the 4(d) Rule. The co-managers incorporated NMFS' Status Review Update for Pacific Salmon and Steelhead listed under the Endangered Species Act (NWFSC 2015), as well as data from the PSSTRT population viability document (Hard et al. 2015) into the Skagit RMP. They used population-specific information where available in the development of the harvest management objectives and guidelines for the Skagit RMP. The RMP also addresses implementation, monitoring, and evaluation procedures designed to ensure fisheries are consistent with the objectives of the RMP.

2.2.1 Steelhead in Skagit River Fisheries

In contrast to the Alternative 1, No Action/Status Quo, where only incidental take of listed steelhead in other fisheries would occur, Alternative 2, Proposed Action/Preferred Alternative,

[8] Sauk-Suiattle Indian Tribe, Swinomish Indian Tribal Community, Upper Skagit Indian Tribe, Skagit River System Cooperative, and Washington Department of Fish and Wildlife.

would allow for directed fishing for listed Puget Sound steelhead. Steelhead fisheries in Skagit River Basin would be conducted as follows:

- Treaty Fisheries: A directed tribal fishery within the Skagit Steelhead Management Unit (SMU) would be conducted in marine and freshwater areas between December 1 and April 15. Time and area regulations would vary depending on the preseason estimate of listed natural origin Skagit River steelhead run size as well as other species that may be potentially affected by a fishery (Sauk-Suiattle Indian Tribe et al. 2016). The treaty tribes commercial, subsistence, and ceremonial fisheries would utilize net and hook and line gear. The tribal fishery would be closed if predetermined mortality rates are anticipated to be met earlier than expected (Sauk-Suiattle Indian Tribe et al. 2016).

- Non-Treaty Fisheries: A directed Skagit SMU recreational fishery may be conducted in freshwater between February 1 and April 30 depending on preseason escapement estimates of returning listed natural origin adult steelhead and the amount of fish available under the proposed harvest regime. Time and area restrictions would vary depending on the forecasted return of listed natural origin steelhead and that of potential incidentally impacted species (Sauk-Suiattle Indian Tribe et al. 2016). Retention of listed natural origin Skagit steelhead may be allowed depending upon the pre-season abundance projection and proposed harvest rates. Because the recreational fishery is managed on a weekly, or shorter basis, fishery impacts would be projected forward and the fishery would be closed with a minimum 48 hour notice to the public. For example, the fishery could be closed early if potential mortality is anticipated to be greater than expected after calculating projected harvest for the entire season based on actual encounter rates for that year (Sauk-Suiattle Indian Tribe et al. 2016).

Under this alternative, there would be no change to the non-retention requirement of listed Skagit natural origin steelhead in the Puget Sound salmon and steelhead fisheries. Incidental take rates of listed natural origin steelhead in other fisheries would be factored into the Skagit RMP harvest management regime when determining total allowable harvest rates of listed natural origin steelhead in the Skagit Basin. The research fisheries described in the No-Action Alternative would also continue.

The co-managers have proposed a stepped harvest framework under the RMP to determine how many steelhead could be caught based on fish abundance. The harvest rate and resulting effects are incorporated into an abundance-based stepped harvest regime described in the Skagit RMP, which allows for increased harvest when steelhead abundance increases in the watershed. This framework provides for harvest rates ranging from 4 percent to 25 percent, depending on the predicted abundance of listed Skagit steelhead natural origin adult returns, as shown in Table 2-2. Based on the co-manager analysis of listed natural origin steelhead productivity, the 4%

harvest rate was found to have only a slight reduction in steelhead abundances of up to 4,000 fish and was not found to be statistically significant from the 4.2% (Sauk-Suiattle Indian Tribe et al. 2016). If listed steelhead natural origin abundance rises, then the allowable harvest rate increases. If listed natural origin steelhead abundances fall, allowable harvest rates decrease accordingly. For example, if the preseason forecast for the listed Skagit Basin natural origin adult steelhead return abundance is 4,000 fish, the total allowable harvest rate would be no more than 160 fish (4,000 adult returns x 4% = 160 steelhead; under this scenario, no fishing would be allowed under the Skagit RMP, since the allowable take rate of 4 percent would be allocated to the ongoing Puget Sound salmon and steelhead fisheries to account for incidental take of listed natural origin steelhead in those fisheries. If the preseason forecast for listed natural origin adult steelhead returns increased to a maximum of 8,001 fish or greater, the total allowable harvest rate would be 2,000 fish (8,001 x 25% = 2,000 steelhead), meaning that 2,000 listed Skagit Basin natural origin steelhead could be harvested under the Skagit RMP (incidental and directed catch combined) (Table 2-2).

Table 2-2. Stepped fishing regime proposed for managing listed natural origin steelhead fisheries in the Skagit SMU (Sauk-Suiattle Indian Tribe et al. 2016), including maximum number of fish harvested and percentage of fish returning to the spawning grounds under the proposed harvest regime.

Preseason Forecast for Natural Origin Steelhead (Terminal Run)	Allowable Harvest Rate* (%)	Maximum Number of Natural Origin Steelhead Harvested	Steelhead Returning to Spawning Grounds (%)
Less than or equal to 4,000	4%	160	96
4,001 to 6,000	10%	400 to 600	90
6,001 to 8,000	20%	1,200 to 1,600	80
Greater than or equal to 8,001	25%	2,000	75

*Harvest rates include total mortalities due to bycatch in the Puget Sound Skagit Basin salmon fisheries and directed harvest in the proposed Skagit Basin fisheries, as well as non-retention in the research fishery. This includes marine and freshwater fisheries harvest estimates combined.

2.2.2 Fisheries Management

Each year, the co-managers would develop a fishery plan consistent with the preseason forecast developed under the provisions of *U.S. v. Washington*. The co-managers would monitor encounters and retention of steelhead in both directed and non-directed fisheries. Depending on the forecasted return of Skagit steelhead, the proposed RMP is designed to limit the total retention and non-retention to the harvest rates identified in Table 2-2. The tribes and WDFW would also communicate regularly and share data on run size, timing, and catch to ensure

appropriate co-management of steelhead. Should new information become available that would indicate a deviation from the steelhead fishery management regime described in the Skagit RMP or substantial changes come to light, the co-managers would consult with NOAA Fisheries, as described under the 4(d) Rule Limit 6 (NOAA 2003) and determine an appropriate course of action (Sauk-Suiattle Indian Tribe et al. 2016).

2.2.3 Reporting

The co-managers currently submit to NOAA Fisheries an annual report ("Puget Sound Steelhead Harvest Management Report") for compliance with the terms and conditions of the biological opinion for the Puget Sound salmon and steelhead fisheries (NMFS 2017b). The co-managers anticipate maintaining this report, but supplementing it with a Skagit-specific fisheries report for the Skagit SMU. The Skagit SMU annual report would provide pre-season management agreements describing fisheries consistent with the Skagit RMP, the observed landed catch and estimated mortality in tribal and recreational fisheries, the estimated number and age composition of natural spawners, terminal harvest rates, any information on illegal harvests, results from any genetic analysis, and other data collected that would be useful in the evaluation of the Skagit RMP (Sauk-Suiattle Indian Tribe et al. 2016). Any deviations from the pre-season agreement would be described and evaluated.

2.2.4 Enforcement

The WDFW Law Enforcement Program enforces regulations enacted by the Washington Fish and Wildlife Commission for non-treaty commercial and recreational fishing regulations. These officers may assist city, county, other state, and tribal law enforcement agencies, and cooperate with the U.S. Fish and Wildlife Service, NMFS Enforcement branch, and the U.S. Coast Guard in fisheries enforcement (Sauk-Suiattle Indian Tribe et al. 2016). Certain recreational fisheries may be assigned high priority for enforcement and may be more intensively monitored. Officers are assigned to work during open fishing days and restricted periods, and conduct additional checks during closed periods. Officers carry out bank and boat patrols to check and assist anglers. Covert surveillance may also be conducted where reports of violations have been received.

Individual tribal governments monitor and enforce their own commercial, subsistence, and ceremonial regulations for fisheries conducted on and off reservation (Sauk-Suiattle Indian Tribe et al. 2016). Tribal enforcement officers can be cross-deputized, and may cooperate with other tribal, state and federal fisheries enforcement agencies. Violations of tribal regulations involve fines or prosecution by tribal justice agencies. Officers are assigned to monitor all tribal usual and accustomed (U&A) fishing areas, fisheries compliance for gear, area, and retention specifics, and other tribally imposed regulations and requirements (Sauk-Suiattle Indian Tribe et al. 2016).

Officers patrol these fisheries from shore and boat, where they can also assist tribal fishers. Officers also patrol closed water for fishing out of season or in closed waters.

2.2.5 Management of Adults on the Spawning Grounds

To ensure that enough listed Skagit SMU natural origin steelhead escape to the spawning grounds, the co-managers would develop an annual plan based on the forecast of the returning run under Alternative 2, Proposed Action/Preferred Alternative. The proposed harvest plan, based on a stepped escaped abundance[9] of listed natural origin steelhead, as opposed to a numerical harvest rate under Alternative 1, No Action/Status Quo, would limit the total allowable harvest rate on the overall run at varying levels of abundance (Sauk-Suiattle Indian Tribe et al. 2016). Therefore, depending on the forecasted run size, the total proportion of the run that would "escape" the fisheries would vary — higher abundance runs would result in a lower proportion of the total run reaching the spawning grounds, while lower run abundance runs would result in a higher proportion of the total run reaching the spawning grounds (Table 2-2). More information on the development of the Skagit RMP and management of adults on the spawning grounds is further described in Section 4.3.1.2, *Skagit River Steelhead*.

The 4(d) Rule criteria (4(i)(A) for salmon and steelhead resource management plans allows populations (in this case, steelhead DIPs) to be aggregated for management purposes when dictated by information scarcity, if consistent with the survival and recovery of the listed DPS (NOAA 2003). The co-managers describe the reasons for using the Skagit River steelhead management unit (SMU) in lieu of populations units based on lack of steelhead data for each of the four DIPs (Sauk-Suiattle Indian Tribe et al. 2016). Then the co-managers apply Ricker and Beverton-Holt spawner-recruit population models to determine how many steelhead adults would be required to reach the spawning grounds so that the proposed fisheries do not appreciably affect the viable salmonid population (VSP) parameters[10] of the listed Skagit River natural origin steelhead populations within the Skagit SMU (Sauk-Suiattle Indian Tribe et al. 2016). The lowest allowable harvest rate of 4 percent has been proposed for run sizes of 4,000 steelhead or less. This means that a minimum of 96 percent of the forecasted run would escape to spawn during lower abundance run sizes (i.e., $\leq$ 4,000 steelhead). The highest allowable harvest rate of 25 percent has been proposed for run-sizes of 8,001 steelhead or greater. This means that a minimum of 75 percent of the forecasted steelhead run would escape to spawn during high steelhead abundance run sizes (i.e., $\geq$ 8,001 steelhead) (Table 2-2). A short description of how these spawner-recruit population models were derived is described in *Section 4.3.1.2, Skagit River Steelhead*.

[9] The portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds of their natal stream(s), which determines the total abundance of fish.
[10] VSP parameters include abundance, productivity, spatial structure, and diversity (McElhany et al. 2000).

The co-managers would actively monitor both the actual escapement (Skagit Basin steelhead abundance) and the fisheries (Skagit Basin harvest) within the action area to ensure that the proposed harvest rates are not exceeded (Sauk-Suiattle Indian Tribe et al. 2016). They would use the results to adaptively manage the fishery in-season, annually, over the five-year duration of the Skagit RMP.

2.2.6 Consideration of Viable Salmonid Population Parameters

NMFS's PSSTRT considered the viability of Puget Sound steelhead under the four viable salmonid populations (VSP) parameters: abundance, productivity, spatial structure and diversity (McElhany et al. 2000; NMFS 2017b)). In addition to the abundance-based stepped steelhead harvest management regimes that take into consideration impacts to abundance and productivity, the co-managers propose to implement additional fishery management strategies for the conservation spatial structure and diversity components for the Skagit SMU, in lieu of information on the individual Skagit steelhead DIPs (Sauk-Suiattle Indian Tribe et al. 2016) to address concerns outlined in NMFS' PSSTRT population delineation and viability documents (Hard et al. 2015; Myers et al. 2015). The co-managers include the following fishery management strategies in the Skagit RMP:

1) Protection of repeat spawners (i.e., kelts) - Alternative 2 (Proposed Action/Preferred Alternative) provides protection of repeat spawners by: a) opening non-treaty recreational fisheries for adult steelhead well upstream of the relatively small Nookachamps Creek population, b) closing non-treaty recreational fisheries for adult steelhead no later than April 30 to limit kelt mortality, and c) treaty fisheries targeting spring Chinook during weeks 18-30 would be conducted to limit encounters with winter steelhead kelts.

2) Protection of summer-run steelhead – Alternative 2 (proposed Action/Preferred Alternative) provides protection for the summer-run component of the Skagit steelhead populations by: a) opening non-treaty recreational fisheries directed at adult steelhead no earlier than February 1 and closing no later than April 30, and b) no directed treaty fisheries would be conducted on summer-run steelhead.

3) Protection of early run winter steelhead – Alternative 2 (Proposed Action/Preferred Alternative) provides protection of early run winter steelhead by: a) opening non-treaty recreational fisheries no earlier than February 1, and b) ensuring treaty fisheries do not target large numbers of early steelhead returns during ceremonial and subsistence fisheries but rather implement treaty fisheries across the entire adult winter steelhead return period to reduce impacts to varying diversity components of the winter steelhead populations.

4) Protection of the smaller Nookachamps Creek steelhead population – Alternative 2 (Proposed Action/Preferred Alternative) provides protection of the Nookachamps Creek population, where data are unknown, by: a) opening non-treaty recreational fisheries for adult steelhead well upstream of the relatively small Nookachamps Creek population, and b) ensuring treaty fisheries do not target large numbers of early steelhead returns during ceremonial and subsistence fisheries but rather implement treaty fisheries across the entire adult winter steelhead return period to reduce effects to varying diversity components of the smaller Nookachamps winter steelhead population.

More information on how the actions described above conserve Skagit River steelhead is also provided in the co-managers' supplemental information provided to NMFS in February 2018 (WDFW et al. 2018) (Appendix B).

2.3 Alternative 3 (Intermediate Fixed Harvest Rate) - Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend a Fixed Harvest Rate

Under this alternative, NMFS would not approve the Skagit RMP, and would recommend a Skagit steelhead fishery based on a fixed harvest rate of 10 percent on adult returning steelhead in the Skagit Basin when abundance reaches over 4,000. The intermediate fixed harvest rate of 10 percent of the total steelhead population within the Skagit Basin would not be based on varying fish abundance. At $\leq$ 4,000 fish, an incidental harvest rate of 4.2 percent would occur, which is the current baseline (No Action/Status Quo, Alternative 1). When the steelhead run size reached $\geq$ 4,001 fish, a fixed intermediate steelhead harvest rate of 10 percent would be permitted.

NMFS' ESA section 4(d) regulations require NMFS determine whether the proposed Skagit RMP meets the 4(d) criteria. Alternative 3 was not proposed by the co-managers and would not be implemented in the absence of the co-managers submitting a new RMP. Under NMFS's 4(d) regulations, NMFS does not have the authority to require the outcome of this alternative as a consequence of its 4(d) determination. Nonetheless, NMFS supports analysis of this alternative to assist with a full understanding of potential effects under various management scenarios, including those that do not achieve all of the co-managers' specific objectives. For purposes of this alternative, NMFS assumes steelhead fisheries in the Skagit Basin would be conducted in the following manner:

- Treaty Fisheries: A directed tribal fishery within the Skagit Steelhead Management Unit (SMU) would be conducted in marine and freshwater areas between December 1 and April 15, but time and area regulations would vary depending on the preseason estimate

of listed Skagit Basin natural origin steelhead run size as well as other species that may be potentially affected by a fishery. The treaty tribes commercial, subsistence, and ceremonial fisheries would utilize net and hook and line gear. The tribal fishery would be closed if potential mortality rates are anticipated to be met earlier than expected.

- Non-Treaty Fisheries: A directed Skagit SMU recreational fishery may be conducted in freshwater between February 1 and April 30 depending on preseason escapement estimates of returning listed natural origin adult steelhead and the amount of fish available under the proposed harvest regime. Time and area restrictions would vary depending on the forecasted return of listed natural origin steelhead and that of potential incidentally impacted species. Retention of listed natural origin Skagit Basin steelhead may be allowed depending upon the preseason abundance projection and given proposed harvest rates. Because the recreational fishery would be managed on a weekly, or shorter basis, fishery impacts can be projected forward and the fishery could be closed with a minimum 48 hour notice to the public. For example, the fishery could be closed early if potential mortality is anticipated to be greater than expected after calculating projected harvest for the entire season based on actual encounter rates for that year.

Under this alternative, harvest rates would be fixed at an intermediate rate of 10 percent of the total terminal (freshwater) steelhead adult return for freshwater and marine harvest (Table 2-3). When preseason forecasted steelhead abundance is less than or equal to 4,000 fish, incidental harvest rates of no more than 4.2 percent would occur. Under the lowest allowable harvest rate, 4.2 percent, a minimum of 95.8 percent of the forecasted run would escape to spawn during low abundance runs (i.e., $\leq$ 4,000 steelhead). When preseason forecasted steelhead abundance is equal to or greater than 4,001 fish, direct and incidental harvest rates of no more than 10 percent would occur. This means that a minimum of 90 percent of the forecasted steelhead run would escape to spawn during moderate abundance (i.e., $\geq$ 4,001 fish) (Table 2-3).

Table 2-3. Intermediate fixed harvest rate fishing regime for listed Skagit River natural origin steelhead.

Preseason Forecast for Natural Origin Steelhead (Terminal Run)	Allowable Harvest Rate (%)*	Maximum Number of Natural Origin Steelhead Harvested	Steelhead Returning to Spawning Grounds (%)
$\leq$4,000	4.2	0-168	95.8
$\geq$4,001	10	400 – 800+	90

*Harvest rates include total mortalities from listed Skagit Basin natural origin steelhead directed and incidental salmon fisheries as well as non-retention in the research fishery. This includes marine and freshwater fisheries harvest estimates combined.

2.4 Alternative 4 (Escapement-Based Harvest Management) - Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend a Escapement-Based Management

Under this alternative, NMFS will compare an escapement-based harvest management regime for the Skagit Basin. Escapement refers to the number of fish surviving (escaping from) the fishery at the end of the fishing season allowing them to reach the spawning grounds to spawn. A fixed escapement-based approach allows for all returning fish, over the escapement target, to be caught in the fisheries. Fishing may be curtailed in cases where the projected run size is below the escapement goal. This alternative differs from the No-Action/Status Quo, Alternative 1, Proposed Action/Preferred Alternative, Alternative 2, and the Intermediate Fixed Harvest Region, Alternative 3 because it does not rely on a particular harvest rate or tiered harvest rates. NMFS' ESA section 4(d) regulations require NMFS to make a determination that the proposed action either meets or does not meet the 4(d) criteria. Alternative 4 was not proposed by the co-managers and would not be implemented in the absence of the co-managers submitting a new RMP. Under NMFS's 4(d) regulations, NMFS does not have the authority to require the outcome of this alternative as a consequence of its 4(d) determination. Nonetheless, NMFS supports analysis of this alternative to assist with a full understanding of potential effects under various management scenarios, including those that do not achieve all of the co-managers' specific objectives. For purposes of this alternative, NMFS assumes steelhead fisheries in the Skagit Basin would be conducted in the following manner under this alternative:

- Treaty Fisheries: A directed tribal fishery within the Skagit Steelhead Management Unit (SMU) would be conducted in marine and freshwater areas between December 1 and April 15, but time and area regulations would vary depending on the preseason estimate of listed natural origin steelhead run size as well as other species that may be potentially affected by a fishery. The treaty tribes commercial, subsistence, and ceremonial fisheries would utilize net and hook and line gear. The tribal fishery would be closed if potential mortality rates are anticipated to be met earlier than expected.

- Non-Treaty Fisheries: A directed Skagit SMU recreational fishery may be conducted in freshwater between February 1 and April 30 depending on preseason escapement estimates of returning listed adult natural origin steelhead and the amount of fish available under the proposed harvest regime. Time and area restrictions would vary depending on the forecasted return of listed natural origin steelhead and that of potential incidentally impacted species. Retention of listed natural origin Skagit Basin steelhead may be allowed depending upon the preseason abundance projection and given proposed

harvest rates. Because the recreational fishery would be managed on a weekly, or shorter basis, fishery impacts can be projected forward and the fishery could be closed with a minimum 48 hour notice to the public. For example, the fishery could be closed early if potential mortality is anticipated to be greater than expected after calculating projected harvest for the entire season based on actual encounter rates for that year.

Under this particular alternative, NMFS will examine the effects of a harvest management regime based on a fixed escapement or spawning goal of 6,000 listed natural origin steelhead adult returns to the Skagit Basin. Below an escapement goal of 6,000, no directed fishing would occur; only incidental catch of listed natural origin steelhead in salmon-directed fisheries would occur at the current average harvest rate described under Alternative 1 (4.2 percent) (Table 2-4). At an escapement or spawning goal of equal to or above 6,000, incidental or directed harvest of greater than 4.2 percent would occur. The lowest allowable incidental harvest rate of 4.2 percent is examined for run sizes of 5,999 steelhead or less. This means that a minimum of 95.8 percent of the forecasted run would escape to spawn during low abundance runs (i.e., $\leq$ 5,999 steelhead). For analysis purposes, a harvest rate of up to 16 percent was chosen for escapement estimates at 6,000 or greater because this rate was proposed, but not implemented, for the Skagit River in a previous draft steelhead harvest management plan for Puget Sound steelhead (PSIT and WDFW 2010b). Thus, a moderate allowable direct and incidental harvest rate of 16 percent would be examined for run sizes of 6,000 steelhead or greater. This means that a minimum of 84 percent of the forecasted wild steelhead run would escape to spawn during moderate steelhead abundance (i.e., $\geq$ 6,000 steelhead) (Table 2-4).

Table 2-4. Escapement-based harvest management for listed Skagit River natural origin steelhead.

Preseason Forecast for Natural Origin Steelhead (Escapement or Spawning Goal)	Allowable Harvest Rate (%)*	Maximum Number of Natural Origin Steelhead Harvested (#)	Steelhead Returning to Spawning Grounds (%)
$\leq$5,999	4.2	0 – 252	95.8
$\geq$6,000	Up to 16%	960 – 1,280+	84

*Harvest rates include total mortalities from Skagit Basin incidental salmon fisheries as well as non-retention in the research fishery in years where escapement estimates are below 6,000 fish. Harvest rate includes total mortalities from Skagit Basin incidental salmon and directed steelhead fisheries as well as non-retention in the research fishery in years where escapement estimates are above 6,000.

2.3 Alternatives Considered but not Analyzed in Detail

A fixed effort management regime was considered but not analyzed in detail. Fixed effort management would establish a constant metric of effort for each fishery. This could be number of fishing days, number of angler days, fishing hours for a net fishery, etc. Fixed effort management is useful when there is no preseason forecast of abundance. A fixed effort fishery is relatively simple to implement, requiring only that effort and catch be measured. NMFS believes that this alternative does not meet the Purpose and Need because this alternative would not be actively responsive to variable annual abundance for ESA-listed steelhead. Fixed effort management can threaten the sustainability of the species in years of low abundance if the fish caught with the fixed effort does not allow for a sufficient number of spawners to reach the spawning grounds. Fixed effort management does not incorporate NMFS' best available science while adequately contributing to the conservation of salmon and steelhead and meeting their biological requirements in light of harvest activities (NOAA 2003).

2.4 Summary of Alternatives to be Analyzed

The four alternatives to be analyzed in this assessment are Alternative 1 (No Action/Status Quo), Alternative 2 (Proposed Action/Preferred Alternative), Alternative 3 (Intermediate Fixed Harvest Rate), and Alternative 4 (Escapement-Based Management Regime). The four alternatives vary in harvest management approaches from fixed to varying tiered harvest to an escapement-based regime and are summarized below.

Under Alternative 1 (No Action/Status Quo Alternative), the fisheries would continue, and an estimated bycatch (incidental take) rate of up to of 4.2 percent[11] of listed Puget Sound steelhead abundance would likely continue (i.e., ongoing fisheries for Chinook, chum, coho, sockeye, and pink salmon and hatchery steelhead). Figure 2-4 shows the potential escapement (total listed natural origin steelhead abundance) and harvest levels resulting from Alternative 1. Although NMFS has estimated that current levels of incidental take of listed natural origin steelhead in treaty and non-treaty fisheries under this alternative would not exceed 4.2 percent[12], the actual incidental take rates recently have averaged 3.1 percent from 2007/08 to 2015/16 (NMFS 2017b).

[11] Aggregate annual average steelhead harvest rate across winter-run populations from the: Skagit, Snohomish, Green, Puyallup, and Nisqually basins.

[12] The current biological opinion for the Puget Sound salmon and steelhead fisheries estimates incidental take of 4.2% of natural origin listed steelhead in terminal waters and 325 listed natural origin, unlisted hatchery origin, and unlisted Canadian steelhead in marine waters (see No-Action/Status Quo, Alternative 1).

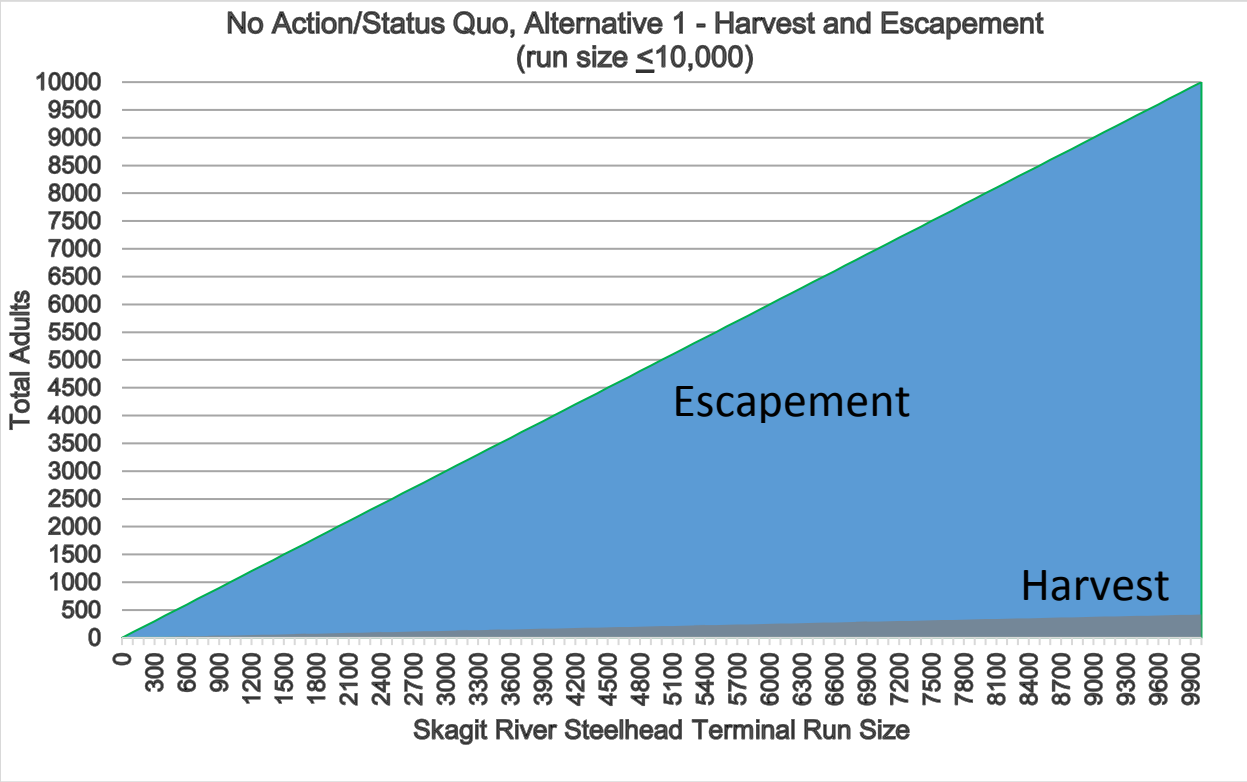

Figure 2-4. Projected harvest and escapement of listed Skagit Basin natural origin steelhead, for a total run size of 10,000 adults under Alternative 1 (No Action/Status Quo Alternative).

Alternative 1 (No Action/Status Quo Alternative) is the only alternative where actual harvest data exists. Alternative 2 through 4 are either the proposed action (Alternative 2) or assumed harvest regimes (Alternative 3 & 4) for comparison of environmental impacts under various harvest regimes.

Under Alternative 2 (Proposed Action/Preferred Alternative), the harvest of listed Skagit River natural origin steelhead, within the project area, would be managed under the proposed Skagit RMP. This would establish a Skagit Steelhead Management Unit (SMU), with a harvest rate managed independently from the other (non-Skagit) steelhead populations in Puget Sound. The Proposed Action adopts an abundance-based, stepped harvest rate, which increases at specific abundance levels, as the total listed Skagit River natural origin steelhead abundance increases (Figure 2-5). The proposed stepped harvest rates would include both direct harvest and incidental harvest as well as non-retention in the research fishery. The lowest proposed harvest rate of 4 percent would apply to abundances at or below 4,000 adult steelhead (effectively limiting harvest to incidental take for existing fisheries). That rate would increase to 10 percent for abundances between 4,001 and 6,000 steelhead. Between 6,001 and 8,000 steelhead the harvest rate would be 20 percent, and above abundances of 8,001 steelhead, the harvest rate would increase to 25

percent (Table 2-2). Figure 2-5 shows the potential escapement and harvest levels resulting from Alternative 2 (Proposed Action/Preferred Alternative).

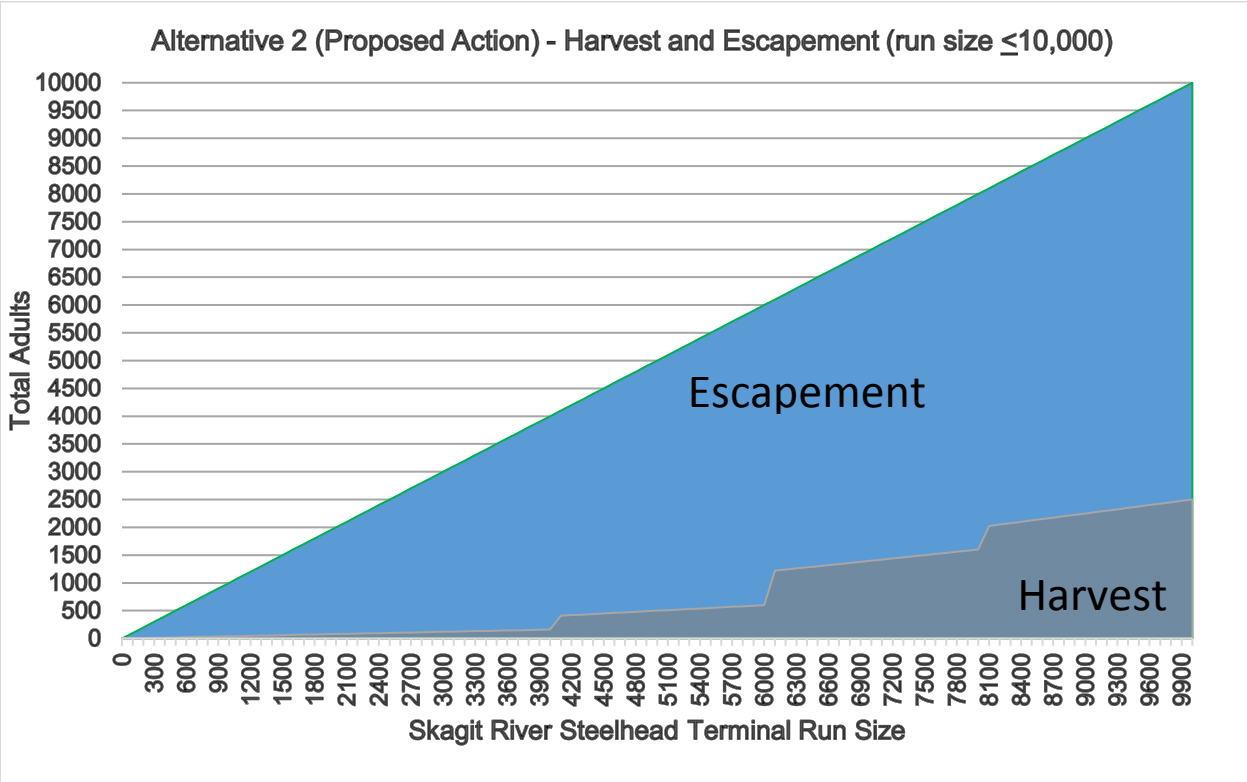

Figure 2-5. Projected harvest and escapement of listed Skagit Basin natural origin steelhead, for a total run size of 10,000 adults, under Alternative 2 (Proposed Action/Preferred Alternative).

Under Alternative 3 (Intermediate Fixed Harvest Rate), an intermediate fixed direct and incidental steelhead harvest rate of 10 percent is used for listed adult natural origin returning steelhead in the Skagit Basin at abundance levels of 4,001 fish or greater. At abundance levels of 4,000 fish or less, a steelhead incidental harvest of 4.2 percent would occur. Figure 2-6 shows the potential listed natural origin escapement and harvest levels resulting from Alternative 3 (Intermediate Fixed Harvest Rate Alternative).

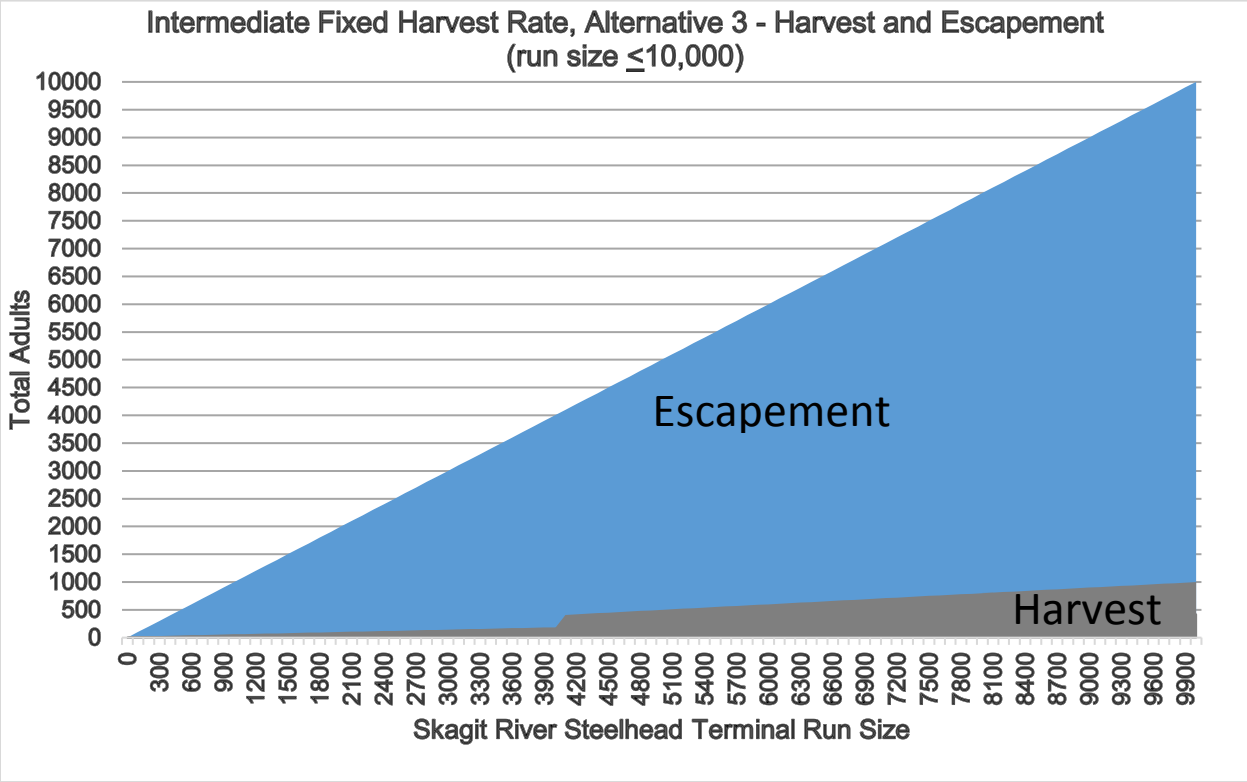

Figure 2-6. Projected harvest and escapement for listed Skagit Basin natural origin steelhead under Alternative 3 (Intermediate Fixed Harvest Rate Alternative).

Under Alternative 4 (Escapement-Based Management Regime), an escapement rate or spawning goal of 6,000 steelhead in the Skagit Basin is used. At abundances of 5,999 fish or less, an incidental steelhead harvest rate of 4.2 percent would occur. At abundances of 6,000 or greater, a direct and incidental steelhead harvest rate of up to 16 percent would occur. Figure 2-7 shows the potential listed natural origin escapement and harvest levels resulting from Alternative 4 (Escapement-Based Management Regime Alternative). Instead of fixed or stepped harvest rates, this alternative is based on a set escapement or spawning goal (i.e., 6,000 listed adult natural origin steelhead returns) before directed harvest can occur.

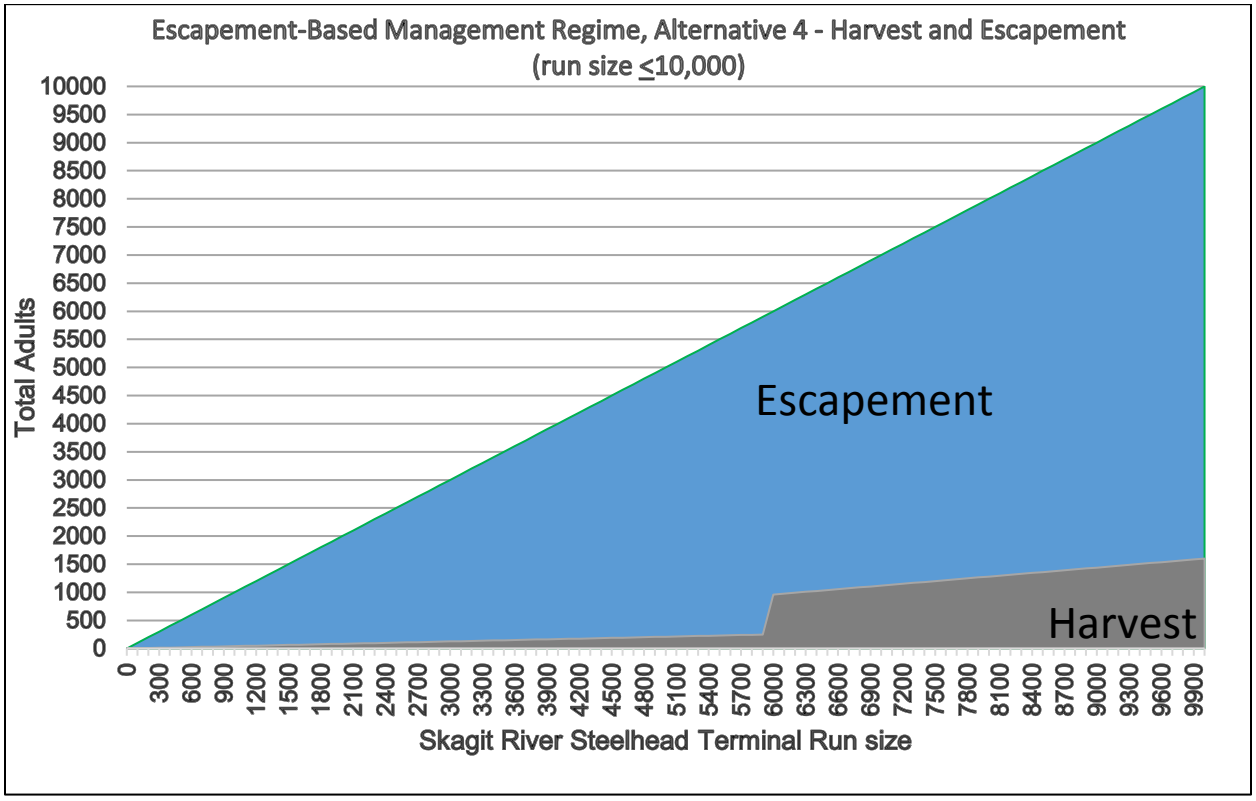

Figure 2-7 Projected harvest and escapement of listed Skagit Basin natural origin steelhead, for a total run size of 10,000 adults under Alternative 4 (Escapement-Based Management Alternative).

3. AFFECTED ENVIRONMENT

3.1 Introduction

Chapter 3 describes the physical, biological, and social components within the project area that would be affected from steelhead harvest in the project area for the 2018/19 to 2022/23 fishing seasons. Resource areas discussed are those topics required to be considered under NEPA and have the potential to be impacted from implementation of the Proposed Action.

3.1.1 Scoping

Through internal scoping, each resource area was reviewed to determine if the resource area had the potential to be impacted by the Proposed Action (Table 3-1). If not, or if the impact is considered negligible, the resource area would not be considered for further analysis in this EA. If the resource area has the potential to be impacted by the Proposed Action, then the resource is described in Chapter 3, Affected Environment, and analyzed in Chapter 4, Environmental Consequences of this EA.

Table 3-1. Resources Considered for Evaluation in this EA.

Resource	Analyzed (Yes/No)	Adverse Effects	Beneficial Effects
Wildlife Species	Yes	No to Low	No to Low
Fish Species	Yes	Low	No to Low
Target/Non-target Species	Yes	No to Low	No to Low
Listed Species & Critical Habitat	Yes	Low to Moderate	No to Low
Non-listed Species	Included above[1]	--	--
Listed Plants	No	--	--
General Vegetation	No	--	--
Marine Ecosystem & Fish Habitat	Yes	Low	No
Invasive Species	No	No	No
Tourism & Recreation	Yes	No	Low to Moderate
Environmental Justice	Yes	No to Low	No to Low
Cultural Resources	Yes	No	High
Socioeconomics	Yes	No to Low	No to Low
Public Services	No	--	--
Human Health & Safety	Yes	No to Low	No
Climate Change	Yes	Low	Low
Ocean Acidification	No	--	--
Geology & Soils	No	--	--
Air Quality	No	--	--
Water Quality/Quantity, Groundwater, Hydrology	No	--	--
Aesthetics, Light & Glare	No	--	--
Noise	No	--	--
Land Use, Ownership	No	--	--
Transportation	No	--	--
Agriculture	No	--	--

[1] Any other non-listed species would be addressed in the above categories: wildlife, fish, and target/non-target species.

As a result of the review above, the resource areas evaluated in this EA include:

- Wildlife: including listed species and their including critical habitat, non-listed species, target species, non-target species, marine ecosystems and habitat

- Fish: including listed species and their including critical habitat, non-listed species, target species, non-target species, marine ecosystems and habitat
- Environmental Justice
- Cultural Resources
- Socioeconomics and Tourism and Recreation
- Climate Change

The resources are discussed relative to how steelhead harvest affects the resource. Where applicable, background information is taken from the *Puget Sound Chinook Harvest Resource Management Plan Final Environmental Impact Statement* (NMFS 2004b) and the *2017-2018 Puget Sound Salmon and Steelhead Fisheries Plan Final Environmental Assessment* (Bureau of Indian Affairs 2017), where applicable, along with other more recent published information. Chapter 3 also begins with a description of the environmental setting considered for the resource analysis.

3.2 Wildlife

Cederholm et al. (2000) compiled a detailed synopsis of relationships between salmon species (including steelhead) and wildlife, and focused on predator/prey relationships between steelhead and wildlife currently and historically common throughout Washington. There are seven indigenous salmon and trout of the genus *Oncorhynchus* in Washington and Oregon (Chinook, coho, chum, sockeye, and pink salmon, and steelhead and cutthroat trout). Other indirect relationships between salmon and steelhead and wildlife include wildlife nutrient benefits from fish carcasses in fresh water, the transfer of toxins in salmonids to wildlife predators, the disturbance of wildlife habitat during fishing, the potential bycatch of wildlife during fish harvest, and the impact of derelict fishing gear to wildlife. These effects to wildlife are discussed below.

3.2.1 Predator/Prey Relationships

Numerous wildlife species prey on salmon and steelhead. Other species, such as marine and freshwater invertebrates, are prey of salmon and steelhead. Of the wildlife that currently occur or were historically common in Washington, over 100 vertebrate wildlife species have a relationship with salmon and steelhead (Cederholm et al. 2000).

Listed Species. Threatened and endangered species that may have a consistent relationship with steelhead are the grizzly bear (state endangered and federally threatened) and Southern Resident Killer Whale (state and federally endangered). The grizzly bear is not known to occur in Puget Sound waters or adjacent shoreline so effects to grizzly bear will not be analyzed further in this EA.

The Southern Resident Killer Whale (SRKW) was listed as endangered under the ESA in 2005 (70 FR 69903, November 18, 2005). Critical habitat was also identified in Puget Sound (71 Fed. Reg. 69054, November 29, 2006). In 2014, NMFS compiled a 10-year report on research and conservation efforts to support SRKW recovery.[13] In 2016, NMFS finalized a 5-year status review under the ESA, which provided an update on the status of SRKW and recommended that the species should remain listed as endangered. The 5-year review evaluated progress toward meeting the recovery criteria identified in the recovery plan. NMFS also launched a Species in the Spotlight program, identifying eight species that are among the most at risk of extinction, including the SRKW, and initiating an agency-wide effort to save these highly at-risk species (NMFS 2016a). NMFS identified three main threats to SRKW survival including scarcity of prey, high levels of contaminants, and disturbance from vessels and sound (NMFS 2016a) but is not certain which threat is the most important to address in order to ensure recovery. SRKW prey on salmon, and actions are ongoing to restore salmon populations and degraded nearshore habitats on the West Coast (NMFS 2016a). A research program is underway to gather more information about SRKW biology, habitat use and distribution, and impacts from different threats, and to monitor population status.

The SRKW population consists of three pods (J, K, and L) for a total of 77 whales (NMFS 2017b) that inhabit coastal waters off Washington, Oregon, and Vancouver Island but are also know to travel as far south as central California and as far north as Southeast Alaska (NMFS 2008). Since the July 2017 census, one mortality occurred and the total population is currently 76 whales. During the summer and fall months, the whales spend a substantial amount of time in the inland waters of Strait of Georgia, Strait of Juan de Fuca, and Puget Sound (Bigg 1982; Ford 2000; Hanson and Emmons 2010). By late fall, all three pods are seen less frequently in inland waters. In recent years, several sightings and acoustic detections of SRKW have been made off the Washington and Oregon coasts in the winter and spring (Hanson et al. 2010; Hanson et al. 2013). Satellite tags have also provided more data on SRKW movements in the winter, confirming that K and L pods use the coastal waters along Washington, Oregon, and California during non-summer months (Mongillo 2018). SRKW K and L pods occur with greater frequency off the Columbia River and Westport, most commonly in March (Hanson et al. 2013). The limited range of the sightings and acoustic detections of J pod in coastal waters, the lack of coincident occurrence during the K and L pod sightings, and the results from satellite tagging in 2012–2016 (NWFSC unpubl. data) indicate J pod's limited occurrence along the outer coast and extensive occurrence in inland waters, particularly in the northern Georgia Strait (Mongillo 2018).

SRKW consume a variety of 22 different fish species and 1 species of squid (Ford et al. 1998; Ford 2011). Their primary prey in inland marine waters during the summer months is Chinook

[13] NMFS 2014 Southern Resident Killer Whale 10-Year Report can be found at: https://www.nwfsc.noaa.gov/news/features/killer_whale_report/.

salmon but the whales are also likely to rely on other fish species, such as coho, chum, and steelhead to supplement their diet during the winter months when Chinook salmon are not present (Mongillo 2018). Research indicates that their diet consists of a high percentage (> 90%) of Chinook salmon from May to September (Hanson et al. 2010). SRKW prey shifts at the end of the summer towards coho salmon (up to 40%) with chum salmon, sockeye salmon, and steelhead making up relatively small contributions to the whales' diet (less than 3% each) (NMFS 2016a; 2017b). No diet study results are available for the winter months at this time. This is likely due to the fact that the majority of the SRKW population migrates to the coastal waters, Columbia River, and Westport during winter months.

NMFS implemented conservation measures that included convening an independent science panel to critically evaluate the effects of salmon fisheries on the abundance of prey availability (specifically Chinook salmon) to the SRKW (NMFS 2017b). The independent scientific panel concluded that on a broad scale, salmon abundance will likely influence the recovery of the whales, but that there was a great deal of uncertainty about whether current fisheries remove enough salmon to have a meaningful influence on the whales' status (NMFS 2016a). The impact of reduced Chinook salmon harvest on future availability of Chinook salmon to the whales is not clear, and the science panel cautioned against overreliance on correlative studies or implicating any particular fishery (Hilborn et al. 2012). NMFS has been developing a risk assessment framework relating Chinook salmon abundance to SRKW population dynamics that will help evaluate harvest impacts and this work, as well as other research on SRKW diets is currently ongoing (NMFS 2017b). Using best available science, NMFS determined that Puget Sound salmon and steelhead fisheries for 2017 are not likely to jeopardize the continued existence of the SRKW population or adversely modify or destroy its critical habitat (NMFS 2017b).

The co-managers do not anticipate any impacts to occur to the threatened Southern Resident Killer Whale population under the proposed action (McClure 2017) because the J, K, and L pods are unlikely to be in the action area (Figure 1-1) when the steelhead fisheries would occur (December through April). Current data regarding Chinook salmon prey events demonstrates that the SRKW population (J, K, and L pods combined) was detected in inland waters[14] only an average of 4 days per month during January through March and feed primarily on Chinook salmon. As steelhead migrate to their spawning grounds, any fish in the action area would be available to the SRKW prior to being available in the steelhead fisheries. During the remaining days per month the SRKW population was detected in coastal waters, also primarily feeding on Chinook salmon (Mongillo 2018). SRKW steelhead-specific diet data has not been compiled monthly (similar to the Chinook salmon diet data described here) as of yet but NMFS' risk

[14] Inland waters is defined as the mouth of Strait of Juan de Fuca, Strait of Georgia and Puget Sound. Coastal waters are defined as the Pacific Coast of Alaska, Canada, Washington, Oregon, and California.

assessment continues to progress. NMFS anticipates that we will have more diet information evaluated and available for other species of salmon in the near future (Mongillo 2018).

Six species of whale that are federally or state listed occur in Washington waters (sperm whale, humpback whale, blue whale, fin whale, sei whale, and North Pacific right whale). However, these species are either rare or do not occur within Puget Sound inland waters (WDFW 2013) or are not found in the proposed action area (Figure 1-1). Therefore, effects to other species of whales will not be analyzed further in this EA. The green sea turtle and loggerhead sea turtle (both state and federally listed) have only been recorded off the coast of Washington and do not feed on salmon (WDFW 2013). Therefore, effects to the green and loggerhead sea turtles will not be analyzed further in this EA.

Listed bird species include the short-tailed albatross, marbled murrelet, and snowy plover. The short-tailed albatross may feed on fish species, such as salmon and steelhead, and is known to be impacted from fishing gear and hooking and drowning on commercial longline gear; however, its distribution is limited to sightings along the outer coast of Washington (USFWS 2001). The marbled murrelet is also known to feed on juvenile salmon, such as steelhead and could occur in the marine waters of the proposed action area (Figure 1-1). Possible effects include entanglement in tribal and non-tribal drift net, set net, purse seine, or hook and line fishing gear. Direct effects of entanglement with fishing gear include injury or mortality. Indirect effects of entanglement include loss of eggs or nestling murrelets through malnourishment due to the death of one or both of their nesting parents. These effects are analyzed in the U.S. Fish and Wildlife Service biological opinion on marbled murrelet for the Puget Sound treaty and non-treaty gillnet fisheries and are incorporated in this document by reference (USFWS 2017; Section 5.1.4, *Summary of the effects of the Proposed Action Overview*; Table 18). The snowy plover only occurs along the southern Washington coast (Paulson 1993) so this species will not be analyzed further in this EA.

Marine Mammals (non-listed). Puget Sound marine mammals are protected under the Marine Mammal Protection Act (16 USC 31). Other than the ESA-listed marine mammal species, as described above, additional marine mammals that occur in Puget Sound are the Pacific harbor seal, California sea lion, Steller sea lion, northern elephant seal, harbor porpoise, gray whale, and minke whale. Three of these species (Steller sea lion, California sea lion, and harbor seals) have a recurrent relationship with steelhead because steelhead are a prey base for these species (Cederholm et al. 2000). Predation on steelhead by marine mammals (principally seals and sea lions) may be of concern in some local areas of Puget Sound experiencing dwindling steelhead run sizes (72 FR 26732, May 11, 2011). The other marine mammal species either do not have a relationship with steelhead or do not occur in Puget Sound waters (NMFS 2014). Steller sea lions, California sea lions, and harbor seals often occur in areas where steelhead concentrate. However, these marine mammal species are not known to be dependent on steelhead specifically; rather these species are opportunistic feeders and would prey on a variety of fish

species, including steelhead, dependent on local abundance and distribution (summary in NMFS 2014).

Bald Eagles and Golden Eagles. The bald eagle and golden eagle are protected under the Bald Eagle and Golden Eagle Protection Act (16 USC 668-668c). Bald eagles are considered to have a strong, consistent relationship with salmon, although not steelhead specifically (Cederholm et al. 2000). The strong, consistent relationship that bald eagles have with salmon occurs in salt water when the species can feed on live adult salmon and in fresh water when bald eagles feed on spawning adult salmon. Golden eagles primarily feed on small to medium size mammals such as rabbits, ground squirrels, and marmots as well as birds and reptiles. They are terrestrial predators and also capable of killing larger mammals, including deer, domestic livestock, bighorn sheep, bobcats, etc.[15] Golden eagles are rarely found near water and generally do not feed on fish[16] so effects to golden eagles will not be analyzed further in this EA.

Fisheries harvest does not directly impact bald eagles; however, harvest has potential to indirectly affect their food supply. Bald eagles are considered opportunistic feeders and can feed on live and dead animals including fish, waterfowl, small mammals, reptiles, and other birds (Puget Sound Institute 2016). Eagles could be affected by harvest activities in that such activities remove adult steelhead that otherwise may be a food source or indirectly decrease the amount of juvenile steelhead in the watershed. However, steelhead spawning occurs in the winter and spring when high water and flooding events typically wash steelhead carcasses out of the system. Steelhead adult carcasses are not as plentiful or abundant food source to eagles as salmon carcasses due to their spawn timing. The bald eagle is not known to be dependent on steelhead specifically; rather this species would prey on variety of other fish, waterfowl, small mammals, reptiles, and birds. They are also known to steal food from other animals or scavenge on carrion (dead animals).[14]

Migratory Birds. There are numerous water birds that are migratory and protected under the Migratory Bird Treaty Act of 1918 (16 USC 703). These species include gulls, kingfishers, loons, murres, oystercatchers, shorebirds, cormorants, and many species of ducks (USFWS 2016). As described by Cederholm et al. (2000), migratory bird species include the harlequin duck which has a strong, consistent relationship with salmon eggs and alevin; grebes, loons, pelican, cormorants, gulls, and other migratory bird species that have a *Recurrent* relationship with juvenile salmon, such as steelhead; and other migratory bird species that have an indirect relationship with juvenile salmon, such as steelhead. The relationship is primarily as bird predators that consume juvenile salmon as prey. Generally, the birds prey on salmon juveniles. Harvest of adult steelhead would not directly affect the food supply of migratory birds, but may

[15] American Eagle Foundation: https://www.eagles.org/what-we-do/educate/learn-about-eagles/golden-eagle-diet/#toggle-id-1.
[16] National Eagle Center: https://www.nationaleaglecenter.org/eagle-diet-feeding/.

indirectly affect the number of juvenile steelhead produced in the system. This is subject to potential density-dependent dynamics, which may allow the population to produce an equal amount of juveniles at varying escapement levels. Predation on steelhead by migratory birds may be of concern in some local areas of Puget Sound experiencing dwindling steelhead run sizes (72 FR 26732, May 11, 2011).

3.2.2 Steelhead Carcass Nutrient Benefits

Research in Pacific Northwest streams indicates the importance of anadromous salmon, including steelhead, to freshwater and terrestrial food webs and ecosystem function (Kline et al. 1990; Cederholm et al. 2000; Hilderbrand et al. 2004). In addition to live steelhead consumed by wildlife predators, steelhead carcasses can provide a potential carrion food source to wildlife and a source of nutrients to other aquatic and terrestrial species through the decomposition of carcasses.

Birds (such as wintering bald eagles), mammals, and aquatic invertebrates feed directly on steelhead carcasses, and the decomposer communities (i.e., organisms including bacteria, fungi, and invertebrates that decompose organic material) that develop on carcasses are, in turn, consumed by other aquatic invertebrate species (Willson et al. 1998). The input of marine-derived nutrients, such as phosphorus and nitrogen, into streams is thought to substantially enhance productivity of many nutrient-poor coastal streams (reviewed by Willson et al. 1998) and riparian vegetation communities (reviewed by Hilderbrand et al. 2004).

3.2.3 Transfer of Toxins from Steelhead to Wildlife

Wildlife species that consume salmon, including steelhead, are susceptible to toxic contaminants and/or pathogens that may be within the fish they consume. There is evidence of bioaccumulation in fish-eating birds and mammals of persistent organic pollutants, including polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethanes (DDTs) and other pesticides, polycyclic aromatic hydrocarbons (PAHs), fire retardants (such as polybrominated diphenyl ethers [PDBEs]) and other compounds that may cause a range of deleterious health effects (Anthony et al. 1983; Ross et al. 2000; Tabuchi et al. 2006; review in Puget Sound Action Team 2007; Cullon et al. 2009; O'Neill and West 2009). Salmon, such as steelhead, may pass contaminants onto wildlife that prey on them.

3.2.4 Harvest Habitat Disturbance

Harvest activities result in use of wildlife habitat specific to the aquatic environment and adjacent riparian and shoreline habitat and the impact is primarily related to disturbance from the

presence of boats, people, and noise (Kelly et al. 2004). The disturbance results in wildlife expending energy to move away from the fishing activity and search for another location to forage, although some gulls are attracted to fishing vessels and the discarded bycatch that is thrown overboard. Habitat disturbance would be limited to animals and fish that live near or in the water.

Fish habitat potentially affected by steelhead fishing within the action area (Figure 1-1) includes benthic substrate and associated plant and animal communities in marine areas where gillnets are used. The most common habitat impact results from actively-fished net gear (NMFS 2004b). This may cause scouring of the seabed or river bottom by the weighted line at the bottom of gill nets. While this undoubtedly occurs in some fishing areas, fishermen endeavor to avoid entanglement and abrasion to their fishing gear. Not only does it interrupt fishing time on the water to untangle nets but it also results in costly repair to the gear. Contact with the bottom substrate also reduces fishing efficiency that results in an overall reduction in catch so fishermen avoid contact with the substrate. While local effects may be observable, it is unlikely that impacts are detectable on a broad scale (NMFS 2004b).

Freshwater spawning and riparian rearing habitat may be affected by in-river fisheries by wading fishermen that walk into the river, contact of fishing gear with the bottom substrate, the wakes of fishing craft that may potentially cause bank erosion, or other mechanical disturbances.

During freshwater steelhead fisheries, anglers frequently lose tackle when their weights become stuck or tangled (NMFS 2004b). Because many artificial lures used in steelhead fisheries are buoyant they float above the bottom substrate where they may continue to attract or hook fish.

Trampling of spawning redds during stream wading has the potential to cause mortality of salmonids (NMFS 2004b). Available information on steelhead redd disturbance and resulting mortality is anecdotal and the extent or cumulative effect of this type of damage is not known (Roberts and White 1992). Anglers are well-informed regarding the importance of protecting steelhead spawning redds and this type of angling behavior (trampling of redds) is frowned upon by the fishing community, which assists in reducing the overall impact to negligible effects.

Some studies have found a relationship between shore angler use, a decrease in riparian plant diversity, and bank erosion (Sutherland and Ogle 1975; Horton 1994). In areas of the river with high power boat use, one study found an increase in bank erosion (King 2002). While local effects may be observable, it is unlikely the impacts are detectable on a broad scale within the action area (NMFS 2004b).

3.2.5 Marine Mammal and Seabird Bycatch

Bycatch is the incidental capture of non-target species, including that brought to ports or discarded during fisheries harvest activities. Although the vast majority of bycatch are fish species, harvest activities can also impact wildlife. Wildlife species most likely caught in fisheries bycatch are seabirds that dive underwater and marine mammals.

Wildlife species of concern in the proposed action area (Figure 1-1) for bycatch in fisheries are: Steller sea lions, marbled murrelet, and common murres. NMFS (2003) reported that serious injuries or mortalities of marine mammals from bycatch is remote and that direct impacts on seabirds are also minimal to non-existent. Marbled murrelet (*Brachyramphus marmoratus*) are listed as a threatened species by the USFWS under the ESA and incidental take in Puget Sound salmon and steelhead fisheries have been assessed in the recent USFWS Biological Opinion (USFWS 2017). The recent regulations for Puget Sound commercial salmon seasons include restrictions specific to purse seine and gill-net gear that are expected to reduce seabird bycatch in non-treaty commercial fisheries (WDFW 2015; NOAA Fisheries 2017).

3.2.6 Derelict Fishing Gear

Also referred to as ghost nets, derelict fishing gear is known to trap, wound, and/or kill seabirds, sea turtles, fish, and marine mammals (Gilardi et al. 2010). WDFW estimated that hundreds of tons of derelict fishing gear have collected over time in Puget Sound, including the Strait of Juan de Fuca up to the Canadian border (WDFW 2016). Derelict fishing gear includes terminal tackle from recreational salmon gear, salmon fishing nets, recreational and commercial crab pots, and traps, longlines, and trawls. The cause of derelict fishing gear may include weather conditions (e.g., storms), gear entanglement with other vessels including recreational boaters and commercial freighters, entanglement on bottom topography (such as rocky reefs), and old age or overused fishing gear.

From a gill-net study in Europe, less than 1 percent of all nets deployed resulted in fishing gear loss, although the relationship was found to be dependent on water depth such that fishing in waters greater than 1,640-foot depth was most likely to result in more loss due to excessive net length, increased soak times, and gear stress (Hareide et al. 2005). Other studies have found varied results depending on study location. As summarized by Gilardi et al. (2010), derelict fishing gear has been identified as a major cause of morbidity and mortality in some fish, coral, and wildlife populations. From a study in Puget Sound, mortality from 870 derelict gill nets was associated with 31,278 invertebrates (76 species), 1,036 fishes (22 species), 514 marine birds (15 species), and 23 marine mammals (4 species) (Good et al. 2010).

Derelict fishing gear made of synthetic materials may take years to decompose in water, although fouling of derelict gear from moss and algae accumulation reduces its effect over time. In addition to wildlife becoming entangled in derelict fishing gear, the gear can also damage underwater habitats and cause economic impacts (e.g., the cost of replacing the lost gear). In Puget Sound, there are multiple programs to promote onshore collection, disposal, and recycling of used gear. In addition, Northwest Straits Commission works directly with WDFW and tribes to find and remove derelict fishing gear.

Gilardi et al. (2010) summarized that, in Washington State, over 85 tons of derelict gear (primarily crab pots and gill nets) were removed from Puget Sound since 2002. In correspondence with Natural Resource Consultants, Gilardi et al. (2010) stated that Natural Resource Consultants predicted that 16 to 42 nets were lost annually in the Puget Sound from drift gill-net fisheries along with purse seines and set gill nets. Gibson and NWIFC (2013) stated that over 4,000 derelict fishing nets were removed from the Puget Sound over the past decade at a cost of several million dollars. This latter study focused on recommendations to prevent future derelict fishing gear. The gill nets become snagged on rocky outcroppings and on rocky ledges (Northwest Straits Commission 2015) although interactions with marine boat traffic is a known cause of lost fishing gear also. Best management practices are implemented by the co-managers to reduce, report, and retrieve derelict fishing gear in Puget Sound, including within the proposed action area (Figure 1-1) (NMFS 2017b). Treaty and non-treaty fisherman are required to report missing gear within 24 hours of loss (NMFS 2017b).

3.3 Fish

3.3.1 Listed Salmon and Steelhead

There are three species of ESA-listed pacific salmonids in the Puget Sound: the Puget Sound Chinook salmon ESU, listed as threatened, the Puget Sound steelhead DPS, listed as threatened, and the Hood Canal summer chum listed ESU, listed as endangered. The only listed salmon or steelhead species affected by the proposed action is the Puget Sound steelhead DPS.

There are four Chinook salmon populations (Upper Skagit River, Lower Skagit River, Upper Sauk River, and Lower Sauk River Chinook salmon) that occur within the proposed project area. Puget Sound Chinook salmon are not included in this NEPA analysis because the fall-run and spring-run of Skagit Chinook salmon occur before and after the planned fisheries, respectively. Hood Canal summer chum do not occur in the proposed project area (Sauk-Suiattle Indian Tribe et al. 2016). Annually, NOAA Fisheries provides guidance, based on co-manager input, regarding conservation needs for ESA-listed salmonid species at the beginning of the salmon and steelhead pre-season harvest planning process in March (NMFS 2017b).

While directed and incidental, hatchery origin salmon and steelhead harvest has been modified and decreased over time to minimize impacts to the abundance, productivity, spatial structure, and diversity of listed natural and hatchery origin salmon and steelhead in Puget Sound (PSIT and WDFW 2010a), harvest is only one of many factors affecting salmon and steelhead (WDFW 2015). In addition to harvest, there are several past and current factors that also impact salmon survival in fresh and marine waters. Known factors (in addition to harvest) that affect salmon survival in fresh water include habitat loss and degradation; decreased water quality and quantity (including contaminant releases); dams, diversions, and culverts blocking fish access; shoreline modifications impacting migration and cover; predation; hatchery management actions; and climate change (such as increasing temperatures and changes in stream flow) (summarized in NMFS 2017b). Impacts to salmon and steelhead diversity, occurrence, and abundance in the marine environment include degraded and converted estuarine habitat, water quality degradation and contaminant releases, climate change affecting ocean temperature and salinity (NWFSC 2015).

In reference to salmon and steelhead habitat, NWIFC (2016) states that aquatic habitat within the Puget Sound has degraded over time due to the following principal findings:

- Degradation of habitat outpaces estuary restoration
- Degraded nearshore habitat is unable to support forage fish
- Freshwater shoreline armoring continues unabated
- Forest cover is disappearing
- Streams lack large woody debris
- Riparian forests not recovering
- High number of stream crossings, high road densities
- Impervious surface area impacts water quality, runoff timing, and salmonid habitat
- Fish barriers cut off vast amounts of habitat
- Agricultural lands remain degraded
- Sensitive flood plains being overdeveloped
- Rapidly increasing permit-exempt wells threaten water for fish

3.3.1.1. Puget Sound Steelhead DPS

The Puget Sound Steelhead DPS was listed as threatened on May 11, 2007 (72 FR 26722). NMFS issued a five-ear status review for Pacific salmon and steelhead on May 26, 2016 (81 FR 33469), and concluded that the biological risks faced by the Puget Sound Steelhead DPS have not substantially changed since the listing in 2007, or since the 2011 status review (NWFSC 2015)

The PSSTRT identified steelhead populations within the DPS (Myers et al. 2015). As described in Section 1.2, *Description of Proposed Action*, the Puget Sound Steelhead DPS populations are grouped into three extant MPGs containing 32 DIPs based on genetic, environmental, and life history characteristics (Myers et al. 2015). Populations can include summer steelhead only, winter steelhead only, or a combination of summer and winter run timing (e.g., summer-run, winter-run, or summer- and winter-run) (Figure 3-1).

The PSSTRT also develop viability criteria for the steelhead DPS and concluded that the threatened Puget Sound Steelhead DPS is not currently viable (Hard et al. 2015). Low population viability is widespread throughout the DPS, across all three MPGs, and includes both summer-run and winter-run populations. Steelhead populations throughout the DPS show evidence of diminished abundance, productivity, diversity, and spatial structure when compared with available historical evidence of the VSP parameters (NWFSC 2015).

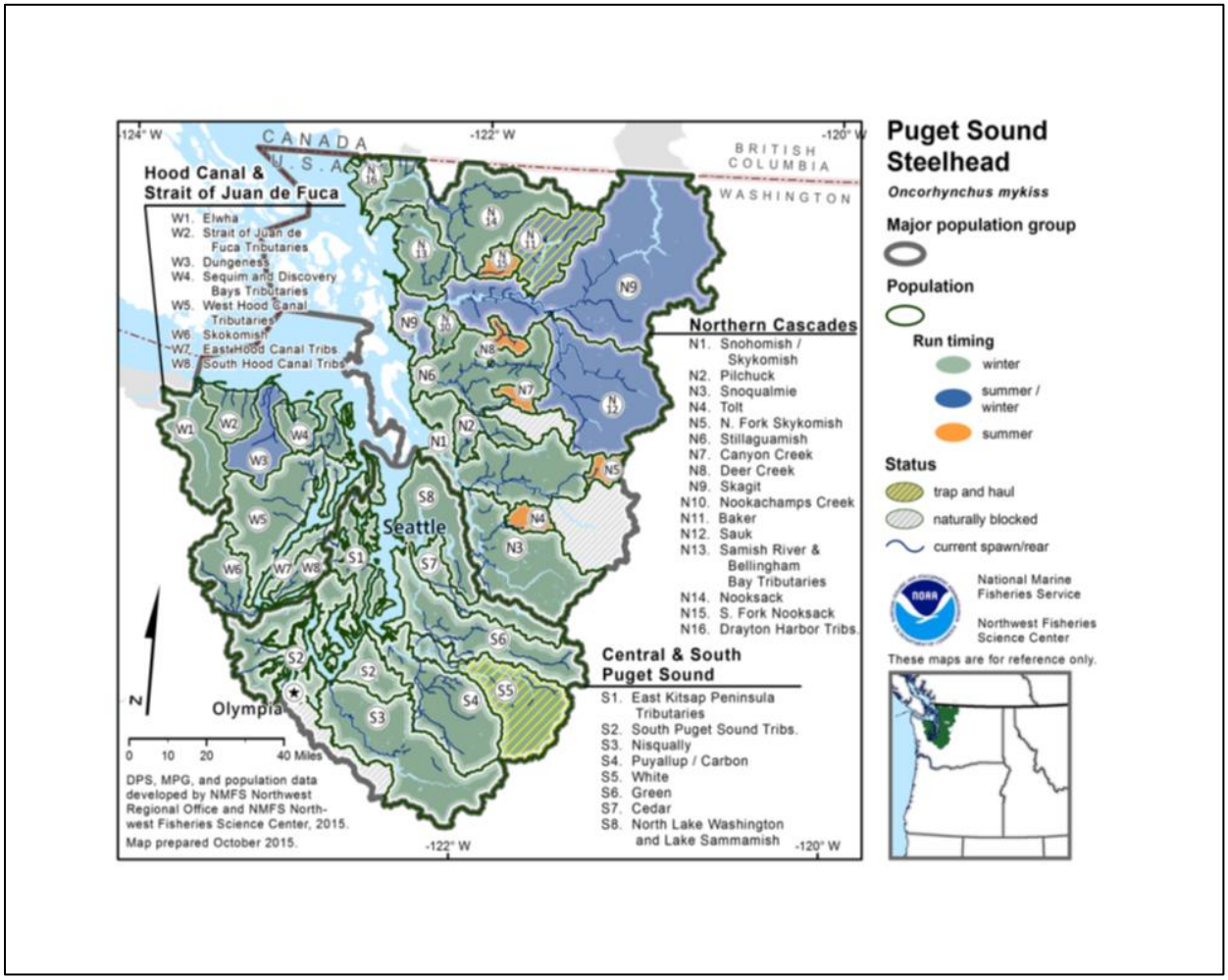

Figure 3-1. Puget Sound Steelhead DPS showing MPGs and DIPs. The MPGs include the Northern Cascades, Central & South Puget Sound, and the Hood Canal & Strait of Juan de Fuca.

Steelhead, anadromous *Oncorhynchus mykiss*, can spend up to 7 years in fresh water and up to 3 years in marine waters prior to migrating back to their natal streams to spawn. Steelhead may spawn more than once during their life span (iteroparous), whereas other species of Pacific salmon spawn once and die (semelparous). Spawning migrations occur throughout the year, with seasonal peaks of activity. In a given river basin, there may be one or more peaks in migration activity, and these "runs" are usually named for the season in which the peak occurs (e.g., winter, spring, summer or fall steelhead) (72 FR 26722, May 11, 2007). Steelhead are divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner et al. 1992).

Spatial Structure and Diversity

The BRT considered the major risk factors associated with spatial structure and diversity of Puget Sound steelhead to be: (1) low abundance of several summer-run populations, (2) sharply diminishing abundance of some winter-run steelhead populations;, and (3) continued releases of out-of-ESU hatchery steelhead from Skamania-derived summer-run and Chambers Creek-derived winter-run stocks (Hard et al. 2007). Hard et al. (2007) also determined that the loss of spatial structure and diversity were "moderate" risk factors for the Puget Sound Steelhead DPS.

The PSSTRT completed its evaluation of factors that influence spatial structure and diversity VSP criteria for the Puget Sound Steelhead DPS (Hard et al. 2015). For spatial structure, this included the fraction of intrinsic potential rearing available and spawning habitat that is occupied compared to what is needed.[17] For diversity, these factors included hatchery fish production, contribution of resident fish to anadromous fish production, and run timing of adult steelhead. Quantitative information on spatial structure and connectivity was not available for most Puget Sound steelhead populations, so the PSSTTRT used a Bayesian Network framework to assess the influence of these factors on steelhead viability at the population, MPG, and DPS scales (Hard et al. 2015). The Puget Sound Steelhead Technical Recovery Team concluded that low population viability was widespread throughout the DPS and populations showed evidence of diminished spatial structure and diversity (Hard et al. 2015). Specifically, population viability associated with spatial structure and diversity was highest in the Northern Cascades MPG and lowest in the Central and South Puget Sound MPG (Figure 3-2). Diversity was generally higher for populations within the Northern Cascades MPG, where more variability in viability was expressed and diversity generally higher, compared to populations in both the Central and South Puget Sound and Hood Canal and Strait of Juan de Fuca MPG, where diversity was depressed and viabilities were generally lower (NWFSC 2015). Most Puget Sound steelhead populations were given intermediate scores for spatial structure and low scores for diversity because of

[17] Intrinsic potential is the area of habitat suitable for steelhead rearing and spawning, at least under historical conditions (Hard et al. 2015).

extensive hatchery influence, low breeding population sizes, and freshwater habitat fragmentation or loss (NWFSC 2015).

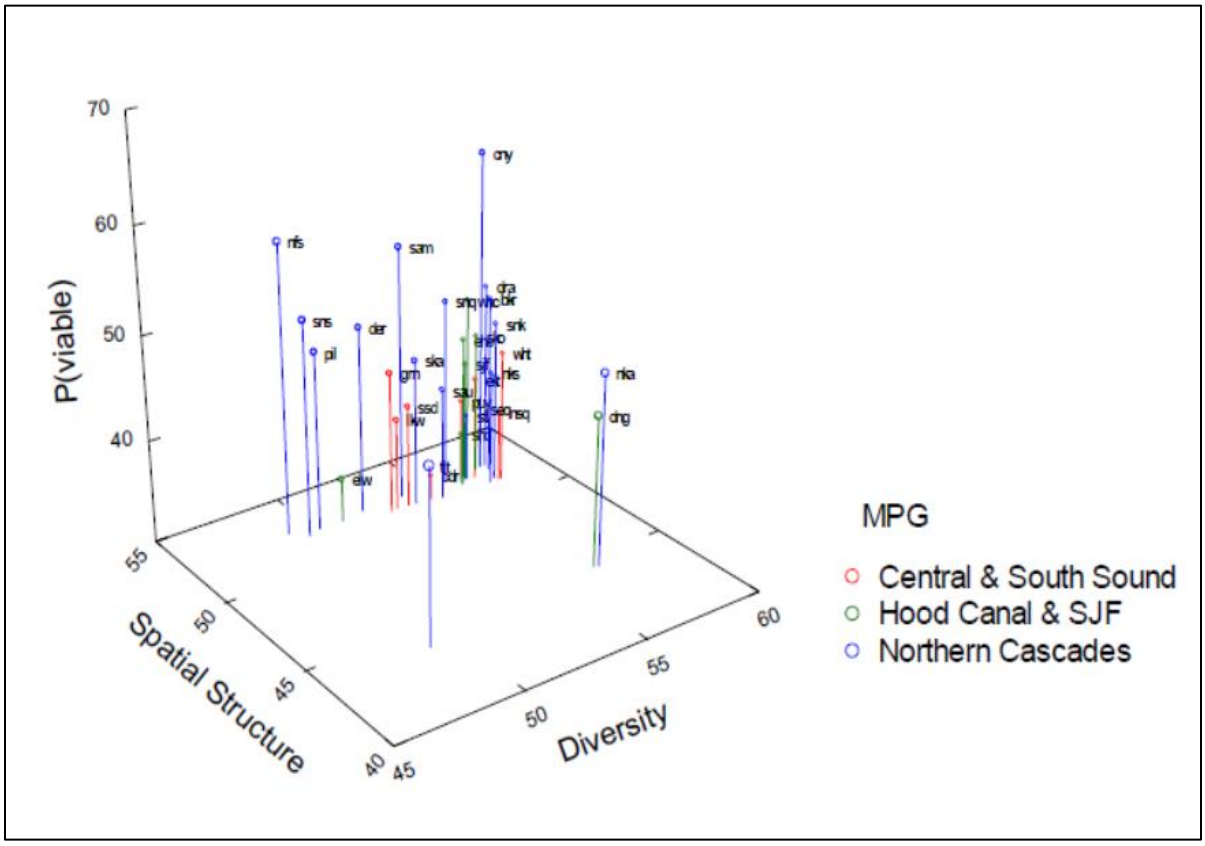

Figure 3-2. Scatter plot of the probabilities of viability for each of the 32 steelhead populations in the Puget Sound Steelhead DPS as a function of the VSP parameter estimates of influence of diversity and spatial structure on viability (Hard et al. 2015).

Hatchery Production

Hatchery steelhead production in Puget Sound is widespread and focused primarily on the propagation of winter-run fish derived from a stock of domesticated, mixed-origin steelhead (the Chambers Creek Hatchery stock) originally native to a small Puget Sound stream that is now extirpated from the wild (72 FR 26722, May 11, 2007). Hatchery summer-run steelhead are also produced in Puget Sound; these fish are derived from the Skamania River in the Columbia River Basin. Hatchery steelhead programs in the DPS include the Soos Creek Summer Steelhead Program and the following early winter steelhead programs: (1) Dungeness River; (2) Kendall Creek; (3) Snohomish/Skykomish River; (4) Tokul Creek; (5) and Whitehorse Ponds (Stillaguamish River).[18] The following hatchery stocks are considered part of the listed DPS: (1)

[18] Source: https://wdfw.wa.gov/hatcheries/hgmp/2012_puget_sound.html.

Green River Natural Program; (2) White River Winter Steelhead Supplemental Program; (3) Three Hood Canal Steelhead Supplementation Off-Station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and (4) Lower Elwha Fish Hatchery Wild Steelhead Recovery Program.[19] The remaining hatchery stocks are not considered part of this DPS because they are more than moderately diverged from the local native populations (NMFS 2005).

The only data that has become available on spatial structure and diversity since the PSSTRT completed its review of Puget Sound steelhead are estimates of the fraction of hatchery origin fish on the spawning grounds (NWFSC 2015). Hatchery production and release of hatchery origin smolts of both summer-run and winter-run steelhead have declined in recent years for most areas within the DPS (NWFSC 2015). The fraction of hatcher origin steelhead spawning naturally is low for many rivers in Puget Sound (NWFSC 2015). In recent years, production and release of hatchery steelhead for winter and summer run types has also declined for most areas of Puget Sound (NWFSC 2015). For 17 DIPs across the DPS, the five-year average for the fraction of natural-origin steelhead spawners exceeded 0.75 from 2005 to 2009; this average was near 1.0 for 8 populations, where data were available, from 2010 to 2014 (NWFSC 2015). In some river systems, e.g., Snohomish/Skykomish and Snoqualmie Rivers, levels of hatchery-origin fish on the spawning grounds are higher than some guidelines recommend (e.g., no more than 5% hatchery-origin spawners on spawning grounds for isolated hatchery programs (HSRG 2009). Overall, the fraction of natural-origin steelhead spawners is 0.9 or greater for the most recent two time periods (i.e., 2005-2009 and 2010-2014); however, this fraction could also not be estimated for a substantial number of DIPs especially during the 2010 to 2014 period (Table 3-2) (NWFSC 2015).

[19] Source: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/steelhead/puget_sound/puget_sound_steelhead.html.

Table 3-2. Puget Sound steelhead 5-year mean fraction of natural-origin spawners[20] for 22 of the 32 DIPs in the DPS for which data are available (NWFSC 2015).

Run Type	DIP	Year				
		1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
Winter	Cedar River					
	Green River	0.91	0.95	0.96		
	Nisqually River	0.99	1.00	1.00	1.00	1.00
	N. Lake WA/Lake Sammamish	1.00	1.00	1.00	1.00	
	Puyallup River/Carbon River	0.95	0.92	0.91	0.91	
	White River	1.00	1.00	1.00	1.00	1.00
	Dungeness River	1.00	1.00	0.98	0.99	
	East Hood Canal Tributaries	1.00	1.00	1.00	1.00	1.00
	Elwha River	0.60	0.25			
	Sequim/Discovery Bays Tributaries					
	Skokomish River	1.00	1.00	1.00	1.00	
	South Hood Canal Tributaries	1.00	1.00	1.00	1.00	1.00
	Strait of Juan de Fuca Tributaries		1.00	1.00	1.00	1.00
	West Hood Canal Tributaries		1.00	1.00	1.00	
	Nooksack River			0.96	0.97	0.97
	Pilchuck River	1.00	1.00	1.00	1.00	1.00
	Samish River/Bellingham Bay Tributaries	1.00	1.00	1.00	1.00	1.00
	Skagit River	**0.94**	**0.95**	**0.96**	**0.95**	
	Snohomish/Skykomish Rivers	0.94	0.95	0.94	0.96	
	Snoqualmie River	0.79	0.76	0.58	0.66	
	Stillaguamish River	1.00	0.88	0.75	0.81	
Summer	Tolt River	1.00	1.00	1.00	1.00	1.00

Early winter-run fish produced in isolated hatchery programs are derived from Chambers Creek stock in southern Puget Sound, which has been selected for early spawn timing, a trait known to be heritable in salmonids.[21] Summer-run fish produced in isolated hatchery programs are derived *from* the Skamania River summer stock in the lower Columbia River Basin (i.e., from outside the DPS). Thus, the production of hatchery fish of both run types (winter and summer) continue to pose risk to diversity in natural-origin steelhead in the DPS.

Summer-Run Timing

The summer or "stream-maturing" type enters freshwater in a sexually immature condition between May and October, and requires several months to mature and spawn. In basins with both

[20] The 5-year estimates represent the sum of all natural-origin spawner estimates divided by the number of estimates; blank cells indicate that no estimate is available for that 5-year range.

[21] The natural Chambers Creek steelhead stock is now extinct.

summer and winter steelhead runs, the summer run generally occurs in habitat that is not fully utilized by the winter run, or where a hydrologic barrier (natural or man-made) separates them. Summer steelhead typically spawn further upstream than winter steelhead (Behnke and American Fisheries Society 1992).

Early Returning Winter Steelhead

There is some information available on the historical return and spawn timing of Puget Sound steelhead, but it is limited to catch records and anecdotal information (72 FR 26722, May 11, 2007). The winter or "ocean-maturing" type enters freshwater between November and April, is fairly sexually mature and spawns shortly thereafter (72 FR 26722, May 11, 2007). NMFS' Biological Review Team (BRT) was unaware of any documentation suggesting a spawning habitat preference exhibited by the early component of the winter steelhead run (72 FR 26722, May 11, 2007). The BRT was concerned about the decline or elimination of this early component to steelhead life history diversity, but, due to lack of reliable data, was unable to establish the magnitude of this loss (72 FR 26722, May 11, 2007) or identify spawning habitat preferences in order to recommend specific conservation measures to protect the early component of the winter steelhead run.

Repeat Spawning

Unlike other species of salmon, steelhead are iteroparous and have the ability to survive and recondition after spawning. Some steelhead females do not guard their redds but return to the ocean after spawning (Burgner et al. 1992; Myers et al. 2015). Male steelhead usually comprise a smaller proportion of repeat spawning fish based on scale pattern analysis (McMillan et al. 2007; McGregor 1986). These steelhead are called kelts.

Hard et al. (2015) describes preliminary modelling efforts to demonstrate the effect of varying rates of iteroparity on the frequency of abundances in simulated small winter steelhead population that includes repeat spawners. It concluded that these analyses reinforce the determination by the PSSTRT that iteroparity is an important consideration in evaluating steelhead viability. Iteroparity is an important factor for maintaining diversity and population persistence but not enough information was available to consider it quantitatively. The degree of iteroparity is likely to be especially influential on viability in small populations during periods when marine mortality varies widely (Hard et al. 2015). The model results indicated that populations with repeat steelhead spawners provide increased levels of resilience compared to populations without repeat spawners (Hard et al. 2015).

Resident O. Mykiss

In the Puget Sound DPS, resident *O. mykiss* play a vital role in the overall stability of the anadromous steelhead life-form. Residents can buffer productivity during low marine survival periods and increase steelhead spawner abundance within the DPS when the resident and anadromous life history forms interact reproductively. This aids in increasing genetic diversity in the overall *O. mykiss* population and buffer against demographic risk during periods of low anadromous steelhead abundance (Hard et al. 2015).

The PSSTRT considered the potential influence of co-occurring resident *O. mykiss* on anadromous steelhead DIPs within the Puget Sound Steelhead DPS (Hard et al. 2015). They concluded that in basins where anadromous O. mykiss natural origin abundance is below the quasi-extinction threshold, the risk of extinction is not necessarily 100% if resident *O. mykiss* are found below natural, long-standing migration barriers

Resident *O. mykiss* (life history form that is not anadromous and does not go out to sea) occur within the range of Puget Sound steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 FR 15666, March 29, 2006).

Abundance and Productivity

The 2007 BRT considered the major risk factors associated with abundance and productivity to be: (1) widespread declines in abundance and productivity for most natural steelhead populations in the ESU, including those in Skagit and Snohomish rivers (previously considered to be strongholds); (2) low abundance of several summer run populations; and (3) sharply diminishing abundance of some steelhead populations, especially in south Puget Sound, Hood Canal, and the Strait of Juan de Fuca (Hard et al. 2015).

Abundance and productivity estimates have been made available in the NWFSC status review update (NWFSC 2015). Steelhead abundance estimates are available for 7 of the 11 winter-run DIPs and 1 of the 5 summer-run DIPs in the Northern Cascades MPG,[22] 6 of the 8 winter-run DIPs in the Central and South Puget Sound MPG,[23] and 8 of the 8 winter-run DIPs in the Hood

[22] Nooksack River, Samish River/Bellingham Bay Tributaries, Skagit River, Pilchuck River, Snohomish/Skykomish River, Snoqualimie River, and Stillaguamish River winter-run DIPs as well as the Tolt River summer-run DIP.

[23] Cedar River, Green River, Nisqually River, North Lake Washington/Lake Sammamish, Puyallup River/Carbon River, and White River winter-run DIPs.

Canal and Strait of Juan de Fuca MPG.[24] Little or no data is available on summer run populations to evaluate extinction risk or abundance trends. Because of their small population size and the complexity of monitoring fish in headwater holding areas, summer steelhead have not been broadly monitored. Data were available for only one summer-run DIP, the Tolt River steelhead population in the Northern Cascades MPG. Total abundance of steelhead in these populations has shown a generally declining trend over much of the DPS (Figure 3-3).

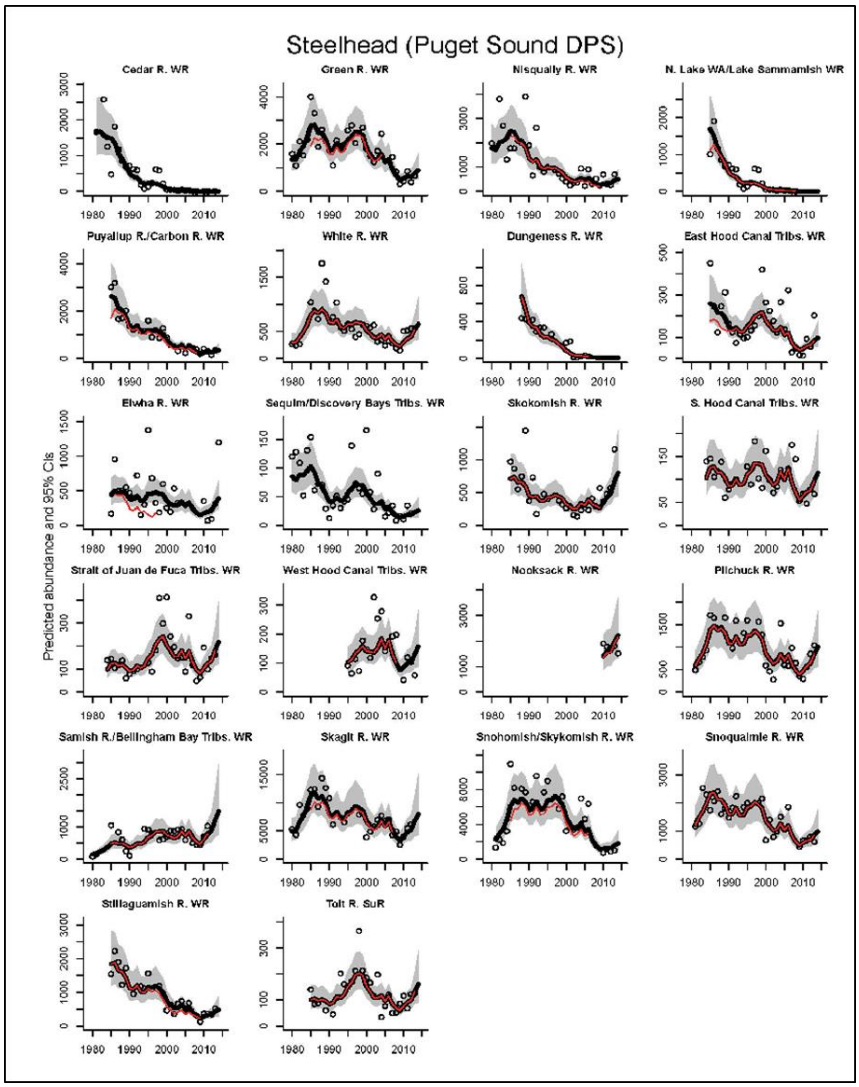

Figure 3-3. Trends in estimated total (black line) and natural (red line) population spawning abundance of Puget Sound steelhead. The circles represent annual raw spawning abundance data and the gray bands represent the 95% confidence intervals around the estimates.

[24] Dungeness River, East Hood Canal Tributaries, Elwha River, Sequim/Discovery Bays Tributaries, Skokomish River, South Hood Canal Tributaries, Strait of Juan de Fuca Tributaries, and West Hood Canal Tributaries winter-run DIPs.

In the most recent status review update, for ESA-listed Pacific salmon and steelhead, NWFSC (2015) found that, in general, broad patterns of steelhead abundance across the Puget Sound DPS are similar to those summarized in the prior status review which had considered data through 2009 (Ford 2011). Since 2009, 10 of the 22 populations indicated small to modest increases in abundance.[25] Most steelhead populations in the Puget Sound DPS remain small. From 2010 to 2014, 8 of the 22 steelhead populations had fewer than 250 natural spawners annually, and 12 of the 22 steelhead populations had fewer than 500 natural spawners (NWFSC 2015; Table 5). Smoothed trends in abundance indicate modest increases since 2009 for 13 of the 22 DIPs (Samish River and Bellingham Bay Tributaries winter-run, Pilchuck River winter-run, White River winter-run, Skokomish River winter-run, Strait of Juan de Fuca Tributaries winter-run, Skagit River winter-run, Green River winter-run, West Hood Canal Tributaries winter-run, Nooksack River winter-run; East Hood Canal Tributaries winter-run, Dungeness River winter-run, Elwha River winter-run, and Tolt River summer-run also show early signs of an upward trend). However, several of these upward trends are not statistically different from neutral, and most populations remain small (NWFSC 2015). Between the two most recent five-year periods (2005-2009 and 2010-2014), the geometric mean of estimated abundance in the Puget Sound DPS increased by an average of 5.4%. For seven populations in the Northern Cascades MPG, the increase was 3%; for five populations in the Central & South Puget Sound MPG, the increase was 10%; and for six populations in the Hood Canal & Strait of Juan de Fuca MPG, the increase was 4.5% (NWFSC 2015; Table 5). These 5-year geometric mean of natural spawner counts are listed in Table 3-3.

[25] Pilchuck River, Samish River/Bellingham Bays Tributaries, Nisqually River, White River, Sequim/Discovery Bay Tributaries, Skokomish River, and Strait of Juan de Fuca Tributaries winter-run steelhead populations and Tolt River summer-run steelhead population with Skagit River and Stillaguamish River also showing early signs of upward trends.

Table 3-3. 5-year geometric mean of natural spawner counts for Puget Sound steelhead. Numbers not in parentheses represent the estimated natural-origin spawners. This is the raw total spawner count, which is in parentheses, times the fraction of natural spawner estimate, if available. Percent change between the most recent two 5-year periods is shown on the far right (NWFSC 2015).

MPG	Run	Population	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	% Change
Northern Cascades	Winter	Nooksack River	--	--	(80)	--	1779 (1834)	--
		Pilchuck River	1300 (1300)	1465 (1465)	604 (604)	597 (597)	614 (614)	3 (3)
		Samish River/Bellingham Bay	316 (316)	717 (717)	852 (852)	534 (534)	846 (846)	58 (58)
		Skagit River	**7189 (7650)**	**7656 (8059)**	**5424 (5675)**	**5547 (4767)**	**(5123)**	**(7)**
		Snohomish/Skykomish River	3634 (3877)	4141 (4382)	2562 (2711)	2945 (3084)	(930)	(-70)
		Snoqualmie River	1832 (2328)	2060 (2739)	856 (1544)	1396 (1249)	(680)	(-46)
		Stillaguamish River	1078 (1078)	1024 (1166)	401 (550)	259 (327)	(392)	(20)
	Summer	Tolt River	112 (112)	212 (212)	119 (119)	73 (73)	105 (105)	44 (44)
Central/ South PS	Winter	Cedar River	(321)	(298)	(37)	(12)	(4)	(-67)
		Green River	1566 (1730)	2379 (2505)	1618 (1693)	(716)	(552)	(-23)
		Nisqually River	1201 (1208)	759 (759)	413 (413)	375 (375)	442 (442)	18 (18)
		N. Lk WA/Lk Sammamish	321 (321)	298 (298)	37 (37)	12 (12)	--	--
		Puyallup River/Carbon River	1860 (1954)	1523 (1660)	907 (1000)	641 (476)	(277)	(-42)
		White River	696 (696)	519 (519)	466 (466)	225 (225)	531 (531)	136 (136)
Hood Canal/ SJF	Winter	Dungeness River	356 (356)	--	182 (186)	--	(141)	--
		East Hood Canal Tribs.	110 (110)	176 (176)	202 (202)	62 (62)	60 (60)	-3 (-3)
		Elwha River	206 (358)	127 (508)	(303)	--	--	--
		Sequim/Discovery Bays	(30)	(69)	(63)	(17)	(19)	(12)
		Skokomish River	503 (385)	359 (359)	259 (205)	351 (351)	(580)	(65)
		South Hood Canal Tribs.	89 (89)	111 (111)	103 (103)	113 (113)	64 (64)	-43 (-43)
		Strait of Juan de Fuca Tribs.	--	275 (275)	212 (212)	244 (244)	147 (147)	-40 (-40)
		West Hood Canal Tribs.	--	97 (97)	210 (210)	174 (149)	(74)	(-50)

There are five primary steelhead management units (MUs) in Puget Sound that contain comprehensive steelhead datasets for determining total listed steelhead natural origin abundance

and harvest rates for the Puget Sound Steelhead DPS. These MUs were developed prior to the steelhead listing and are a combination of the now established DIPs within an MPG that reside within major watersheds within the DPS. Available recent escapement estimates for the Puget Sound steelhead DPS and for the five primary management units (MU) in Puget Sound[26] are provided in Table 3-4. Based on returns during 2011 to 2015 for the five primary steelhead management units (MU).[13] the adult return has increased by an average of 10 percent per year and the total Puget Sound DPS has increased by an average of 10 percent per year.

Table 3-4. Puget Sound steelhead DIP spawning escapements showing total Puget Sound and Five Primary MUs, 2011-2015. Source: (NWFSC 2015).

Management Unit	Abundance/Escapement (#)				
	2011	**2012**	**2013**	**2014**	**2015**
Total Puget Sound Steelhead Escapement	14,639	14,070	19,842-19,997	18,452	24,223
Escapement from Five Primary Steelhead MUs[6]	9,450	9,790	13,128	13,658	14,672

Puget Sound steelhead productivity has been temporally (time) variable for most populations since the mid-1980s (NWFSC 2015). Figure 3-4 shows the trends in productivity, estimated as the natural spawning abundance in year minus the natural spawning abundance four years earlier, for nineteen steelhead DIPs (NWFSC 2015). Natural productivity measured this way is more or less equivalent to the intrinsic rate of natural increase (r) and it has been well below replacement for most of this period for at least eight of these DIPs. These include, in the Northern Cascades MPG: Stillaguamish River winter-run and Snoqualmie River winter-run and, to a lesser extent, Skagit River winter-run and Green River winter-run; in the Central & South Puget Sound MPG: North Lake Washington and Lake Sammamish winter-run, Puyallup River/Carbon River winter-run, and Nisqually River winter-run; and in the Hood Canal & Strait of Juan de Fuca MPG: East Hood Canal Tributaries winter-run, Dungeness River winter-run, and Elwha River winter-run (NWFSC 2015). For the other populations, productivity has fluctuated around replacement, but most have been predominantly below replacement since about 2000. That said, some populations are showing signs of productivity that has been above replacement since about 2009; these include Tolt River summer-run and Pilchuck River winter-run (see also Nooksack River winter-run) (Northern Cascades MPG); Nisqually River winter-run and White River winter-run (Central & South Puget Sound MPG); and East Hood Canal Tributaries winter-run, South Hood Canal Tributaries winter-run, and Strait of Juan de Fuca winter-run (Hood Canal & Strait of Juan de Fuca MPG).

[26] Puget Sound Primary Management Units include: Skagit Snohomish, Stilliguamish, Green, and Puyallup Rivers.

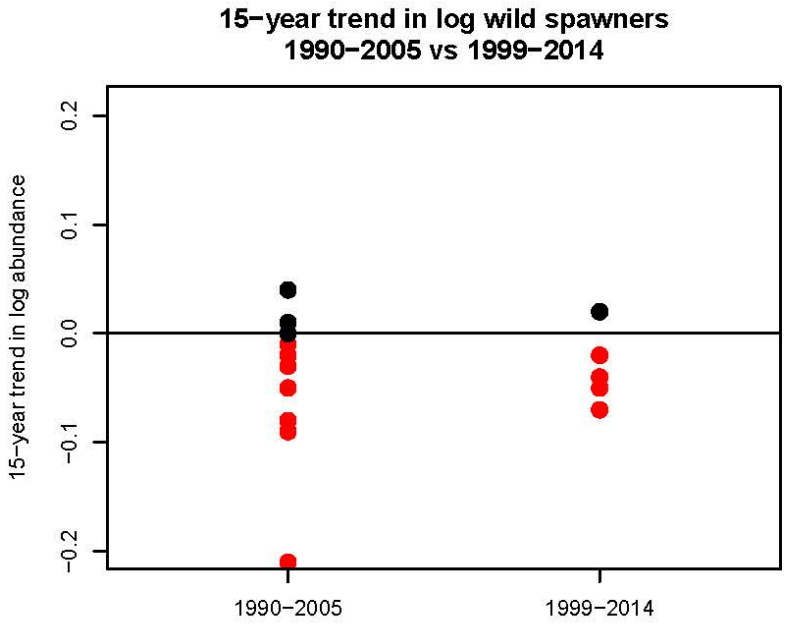

Figure 3-4. Plot of 15-year trend in log abundance of natural steelhead spawners across Puget Sound steelhead populations between two consecutive 15-year periods (1990-2005 and 1999-2014). Red dots indicate negative trends; black dots indicate positive trends (NWFSC 2015).

There are some signs of modest improvements in listed Puget Sound steelhead natural origin steelhead since the 2011 status review for at least some populations, especially in the Hood Canal & Strait of Juan de Fuca MPG (NWFSC 2015). These modest changes must be sustained for at least two generations to reach any conclusion that productivity is improving over larger scales across the DPS (NWFSC 2015). Several populations are still showing low productivity, especially those in the Central & South Puget Sound MPG, and two major DIPs in the Hood Canal & Strait of Juan de Fuca MPG (Dungeness River winter-run and Elwha River winter-run) are exhibiting the same pattern (NWFSC 2015).

There is no clear evidence to suggest that improvements in productivity across the DPS since the last status review are sufficient to support a change in conclusion about demographic risk to steelhead viability (NWFSC 2015). The recent upward estimates of productivity are promising

but are limited to relatively few populations and span only one to a few years. Improving patterns of productivity are neither widespread or sustainable yet (NWFSC 2015).

Harvest

Direct harvest of unlisted hatchery steelhead and incidental take of listed steelhead occurs in fisheries throughout the project area in marine and freshwater areas. Most of the harvest occurs in freshwater areas. Incidental catch of listed steelhead is minimized primarily due to return timing differences for salmon species. In Puget Sound marine areas, bycatch of steelhead is minimal, and the steelhead caught are of mixed origin (hatchery origin and natural origin, listed and unlisted). In some areas, steelhead bycatch can include unlisted natural origin or hatchery-origin steelhead (i.e., stocks from the Strait of Juan de Fuca west of the Puget Sound steelhead DPS and steelhead from Canada) (NMFS 2017b).

Terminal harvest rate estimates are defined here as the numbers of fish occurring in a freshwater area, such as in a mainstem river or a tributary near in their natal stream, as anadromous fish return to their point of origin. In terminal areas, the stocks of fish have been disaggregated from a large group of fish so that harvest is considered to be on a single identified stock rather than on fish from mixed stocks. Terminal harvest rate estimates for the five watersheds within the Puget Sound, where sufficient escapement and harvest data are available, indicate that harvest impacts to listed Puget Sound natural origin steelhead are currently small in scope. Listed steelhead natural origin harvest rates from 2007-2016, by watershed, average at or below 3.1 percent per year, and the annual average harvest rate across these populations of less than 1.5 percent (Table 3-5) (NMFS 2017b).

Table 3-5. Terminal natural origin harvest rates for Puget Sound steelhead as calculated by the five watersheds: Skagit River summer/winter-run, Snohomish River winter-run, Green River winter-run, Puyallup River winter-run, and Nisqually River winter-run steelhead, 2007 – 2016 (NMFS 2017b).

Management Units	Terminal Harvest Rate (%)									9-Year Avg.
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	
Skagit River summer/winter	5.90	4.90	3.30	3.40	2.90	2.30	2.60	1.25	1.12	3.10
Snohomish River winter	0.40	1.10	2.10	1.50	0.90	1.10	0.89	1.00	0.09	1.10
Green River winter	3.50	0.30	0.40	1.60	2.00	2.38	1.09	1.05	0.92	1.50
Puyallup River winter	1.00	0.00	0.00	0.60	0.40	0.70	0.56	0.54	0.06	0.40
Nisqually River winter	3.70	3.70	1.20	1.80	2.50	1.10	1.33	0.89	0.20	1.80

Total average harvest per year	2.90	2.00	1.40	1.78	1.74	1.52	1.29	0.95	0.48	1.58

Directed steelhead harvest is primarily limited to watersheds where hatchery-origin fish occur (excluding the Skagit River where no hatchery program exists) for any commercial, recreational, and tribal harvests. Limited commercial hatchery origin steelhead harvest occurs on the Snohomish Rivers; elsewhere tribal hatchery origin steelhead harvest in Puget Sound is limited to nominal subsistence and ceremonial harvest. Despite increases in listed adult natural origin steelhead returns, the average steelhead harvest rate for the five primary steelhead management units has decreased by 73 percent from 2011 to 2016 (from 1.78 percent to 0.48 percent) (NMFS 2017b).

More information on Puget Sound steelhead VSP parameters (abundance, productivity, spatial structure, and diversity), summarized here and incorporated by reference, can be found in NMFS' PSSTRT viability report (Hard et al. 2015), NMFS' status review update on Pacific salmon and steelhead (NWFSC 2015), and NMFS' biological opinion on the Skagit River Steelhead Fishery Resource Management Plan.

3.3.1.2 Skagit River Steelhead

The following four steelhead demographically independent populations (DIPs) occur, or historically occurred, within the proposed Skagit River action area (Figure 1-1) as identified by the Puget Sound Steelhead Technical Review Team (PSSTRT) (Myers et al. 2015):

1) Skagit River Summer- and Winter-Run
2) Nookachamps Creek Winter-Run
3) Sauk River Summer- and Winter-Run; and
4) Baker River Summer- and Winter-Run

Myers et al. (2015) noted that many of the members of the PSSTRT considered the Baker River Summer- and Winter-Run to have been extirpated. Data exists for only some of the Skagit River steelhead populations and there is limited information on the DIPs identified by the PSSTRT. Taking into account spatial and temporal distribution, genetic and phenotypic diversity, and other appropriate identifiable, unique biological and life history traits, the co-managers propose a Skagit Steelhead Management Unit (SMU) consisting of all extant steelhead populations in the Skagit Terminal Area (Skagit River Summer- and Winter-Run, Nookachamps Creek Winter-Run, Sauk River Summer- and Winter-Run, and Baker River Summer- and Winter-Run steelhead). The Skagit RMP states that management at the SMU level, rather than the DIP level, is necessitated by the limited population-specific information available for steelhead in the Skagit River Basin (Sauk-Suiattle Indian Tribe et al. 2016). The co-managers use population-

specific information, where available, in the development of the Skagit RMP's management objectives and guidelines.

In Puget Sound, steelhead harvestable abundance would be determined based on pre-season forecasted adult abundance (PSIT and WDFW 2010a). Under the 4(d) Rule criteria, for populations at or below critical thresholds, a directed fishery is not appropriate and harvest is limited to incidental impacts from fisheries directed at more abundant species or stocks. For populations with a high degree of confidence to be above critical thresholds but not yet at viable levels, such as the Skagit steelhead populations represented by the Skagit SMU, harvest actions must not appreciably slow achievement of viable function (NOAA 2003). Viable function includes achievement of the viable salmonid population (VSP) parameters such as abundance, productivity, spatial structure, and diversity. The following sections provide an overview of the status of VSP parameters in the Skagit Basin.

Skagit River Steelhead Abundance and Productivity

The Skagit SMU has experienced reductions in spawning abundance since the 1980s but has generally maintained several thousand listed natural origin adult steelhead spawners per year, remaining the largest natural population in the Puget Sound DPS (NMFS 2018). The Skagit Basin has been one of the largest and most productive listed natural origin steelhead basins in the Puget Sound Steelhead DPS and the estimated probability that Skagit River summer- and winter-run steelhead would reach the quasi-extinction threshold of 157 fish established by the NMFS Puget Sound Steelhead Technical Review Team (PSSTRT) is very low – less than 10% within 100 years (Hard et al. 2015).[27]

Listed Skagit River natural origin steelhead abundance has been highly variable over time. While the population estimates have generally declined since the early 1980s, there is no significant evidence to determine a population trend at this time (Hard et al. 2015). Available long-term steelhead spawner estimates have averaged 6,956 fish from 1978 to 2014 (Figure 3-5). Although the most recent 10-year average (5,821 fish; 2005-2014) and three 5-year averages (5,582 fish; 2000-2004, 4,854 fish; 2005-2009, and 6,688 fish; 2010-2014) were below the long-term average spawner estimate, the co-managers did not find a significant trend ($R^2 = 0.087$; $P = 0.074$) in the overall abundance of Skagit River steelhead from 1978 to 2014 (Sauk-Suiattle Indian Tribe et al. 2016).

[27] The PSSTRT is highly confident ($P < 0.50$) that a 90% decline in the Skagit Basin populations would not occur within the next 20 years and that a 99% decline would not occur within the next 45 years. However, beyond the near term (after a few decades), we are uncertain about the precise level of extinction risk (Hard et al. 2015).

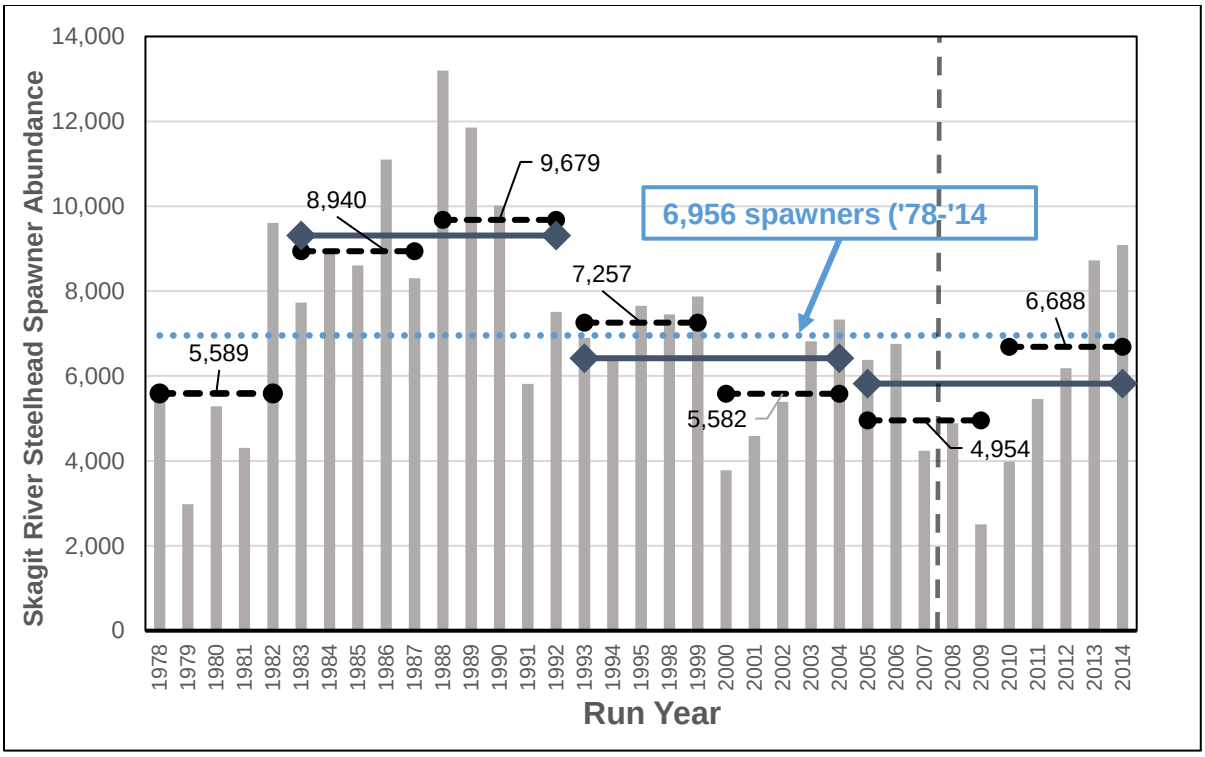

Figure 3-5. Skagit natural origin steelhead spawner abundance (gray vertical bars) for the 1978-2014 run years; incremental average spawning abundance in 5-year (black, dashed horizontal lines with round ends) and 10-year (dark-gray, solid horizontal lines with diamond ends) increments, backward from most recent. Vertical dashed dark-gray line (2007-08) represents the ESA-listing of the Puget Sound Steelhead DPS. Source: Appendices A-1 and A-2 (Sauk-Suiattle Indian Tribe et al. 2016). Note that abundance estimates for 1996 and 1997 are not available.

More recently, listed steelhead natural origin spawners in the Skagit River reached the lowest abundance estimate of roughly 2,000 spawners in 2009. Since 2009, listed Skagit River natural origin spawners have increased by 350% and have averaged 8,800 from 2013 to 2015 (Sauk-Suiattle Indian Tribe et al. 2016) (Figure 3-6).

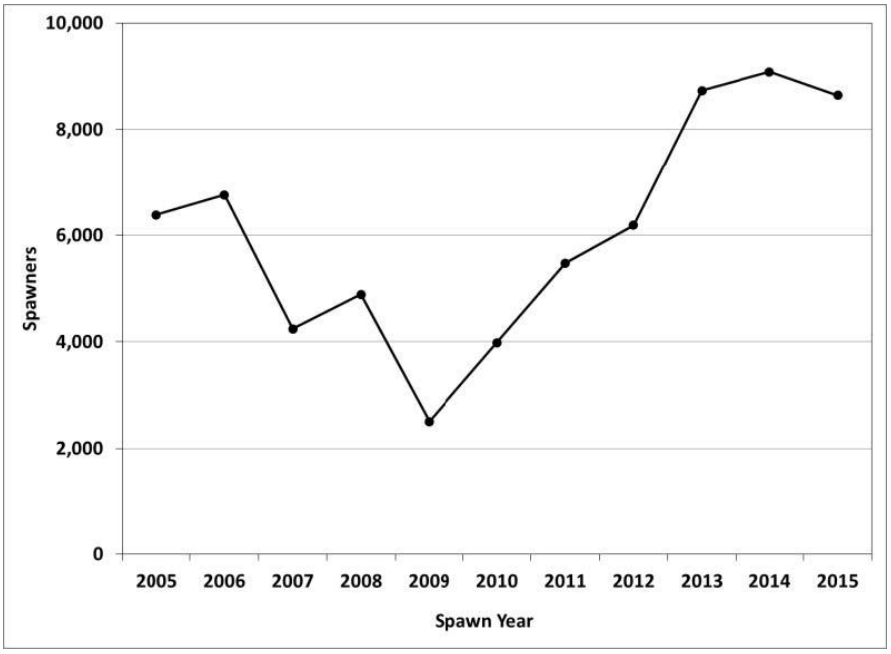

Figure 3-6. Steelhead natural origin spawner abundance in the Skagit River from 2005 to 2015. Source: (Sauk-Suiattle Indian Tribe et al. 2016).

Recent escapement estimates for the Skagit River winter-run steelhead populations are provided in Table 3-6. Based on returns from 2011 to 2015, Skagit River winter-run steelhead have increased by an average of 7 percent per year during this timeframe.

Table 3-6. Skagit River natural origin steelhead spawning escapements from 2011 to 2015. Source: (Leland 2018).

Management Unit	Escapement (Number of Fish)				
	2011	**2012**	**2013**	**2014**	**2015**
Skagit River summer- and winter-run	6,376	8,936	9,340	8,764	8,009

The PSSTRT has developed preliminary viability steelhead abundance criteria for the Skagit Basin DIPs: (1) Skagit River summer- and winter-run (32,388 fish); (2) Nookachamps Creek winter-run (616 fish); (3) Sauk River summer- and winter-run (11,615 fish); and (4) Baker River summer- and winter-run (2,514 fish) for a basin-wide total of 47,133 fish (Hard et al. 2015). In referencing these interim criteria, the PSSTRT noted that "under any potential scenario, it is likely that considerable time and effort will be required to reach the viability criteria (Hard et al. 2015). The co-managers note that, "in particular, the spawner-recruit analysis indicates that substantial improvements in habitat (taken in the broad sense) capacity and productivity will be needed before Skagit steelhead can approach this level of abundance. Until that time, the co-

managers propose that harvest management objectives should be based on quantitative understanding of current population productivity, as defined by current habitat function" (Sauk-Suiattle Indian Tribe et al. 2016).

Productivity has also been variable over the available historical time frame from 1978-2007 for the Skagit SMU demonstrating fewer positive (> 1.0) recruitment rates and more negative rates (< 1.0) since 1986 (Figure 3-7). The available time series of recruitment (recruits per spawner trend) shows a negative trend but it is not statistically strong (R2 = 0.25; P = 0.014) (NMFS 2018).

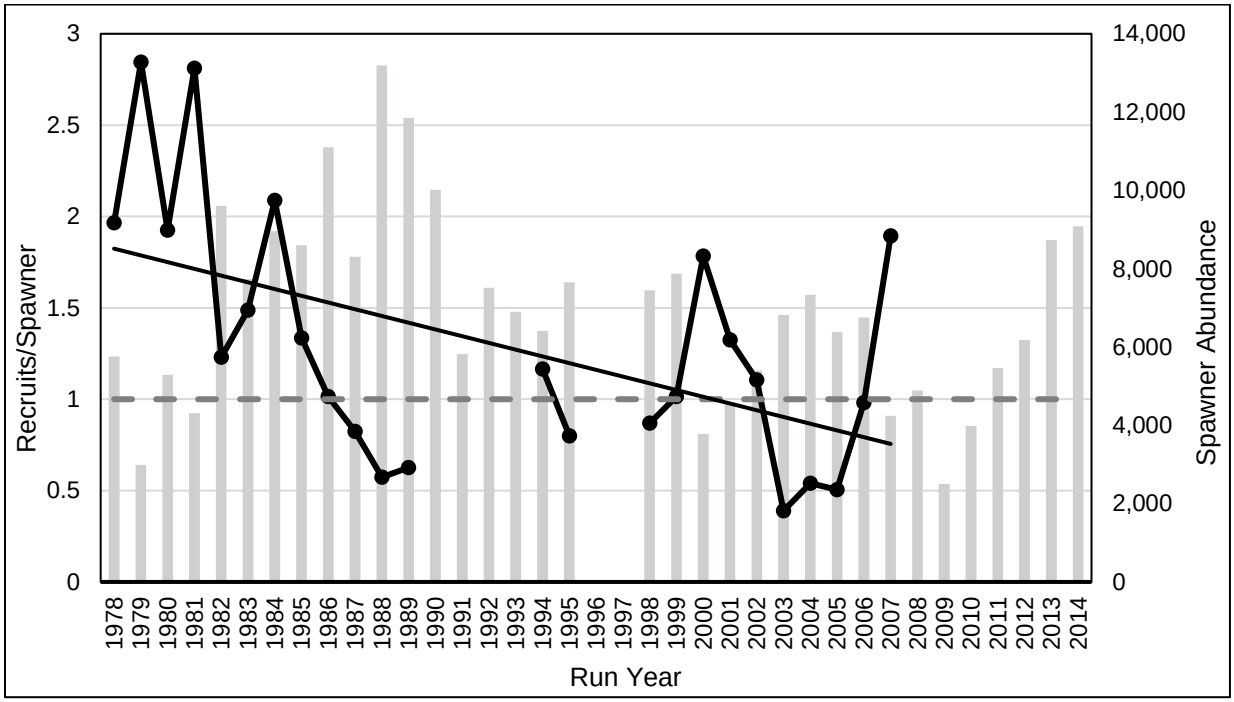

Figure 3-7. Listed Skagit River natural origin steelhead recruits per spawner estimates (black, solid line and points) over historical spawner abundance estimates (gray vertical bars). Black trend line for recruitment rate over time (using only years with estimates [n=24]). The dashed, horizontal dark-gray line indicates replacement (1 recruit per spawner). Recruits/spawner trendline is solid black line. Source data: Appendices A-1 and A-2 (Sauk-Suiattle Indian Tribe et al. 2016).

The co-managers estimated the Skagit SMU natural origin steelhead growth rates from 1977 to 2016 (Sauk-Suiattle Indian Tribe et al. 2016; Table 3-5). The majority of time series have point estimates of growth rates near but slightly below 1.0, indicating an overall slight decrease in the population growth-rate trend. The majority of the growth rate estimates (excluding Ford et. al. 2010) have confidence intervals that encompass 1.0 (Table 3-7). The most recent estimate (Cram et al. in prep) has a preliminary point estimate of slightly over 1.0 with a comparatively broad

confidence interval. Considering growth rates over the long-term period (1977-2016) of these time frames, the overall average Skagit SMU has been in a period of decreasing to stable population growth, with recent potential increases in productivity (NMFS 2018).

Figure 3-8. Estimates of population growth rate λ (lambda) (95% CI) for the Skagit River SMU across year ranges from 1977 to 2016 (Sauk-Suiattle Indian Tribe et al. 2016).

Management Unit	Time Series	λ	95% CI	Source
Skagit River	1977-2011	0.997	0.921-1.079	Hard et al. 2015
Skagit River	1978-2013	0.987	0.913-1.053	Cram 2015
Skagit River	1985-2009	0.969	0.954-0.985	Ford et al. 2011
Skagit River	1995-2009	0.978	0.931-1.029	Ford et al. 2011
Skagit River	1995-2011	0.966	0.494-1.891	Hard et al. 2015
Skagit River	2004-2016	1.018	0.588-1.987	Cram et al. (in prep)

Skagit River Steelhead Populations' Spatial Structure and Diversity

The PSSTRT concluded that production of hatchery fish of both run types (summer- and winter-run) has posed considerable risk to diversity of listed natural origin steelhead. Winter-run fish previously produced in the Skagit Basin were derived from the Chambers Creek stock in southern Puget Sound, selected for early spawn timing, and the summer-run fish are derived from the Skamania River stock in the Columbia River Basin (i.e., out-of-DPS). In April 2014, the Washington Department of Fish and Wildlife terminated the early-winter steelhead hatchery program in the Skagit Basin and agreed to not release steelhead from outside the region for 12 years.

Since the PSSTRT 2011 review, the only new data available on spatial structure and diversity have been estimates of the fraction of hatchery fish on the spawning grounds (NWFSC 2015). Historically, hatchery releases of steelhead in the Skagit Basin have been predominately early-winter steelhead, although hatchery summer steelhead were released in small numbers from the 1970s to 1990s (NMFS 2018; Pflug et al. 2013). Releases of hatchery steelhead in the Skagit Basin were discontinued in 2013 (NMFS 2018). The overall genetic effect of these hatchery releases on the Skagit DIPs are difficult to estimate. A more recent genetic study shows

relatively low rates of genetic introgression between the early winter steelhead releases and the wild steelhead populations (NMFS 2018). Gene flow rates from returning hatchery-origin adult to listed natural origin Skagit steelhead ranged from 2% for the Skagit and Nookachamps populations to 4% for the Sauk population (Warheit 2014). Hard et al. (2015) stated that the Skagit Basin steelhead hatchery program had only a nominal effect on the diversity of the listed Skagit natural origin steelhead populations.

Adult and juvenile distribution

Tribal and state fisheries staff conduct annual spawning ground surveys under various methods (by foot, floating stream sections, or fixed-wing or helicopter aerial surveys), depending on stream size and visibility (Sauk-Suiattle Indian Tribe et al. 2016). Depending on the location of the stream, surveys are conducted on index reaches in tributaries on a 10-14 day rotation from late February to early March or June through early July. Surveys are conducted in mainstem areas of the Skagit and Sauk Rivers, as well as smaller tributaries[28] (Sauk-Suiattle Indian Tribe et al. 2016). These surveys provide broad-scale coverage of adult spawning utilization (spatial structure) for mainstem and tributary areas. This broad spawning ground survey coverage also encompasses the variation in the ecological differences in the Skagit Basin providing information for the Lower Skagit mainstem tributaries, which are predominately rain-fed systems, and the Sauk and upper Skagit River area, which encompass both snow and ice-fed systems and rain-fed systems (NMFS 2018). Analysis of the spawning ground survey data indicates that spawning of the populations in the Skagit SMU occurs primarily from April through mid-June with peak spawning occurring in mid-May (Figure 3-9).

[28] Spawning ground survey areas include: the mainstem Skagit River from river mile (RM) 22-94 and Skagit River tributaries such as the Diosbud, Rocky, O'Tooole, Cumberland, Day, Sorenson, Hansen, and Jones Creeks. The spawning ground surveys also include the Sauk River mainstem, from the mouth to RM 41, the lower 2 miles of the South Fork Sauk River, and Sauk River tributaries such as the White, Dan, Murphy, and Falls Creeks(Sauk-Suiattle Indian Tribe et al. 2016).

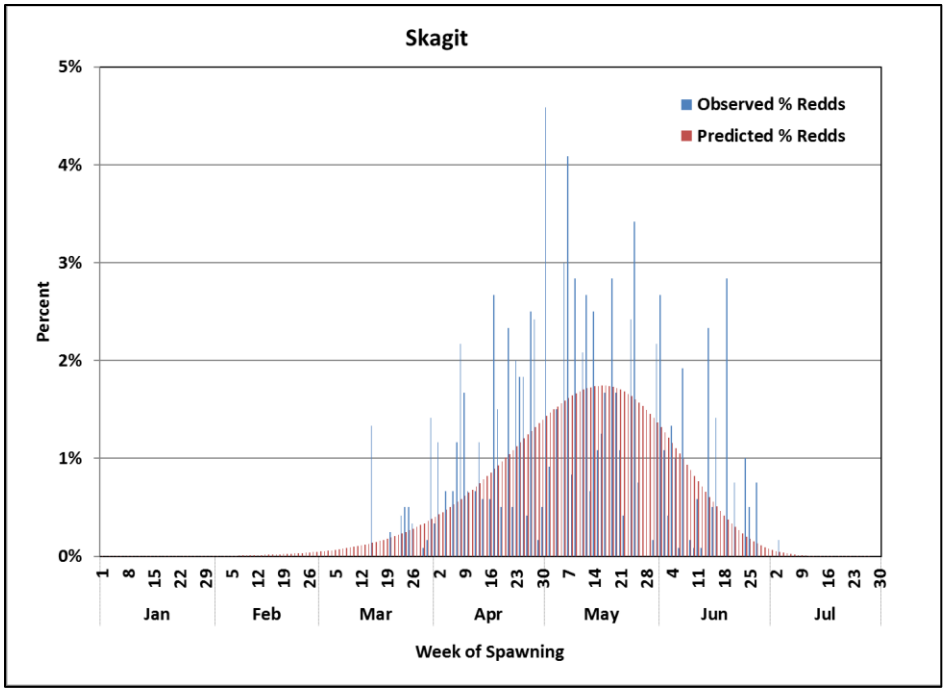

Figure 3-9. Skagit River natural origin steelhead observed and predicted redd distribution (Sauk-Suiattle Indian Tribe et al. 2016).

Recent work to survey and monitor juvenile steelhead spatial distribution and presence throughout the Skagit Basin indicates that juvenile *O. mykiss* are found throughout the entire anadromous zone of the Skagit River basin. 2011 and 2012 surveys indicate that *O. mykiss* occupied 95% of the sites surveyed (Table 3-7) (Upper Skagit Indian Tribe and Seattle City Light, unpublished data; in Sauk-Suiattle et al. 2018).

Table 3-7. Juvenile O. Mykiss densities per linear meter of stream for sites in the Skagit River Basin, sampled 2011 and 2012.

Sample Site	Site Number	Summer 2011	Winter 2012	Present at Site
Hansen Creek (lower)	1	0.569	0.044	Yes
Skagit @ Mill Creek	2	0.205	0.178	Yes
Suiattle Below Buck Creek	3	0.020	0.015	Yes
Sauk @ Skull Creek	4	0.070	0.163	Yes
Skagit @ Damnation Creek	5	0.000	0.031	Yes
Finney Creek (upper)	6	0.440	0.335	Yes
Skagit @ Illabott Creek	7	0.667	0.686	Yes
Sauk above Whitechuck River	8	0.402	0.360	Yes
Sauk above Whitechuck River	9	0.336	0.194	Yes
E. Fork Nookachamps Creek	10	5.468	0.110	Yes

Suiattle Mouth	11	0.000	0.142	Yes
Above Hatchery	12	0.000	0.000	No
Ross Island Slough	13	0.574	0.362	Yes
Sauk @ Old Sauk Trail	14	0.236	0.057	Yes
Suiattle @ Circle Creek	15	0.115	0.644	Yes
Skagit @ Cockerham Island	16	0.000	0.007	Yes
Skagit @ Jackman Creek	17	0.248	0.126	Yes
Skagit @ Jackman Creek	18	0.097	0.202	Yes
Buck Creek	19	0.016	0.031	Yes
Buck Creek	20	0.123	0.139	Yes
Day Creek	21	0.119	0.150	Yes
Sauk below Hilt Creek	22	0.051	0.032	Yes
Cascade @ Marble Creek	23	0.135	0.018	Yes
Skagit below Goodell	24	0.027	0.055	Yes
Above Sauk mouth	25	0.000	NS	No
Illabott Creek	26	0.115	0.024	Yes
Hansen Creek (upper)	27	0.077	0.112	Yes
Cascade @ Mineral Creek	28	0.025	NS	Yes
Upper Nookachamps	29	0.010	0.000	Yes
Bacon Creek above Oakes Creek	30	0.059	NS	Yes
Finney Creek (lower)	31	0.272	NS	Yes
Average Density		0.338	0.156	
95% CI		± 0.36	± 0.07	
Percent Occupied	84%	93%	94%	

The Washington Department of Fish and Wildlife and Upper Skagit Indian Tribe operate juvenile fish traps throughout the lower and upper Skagit Basin to monitor listed natural origin juvenile steelhead production and collet data on age structure and life-stage, from 2012 to the present. The total number of individual monitoring sites has decreased since 2012, with a focus on the following primary tributary locations: Illabot Creek in the upper Skagit Basin and Hansen Creek in the lower Skagit Basin, and the lower mainstem trap near Mount Vernon, Washington. Although these juvenile steelhead data sets are limited in time frame, they give some indication of the smolt production numbers and variability in Skagit River tributaries (Figure 3-10). Steelhead smolt abundance trends appear to be stable in Illabot Creek over the last four years and have increased in Hansen Creek over the last two years. This steelhead monitoring will continue to allow for listed juvenile natural origin production trend monitoring and potential use as references for developing empirically-based Skagit Basin productivity models.

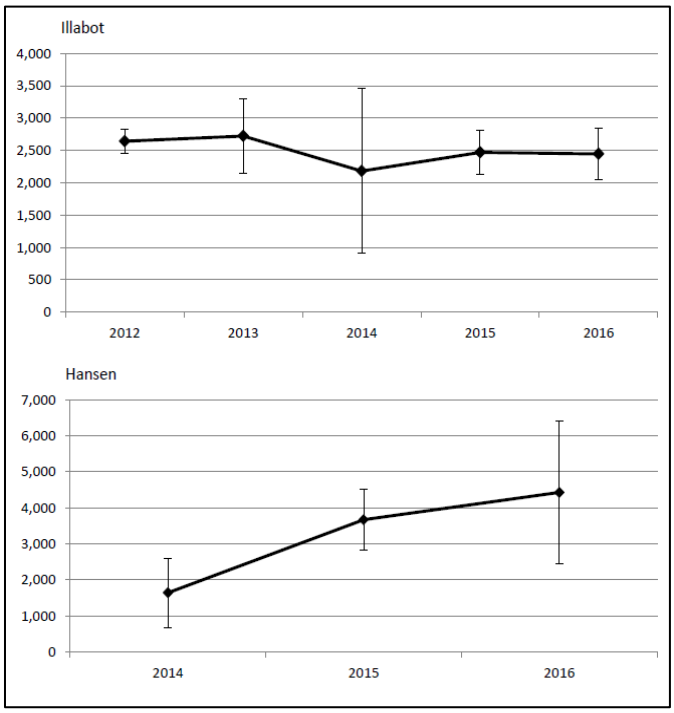

Figure 3-10. Steelhead smolt abundances within the Skagit River Basin at Illabot (2012-2016) and Hanson (2014-2016) Creeks (Kinsel et al. 2016).

Summer-Run Timing

Two of the four extant Skagit SMU steelhead DIPs contain a summer-run component: (1) Skagit summer- and winter-run and (2) Sauk summer- and winter-run. Summer-run steelhead are highly adapted to specific environmental conditions, which are not commonly found in Puget Sound.

Thus, the relative incidence of summer-run steelhead populations is substantially less than that for winter-run steelhead. Summer-run steelhead have not been widely monitored because of their small population size and the difficulties in monitoring fish in their headwater holding areas where summer-run are most likely to be found (Myers et al. 2015).

There appears to be some temporal separation between the Skagit Basin winter and summer components in spawning timing but genetic information is not available to establish whether there is complete reproductive isolation (Myers et al. 2015). For the three Skagit Basin summer-run steelhead–bearing tributaries, cascades or falls may be a migration barrier to winter-run fish but not summer-run fish (Myers et al. 2015). Summer-run fish have been reported in Finney Creek, Day Creek, Cascade River, upper Sauk River, and the South Fork Sauk River. Despite extensive surveys by the co-managers, Finney Creek (RM 8.0 to 11.6) is the only location where summer-run fish are currently known to spawn. The summer-run steelhead enter Finney Creek in October and November, with spawning occurring primarily from February through March (Sauk-Suiattle Indian Tribe et al. 2016). Little is known about the genetic composition of Finney Creek steelhead but electrophoretic analysis of steelhead fry from Finney Creek indicates that allele frequencies of Finney Creek summer-run steelhead differed significantly from those collected elsewhere in the Skagit Basin (WDF et al. 1993). Wild summer steelhead are believed to be native in Finney Creek but their stock status is currently unknown (WDF et al. 1993).

Early Returning Winter Steelhead

The four Skagit River DIPS have winter-run timing, either as a component of their life history (Skagit, Sauk, and Baker River summer- and winter-run) or within its entirety (Nookachamps winter-run). Winter-run steelhead return to freshwater in the winter and early spring months and spawn soon after entering freshwater (Myers et al. 2015). The Biological Review Team (BRT) for Puget Sound steelhead was unaware of any documentation suggesting a spawning habitat preference by the early component of the winter-run. The BRT was concerned about the decline (or elimination) of this early component to steelhead life history diversity, but was unable to establish the magnitude of this loss (72 FR 26726, May 11, 2007). There are concerns that former fisheries directed at the harvest of early-returning hatchery fish (i.e., Chambers Creek) may have resulted in the loss of the early-timed component of Puget Sound natural-origin steelhead (NMFS 2016a).

Historical surveys suggest that Sauk winter-run had an earlier timing than the mainstem Skagit or Suiattle Rivers (Myers et al. 2015). Pflug et al. (2013) found a correlation between the month that Skagit steelhead adults were tagged and where the fish was likely heading to spawn in the basin. Fish tagged in February were heading into the Sauk and Suiattle watershed with a long delay between steelhead tagging and their arrival to the spawning grounds, indicating a long pre-spawn holding pattern (Figure 3-11).

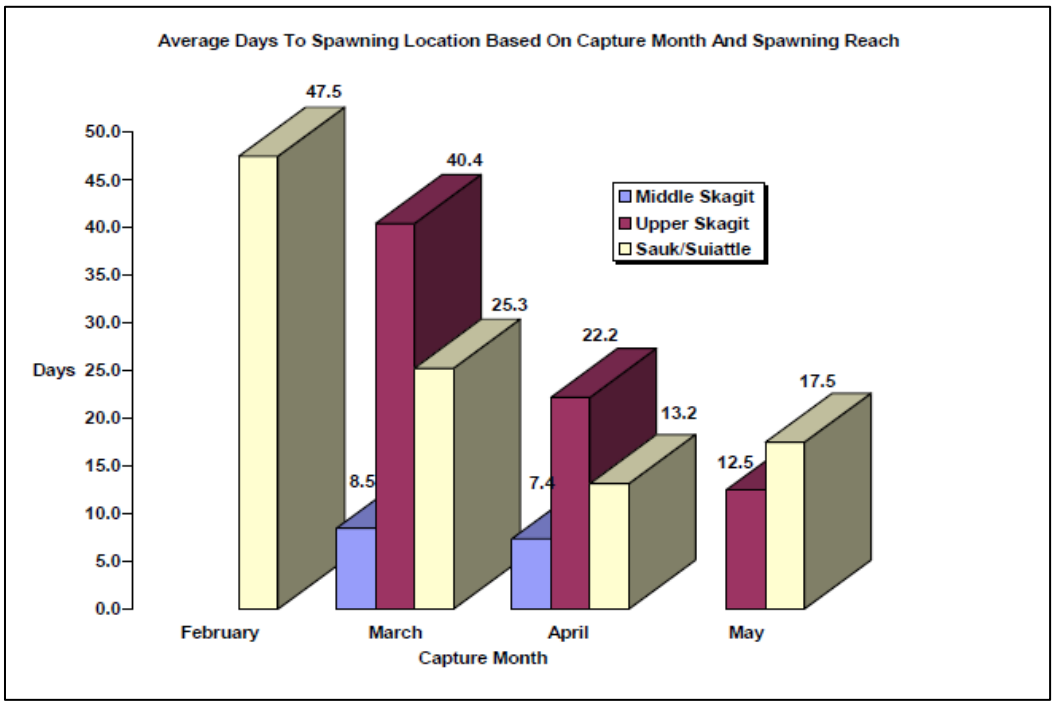

Figure 3-11. Average days to spawning location by natural origin steelhead based on capture tag (month) and spawning reach (Pflug et al. 2013; Figure 9).

The majority of steelhead life history information taken in the early 1900s come from the collection and spawning of steelhead intercepted at hatchery weirs (Myers et al. 2015). Using gillnets, steelhead returning to Baker Lake were collected by the U.S. Fish Commission Hatchery. Adult steelhead collections occurred from March 9 to May 8 with few fish surviving to spawn and no spawning dates were documented (USBF 1900). Steelhead collections in Finney (also known as Phinney) and Grandy Creeks had limited success but concluded that the majority of the steelhead run entered the rivers in January (Ravenel 1901).

Pflug et al. (2013) conducted the most recent study on the potential breadth of the current Skagit River natural origin steelhead run timing in the mid and upper Skagit Basin from 2008 to 2011. In return years 2009 and 2010, steelhead tagging occurred over a 20-week time period spanning the return timing of natural origin steelhead in the Skagit Basin (Table 3-8). The information in Pflug et al. (2013) represents the Skagit River steelhead run as sampled in the mainstem Skagit, below the confluence with the Sauk River, and may not represent the entire run timing of steelhead in the lower tributaries of the Skagit Basin, such as Nookachamps Creek.

Table 3-8. Acoustic tags deployed by month in natural origin adult steelhead during return years 2008 to 2011 (Pflug et al. 2013; Table 9).

Return Year	January	February	March	April	May	Total
2008	-	-	-	10	-	10
2009	-	2	20	14	2	38
2010	1	9	36	34	2	82
2011	1	-	1	1	-	3
Total	2	11	57	59	4	133

The Nookachamps Creek winter steelhead spawn timing may have also been affected by fisheries directed at early returning hatchery origin steelhead (Hard et al. 2015; McMillan et al. 2007). Fowler and Turnbull (2016) and WDFW (unpublished data) have estimated Nookachamps Creek spawners at 250 fish.

Repeat Spawning (Iteroparity)

Unlike other species of salmon, steelhead are iteroparous and have the ability to survive and recondition after spawning. Some steelhead females do not guard their redds but return to the ocean after spawning (Burgner et al. 1992; Myers et al. 2015). Male steelhead usually comprise a smaller proportion of repeat spawning fish based on scale pattern analysis (McMillan et al. 2007; McGregor 1986). These steelhead are called kelts.

Hard et al. (2015) describes preliminary modelling efforts to demonstrate the effect of varying rates of iteroparity on the frequency of abundances in simulated small winter steelhead population that includes repeat spawners. It concluded that these analyses reinforce the determination by the PSSTRT that iteroparity is an important consideration in evaluating steelhead viability. Iteroparity is an important factor for maintaining diversity and population persistence but not enough information was available to consider it quantitatively. The degree of iteroparity is likely to be especially influential on viability in small populations during periods when marine mortality varies widely (Hard et al. 2015).

The model results indicated that populations with repeat steelhead spawners, like the Skagit Basin, provide increased levels of resilience compared to populations without repeat spawners (Hard et al. 2015). During the 1985 to 1986 and 2004 to 2005 spawning years, repeat spawners averaged 6% (range 0% to 12%) of the total number of steelhead spawners in the Skagit River (Scott and Gill 2008). The highest number of kelts observed leaving the Skagit Basin occurred in May, followed by June (Pflug et al. 2013).

Resident Life-History

Resident *O. mykiss* play a vital role in the overall stability of the anadromous steelhead life-form. Residents can buffer productivity during low marine survival periods and increase steelhead spawner abundance when the resident and anadromous life history forms interact reproductively. This aids in increasing genetic diversity in the overall *O. mykiss* population and buffer against demographic risk during periods of low anadromous steelhead abundance.

The PSSTRT considered the potential influence of co-occurring resident *O. mykiss* on anadromous steelhead DIPs. They concluded that in basins where anadromous O. mykiss natural origin abundance is below the quasi-extinction threshold, the risk of extinction is not necessarily 100% if resident *O. mykiss* are found below natural, long-standing migration barriers (Hard et al. 2015).

The contribution of resident *O. mykiss* to the four steelhead DIPs in the Skagit River has not been quantified (Hard et al. 2015).

Harvest

There is currently no direct harvest of listed natural origin steelhead from the Skagit River Basin, although some fish are incidentally caught in freshwater and marine fisheries targeting salmon and unlisted hatchery steelhead (e.g., spring-run Chinook salmon) or for ceremonial and subsistence purposes (Sauk-Suiattle Indian Tribe et al. 2016). Since 2014, there have been no hatchery steelhead releases in the Skagit River Basin. Thus, no direct fisheries targeting hatchery steelhead have occurred in the Skagit River basin in recent years.

While listed Skagit natural origin steelhead spawning escapements have increased in recent years, terminal (marine and freshwater) incidental take rates of listed Skagit River natural origin summer/winter-run steelhead populations have decreased from 2011 (3.4 percent) to 2016 (1.12 percent), averaging 2.26 percent from 2011 to 2016 (Table 3-9). The average incidental take for the five watersheds in Puget Sound combined[29] is even lower (average of 1.29 percent from 2011 to 2016) (NMFS 2017b).

[29] The five watersheds represent listed natural origin steelhead harvest rates in the broader Puget Sound Steelhead DPS.

Table 3-9. Terminal listed natural origin harvest rates on Skagit River steelhead and average harvest for the five watersheds from 2011 to 2016 (NMFS 2017b).

Management Unit	Terminal Harvest Rate (%)						
	2011	2012	2013	2014	2015	2016	Avg.
Skagit River summer/winter-run	3.40	2.90	2.30	2.60	1.25	1.12	2.26
Average harvest for five Puget Sound watersheds	1.78	1.74	1.52	1.29	0.95	0.48	1.29

Harvest can also affect diversity. Fisheries targeting early winter steelhead hatchery-origin fish were concentrated on wild fish returning in the early November to January time frame (NMFS 2018). Previous fisheries directed at the harvest of early winter hatchery fish may have resulted in the loss of the early-timed run component of natural origin steelhead by removing them from the Skagit Basin (NMFS 2016). In particular, the spawn timing of the Nookachamps DIP may have been affected by fisheries directed at early winter steelhead hatchery fish (Hard et al. 2015).

More information on Skagit River Puget Sound steelhead VSP parameters (abundance, productivity, spatial structure, and diversity) and harvest rates, summarized here and incorporated by reference, can be found in NMFS' PSSTRT population delineation and viability reports (Hard et al. 2015; Myers et al. 2015)), NMFS' status review update on Pacific salmon and steelhead (NWFSC 2015), and NMFS' biological opinion on the Skagit River Steelhead Fishery Resource Management Plan (NMFS 2018).

3.3.2 Non-listed Salmon

There would be no effects to pink salmon under any of the alternatives since ongoing and proposed tribal and non-tribal steelhead fisheries would occur after the pink spawning season is completed in late September or October and before the pink salmon return in mid-August. In addition, no impacts are anticipated to occur to sockeye salmon because the proposed fisheries would be implemented before adult sockeye return to the Skagit River in June and after spawning is completed in December. Therefore, no pink or sockeye salmon would be in the Skagit River project area during the time of the proposed action. Thus, no impacts to non-listed pink and sockeye salmon are anticipated to occur, and these species are not analyzed in this environmental assessment.

3.3.2.1 Coho Salmon

Washington Department of Fisheries identified 40 coho salmon populations for the Puget Sound ESU (WDFW and WWIT 1993), which is not listed under the ESA. While the majority of the populations are sustained by natural origin spawning, only three of these populations (Sumas/Chilliwack, Skagit, and Deer Creek (Stillaguamish River) are determined to be of native origin. The remaining coho populations are of mixed, non-native, or unknown origin. One coho salmon population occurs in the proposed project area: Skagit River coho salmon (WDFW and WWIT 1993). The proposed action is likely to overlap the end of the coho salmon spawning season in January for tribal fisheries and in February for non-tribal fisheries.

Historically, the Skagit River has had the largest escapements of coho salmon in Puget Sound. However, this population has experienced unexpectedly low escapement during the 2015 and 2016 seasons. The 2006 to 2015 average Skagit coho salmon escapement was 43,133 fish with a 2015 estimate of only 5,476 fish.[30] Harvest estimates for Puget Sound tribal and non-tribal coho salmon net fisheries are not available (WDFW 2017). Therefore, a baseline for coho salmon harvest in the Skagit River cannot be established at this time.

3.3.2.2 Chum Salmon

WDFW and WWIT (1993) identified 45 fall-run chum salmon populations in Puget Sound, including 9 populations in North Puget Sound (Canada-Washington border to Stillaguamish River), 30 populations in South Puget Sound (Snohomish River south and Hood Canal), and 6 populations in the Strait of Juan de Fuca. Winter-run chum salmon occur primarily in South Puget Sound, including the Puyallup and Nisqually Rivers, which falls outside the proposed project area. One fall-run chum salmon population is located in the proposed project area: Mainstem Skagit River fall chum salmon (WDFW and WWIT 1993). The proposed Tribal steelhead fisheries would likely overlap the end of the chum salmon spawning season in December. Non-tribal fisheries associated with the proposed action are unlikely to occur during the chum salmon spawning season.

Historically, the Skagit River has had one of the largest escapements of chum salmon in Puget Sound. This population also experienced unexpectedly low escapement during the 2015 season. The 2007 to 2015 average Skagit chum salmon escapement was 31,800 fish, with a 2015 estimate of only 9,700 fish (WDFW 2017). Harvest estimates for Puget Sound tribal chum salmon fisheries have averaged 4,300 fish from 2007 to 2016 (WDFW 2017). The most recent tribal chum salmon harvest was 500 fish in 2016 (WDFW 2017).

[30] WDFW SCoRE database (https://fortress.wa.gov/dfw/score/score/), accessed 12/1/2017.

3.3.3 Other Fish

Other fish potentially affected by salmon and steelhead fishing in Puget Sound include groundfish, forage fish, trout, eulachon, green sturgeon, and northern pikeminnow (invasive species). Table 3-10 provides a description of how fish, other than salmon and steelhead, are affected by salmon and steelhead fishing in Puget Sound.

Table 3-10. Interaction and status of other fish species that may be affected by salmon and steelhead harvest in the project area.

Species	Federal/State Listing Status	Interaction with Salmon and Steelhead Fisheries
Groundfish (80 species including rockfish)	Some species in depressed conditions. Three species are federally listed (one threatened and one endangered) and/or have State Candidate listing status[1]. The three listed species also have critical habitat in Puget Sound	• Some species are predators of juvenile salmon and steelhead • Juveniles are prey for juvenile and adult salmon and steelhead • May be caught during marine recreational steelhead fisheries • Maybe impacted by lost/derelict net gear
Forage fish (herring, sandlance, smelt, hake, anchovy, Pollock, surf smelt, and others)	Pacific eulachon is a federally threatened species	• Prey for juvenile and adult salmon and steelhead
Bull trout[2]	Federally listed as threatened, critical habitat in Puget Sound	• Freshwater predator on salmon and steelhead eggs and juveniles • May benefit from additional marine-derived nutrients • May be caught in freshwater salmon and steelhead recreational fisheries, dependent on gear size
Rainbow trout	Not listed	• Predator of salmon and steelhead eggs and fry • May benefit from additional marine-derived nutrients • May be caught during freshwater salmon and steelhead recreational fisheries
Coastal cutthroat trout	Not listed	• Predator of salmon and steelhead eggs and fry • May benefit from additional marine-derived nutrients • May be caught during salmon and steelhead tribal and non-tribal fisheries, if open

Green sturgeon	Federally threatened, critical habitat in Strait of Juan de Fuca	• May benefit from additional marine-derived nutrients • May be caught in recreational and commercial salmon and non-tribal steelhead fisheries, if open
Whitefish	Not listed	• Freshwater predator on salmon and steelhead eggs and juveniles • May be caught during freshwater salmon and steelhead tribal and non-tribal fisheries, if open
Suckerfish	Not listed	• May benefit from marine-derived nutrients • May be caught in marine tribal gill net fisheries

[1] The Georgia Basin bocaccio DPS (*Sebastes paucispinis*) is Federally listed as endangered and state candidate species; the Georgia Basin yelloweye rockfish DPS (*S. ruberrimus*) is Federally listed as threatened and state candidate species; state candidate species; Black, brown, China, copper, green-striped, quillback, red-stripe, tiger, and widow rockfish are state candidate species.

[2] Bull trout (*Salvinlus confluentus*) are Federally-listed as threatened by USFWS. A special 4(d) rule exempts fishery actions consistent with state or tribal fishery regulations from take prohibitions.

Common groundfish include sole and flounder, rockfishes, surf perches, halibut, sculpins, spiny dogfish, lingcod, and Pacific cod. Rockfish constitute 30 percent of groundfish harvest and include listed species under the ESA. To conserve groundfish in Puget Sound, there are state management plans (Bargmann 1998; WDFW 2011), as well as federal regulations and guidelines under the Magnuson-Stevens Fishery Conservation and Management Act. The proposed action would operate under the current management plans for groundfish, as well as federal regulations and guidelines under the Magnuson-Stevens Fishery Conservation and Management Act to protect these species.

In April 2010, the Puget Sound/Georgia Basin Bocaccio rockfish was listed as endangered and the Puget Sound/Georgia Basin Yelloweye rockfish was listed as threatened under the ESA (75 FR 22276). Current threats include directed fishing, bycatch in other fisheries (including salmon), and adverse environmental factors. Fishermen targeting salmon and steelhead in marine recreational fisheries can incidentally catch bocaccio and yelloweye rockfish causing in injury and death from barotrauma (NMFS 2017b). Barotrauma occurs when rockfish are brought up from depths too quickly and decompression causes over-inflation or rupture of the swim bladder (Pribyl et al. 2011). Recently, NMFS providing funding to the Pacific States Marine Fisheries Commission and the Puget Sound Anglers to purchase and distribute descending devices to local fishermen and guides (NMFS 2017b). Most commercial salmon fishers in the Puget Sound use purse seines and gillnets (PSIT and WDFW 2010; Speaks 2017). Tribal gillnet fisheries in marine waters of Skagit Bay would occur under the proposed action. However, gillnets and purse

seines rarely catch rockfish of any species (NMFS 2017b). Given that only a small proportion of the proposed action occurs in marine waters and the majority of steelhead fisheries would occur in freshwater areas (Figure 1-1), descending devices to prevent rockfish mortality during non-tribal recreational fisheries are readily available to prevent or decrease mortality in marine areas, and tribal salmon and steelhead marine fisheries rarely intercept rockfish, this species is unlikely to be impacted by the proposed action and will not be discussed further in this EA.

In addition to fishery mortality, rockfish are killed by lost derelict fishing gear. Due to recent changes in state law, including several closures of commercial non-tribal fisheries to protect dwindling rockfish populations (NMFS 2017b), additional outreach and assessment efforts to report and recover derelict gear (Gibson 2013), and recent lost net inventories showing a low number of derelict gill nets (Beattie and Adicks 2012; Beattie 2013), it is likely that fewer nets will be lost in upcoming fishing seasons compared to several years ago. Because of the low number of anticipated lost nets, it is unlikely that few (if any) bocaccio or yelloweye rockfish mortalities would occur from new derelict gill nets, and that any additional mortality would cause risk to any rockfish populations (NMFS 2017b). Thus, this species is unlikely to be significantly impacted by the proposed action. More information on lost fishing gear can be found in Section 3.2.6, *Derelict Fishing Gear*.

Forage fish, such as eulachon, are important prey of salmon and steelhead. Eulachon were listed under the ESA as a threatened species on March 18, 2010 (75 FR 13012). WDFW protects forage fish species and their spawning habitat by limiting human activities on important beaches where forage fish spawn. Eulachon are an anadromous forage fish and are endemic to the Northeastern Pacific Ocean, ranging from northern California to southwest and south-central Alaska and the southeastern Bering Sea. Unlike most marine forage fish, Pacific Eulachon travel up rivers to fresh water to spawn. However, eulachon are not likely to be in Skagit River action area or intercepted in tribal commercial net or non-tribal recreational steelhead fisheries, and, thus, would not be impacted by the proposed action or discussed further in this EA.

On April 7, 2006, NMFS listed the southern distinct population segment of North American green sturgeon as threatened under the ESA (71 FR 17757). Green sturgeon are found along the West Coast of North America. Green sturgeon are caught incidentally in tribal gillnet fisheries and occasionally caught in non-tribal recreational fisheries in the Columbia River and along the Pacific Coast (SWFSC 2002). However, few green sturgeon are incidentally caught in Puget Sound (i.e., tribal salmon fisheries with the majority caught in trawl fisheries) (SWFSC 2002). Green sturgeon are unlikely to be found within the Skagit Basin action area (Figure 1-1), and, thus this species is not likely to be impacted by the proposed action and will not be discussed further in this EA.

NMFS recently evaluated the effects of The Puget Sound salmon and steelhead fisheries (No Action/Status Quo, Alternative 1) on ESA-listed groundfish, such as Yelloweye and Bocaccio rockfish, eulachon, and green sturgeon, in a biological opinion and determined that those fisheries were not likely to jeopardize the continued existence these ESA-listed species or to adversely modify their designated critical habitat (NMFS 2017b).

Bull trout are a federal ESA listed species (threatened status; 64 FR 58910, November 1, 1999) that prey on salmon and steelhead. The Coastal-Puget Sound bull trout species feeds heavily on salmonids and generally benefits from releases of juvenile salmon and steelhead but bull trout can also be incidentally caught as bycatch. The Skagit River supports the largest population of native char (bull trout/Dolly Varden) in Puget Sound (PSE 2003). The U.S. Fish and Wildlife Service has identified two bull trout core areas in the Coastal Bull Trout Recovery Unit in the Skagit Basin: (1) Lower Skagit River, located below the Skagit River hydropower facilities, and (2) the Upper Skagit River, above hydropower facilities (USFWS 2015). The U.S. Fish and Wildlife Service has identified the Lower Skagit and Upper Skagit core areas as two of the four core areas within the Coastal Recovery Unit that have been identified as, "current bull trout population strongholds" and are "considered the most stable and abundant bull trout populations within the Coastal Recovery Unit" (USFWS 2015). The Lower and Upper Skagit core areas "likely contain two of the most abundant bull trout populations with some of the most intact habitat within this recovery unit" (USFWS 2015),

The Lower Skagit River bull trout core area falls within the action area (Figure 1-1) and the Upper Skagit River bull trout core area does not. For this reason, this assessment with focus on the Lower Skagit River bull trout core area population. Primary limiting factors for this core area include flood control and water quality issues associated with agricultural practices, residential development and urbanization, increasing variability in water flows due to climate change, and upstream/downstream fish passage connectivity impairment associated with the Baker River hydropower project (USFWS 2015).

Bull trout are not targeted in commercial fisheries and are managed for catch-and-release in Puget Sound (WDFW 2017). Bull trout redd surveys in recent years commonly end early or are prevented entirely because of repeated stream blow outs due to high flow events that flatten redds. Monthly high flow events result in fallen trees, avulsions, and displaced gravel (Fowler 2015). As a result, information on bull trout behavior and population size is limited. The only area which has been historically surveyed regularly for total redds has been the upper South Fork Sauk River. Other rivers and numerous smaller tributaries, such as the Cascade River and Bacon, Downey, and Illabot Creeks, are periodically checked for spawner utilization (Table 3-11). Spawning ground surveys were conducted from September 6 through November 18, 2016. Weather and stream conditions were extremely poor throughout October and resulted in substantial survey disruption and "uncertainty whether redd counts reflected reality" (Fowler

2017). In addition to not being able to survey due to high flows, unusually high freezing events combined with high precipitation fully mobilized some stream beds resulting in redd flattening, complete scour, channel avulsions, and channel abandonment. Bull trout populations with acceptable survey coverage throughout the spawning period were the West Fork Bacon, Illabot, and Downey Creeks with a total of 222 redds (Fowler 2017). An additional 106 bull trout redds were found in other streams through attempted monitoring for a cumulative Skagit Basin total of 328 redds (Table 3-11).

Table 3-11. Redd counts from 2016 Skagit Basin bull trout spawning ground (index areas) surveys (Source: excerpt from Fowler (2017; Table 2)).

Table 2. Redd counts from 2016 Skagit Basin bull trout spawning ground surveys.

Stream	River mile		Week	37	37	38	39	39	39	40	40	40	40	41	41	41	42	42	42	43	44	45	44	45	46	47	Total redds
				September										October											Nov		
	Low	Up	Date	6	7	15	20	22	23	27	28	29	30	3	5	6	10	11	12	19	24	25	26	31	10	18	
WF Bacon Creek	6.1	8.1					0				0				0		1			9	7			1		5	23
SF Cascade River	20.0	21.8								2								12					25				39
SF Cascade River	18.6	19.3						0						9								2					11
Cascade River	15.8	18.6						0						21								5					26
Illabot Creek	9.9	10.7									0						0				3				0		3
Illabot Creek	10.7	11.7									2						1				7						10
Downey Creek	0.0	2.1			0	0		0								91			17					0			108
Downey Creek	3.0	6.3		3		12			11				15		32				5				0				78
SF Sauk River	4.5	5.0										0							1								1
SF Sauk River	6.1	9.3										8							3					18[2]			29
																										Cumulative total from all indexes:	328

[1] WRIA references for the Upper Skagit River Basin begins with a "03." within WDFW's spawning database.

[2] Partial survey, less than half of the index surveyed. Heavy rain all day and river blew out during the survey.

Results from Skagit River native char surveys show a stable, robust population based on redd counts but adult escapement estimates are not always published (WDFW and WWTIT 1998). The most recent redd count population monitoring published for the Skagit River Basin from 2002 to 2016 is provided in Table 3-12.

Table 3-12. Yearly bull trout redd counts from 2002 to 2016. (Source: excerpt from Fowler (2017; Table 3)).

Table 3. Yearly bull trout redd counts from 2016 back through 2002. Counts were cumulative counts from all indexes within each stream. The Cascade River redd counts also included the counts from the Middle Fork and South Fork Cascade River indexes. If no redd count is listed then no surveys were conducted in that index that year. Redd counts are shown from prior to 2005 but it should be noted that during that time some spawning areas were still being explored and located so survey coverage was not necessarily consistent year to year prior to the 2005 spawn year.

Stream	Comparisons					North Puget Sound bull trout redd counts by year														
	Years compared			Redds																
	Last	First	N	Mean	Median	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
WF Bacon Creek	2015	2002	14	75	80	23	58	87	59	91	48	67	21	84	86	59	101	91	75	127
Cascade River	2015	2006	10	295	339	Partial	140	412	376	437	178	207	91	333	344	434				
Illabot Creek	2015	2002	9	100	57	13	40	124						33	51	26	57	156	211	201
Downey Creek	2015	2005	11	176	172	186	143	263	208	260	141	95	103	197	172	193	158		Partial	
SF Sauk River	2015	2002	14	175	147	Partial	67	124	156	151	133	152	77	208	110	143	104	433	279	318
					Total redds:		521	292	855	763	855	420	680	565	646	521	292	855	763	855

"Partial" means some surveys were conducted in all or some of the indexes in that stream that year, but surveys did not cover all habitat within the index or surveys were not performed at regular intervals.

Spawning surveys funded by the U.S. Fish and Wildlife Service and conducted by the Washington Department of Fish and Wildlife and Seattle City Light occur annually but seasonal redd counts from most index areas in recent years (2014 to 2016) are unreliable and unlikely to be comparable to prior years due to inclement weather events (Fowler 2016; Fowler 2017; Chan 2018). Thus, no population estimates for the Skagit Basin core areas are published. Based on expert opinion, the Lower Skagit Basin core area bull trout population estimate is likely between 13,000 to 16,000 fish (E. Connor, Seattle City Light, pers. comm. 2018). The Lower Skagit Basin core area bull trout are classified as "Healthy", and the Skagit River Basin is one of the few areas that remain open for recreational harvest (WDFW and WWTIT 1998). Spawn timing of native char in the Skagit River primarily occurs in early September through early November in the upper tributary reaches prior to when the proposed steelhead fishery occurs (PSE 2003). After spawning, adults begin to outmigrate during the late fall and may be encountered in salmon fisheries before they enter the estuary in late spring. Since 1990, native char in the Skagit River have been protected from potential recreational harvest by a 20-inch minimum size limit in the mainstem Skagit, Cascade, Suiattle, Whitechuck, and Sauk Rivers to allow the majority of females to spawn at least once, while all other Skagit River tributary areas are closed to native char fishing (WDFW and WWTIT 1998). Many of the upper Skagit areas used by spawning bull trout adults lie within either the North Cascades National Park boundary or the U.S. Forest Service boundaries designated as wilderness areas which contain excellent habitat for spawning, incubation, and juvenile rearing (WDFW and WWTIT 1998).

Bull trout and Dolly Varden can be difficult to distinguish based on appearance, requiring analysis of multiple physical features (PSE 2003). Both species have been found in the Skagit River (WDFW and WWTIT 1998). Dolly Varden are also present in the proposed project area and are not listed. No impacts from the proposed Skagit RMP, adverse or beneficial, are anticipated to occur to Dolly Varden, because the proposed fisheries would not occur in tributaries entering the mainstem Skagit, Sauk, or Suiattle Rivers where Dolly Varden are known to reside (Sauk-Suiattle Indian Tribe et al. 2016).

Similarly, rainbow trout, coastal cutthroat trout (also known as Westslope cutthroat trout), suckerfish, and whitefish also benefit during juvenile salmon and steelhead migration from freshwater streams to estuaries and the ocean but may also be incidentally caught as bycatch. Comprehensive data sets for Skagit River rainbow trout, suckerfish, and whitefish populations in the action area are not available at this time to evaluate the effects of these predators (on juvenile steelhead) or as bycatch in steelhead fisheries. However, the comanagers are currently assessing rainbow trout occupancy within the Skagit SMU anadromous zone and above some impassable barriers (Sauk-Suiattle Indian Tribe et al. 2016). From 2011 to 2012, rainbow trout were ubiquitous across the Skagit SMU and occupied 95% of the sites surveyed (J. P. Shannahan, Upper Skagit Tribe, unpubl. data). Rainbow trout juveniles occupied 84% of the sites in the summer 2011 (average density of 0.34 juveniles per linear meter) and 93% of the sites in winter 2012 (average density 0.16 juveniles per linear meter) (WDFW et al. 2018). This information suggests that rainbow trout are broadly distributed throughout the Skagit River Basin (WDFW et al. 2018).

Leider (1997) noted that, "confident assessment of the status of coastal cutthroat trout in most areas of the state is limited at this time." The best available data is on coastal cutthroat trout but little recent information is available relative to population status in the major Puget Sound tributaries (such as the Skagit River), that would permit an assessment or revision of the status ratings provided by Blakely et al. (2000). According to the WDFW Salmonid Stock Inventory (SaSI) reports, status for anadromous coastal cutthroat in the Skagit River was identified as unknown (Blakely et al. 2000). Less information is known on the status of non-anadromous forms of coastal cutthroat trout. Knowledge of population abundance, trends in abundance, population dynamics, and relationships among life history forms, productivity, spatial structure, diversity, and status are lacking (Anderson 2008a). Little recent quantitative information is available to update WDFW's 2000 determination. However, available monitoring information suggests that cutthroat are widespread and ubiquitous, and that all life history strategies are represented within suitable habitat (Anderson 2008b). In 1997, the WDFW estimated 13,000 coastal cutthroat trout spawners in the Skagit River system (PSE 2003). In 2003, the Westslope cutthroat trout population was determined to not warrant listing by the U.S. Fish and Wildlife Service (68 FR 46989, August 7, 2003).

Cutthroat trout are not targeted and bycatch in commercial gillnet fisheries is minimal because of the large mesh size of gillnets relative to the size of cutthroat trout (Anderson 2008b). Non-tribal fisheries are designed to increase the likelihood that smaller fish, like cutthroat trout, escape the fishery so that rearing juveniles and migrating smolts are protected, and the majority of adult females are able to spawn at least once before encounters may occur in fisheries (Anderson 2008b). Juvenile coastal cutthroat trout smolts outmigrate from freshwater streams to the ocean from June through October and would not be affected by the proposed steelhead fisheries, which

would occur from December to April. Currently, non-retention rules are in place for recreational fisheries, and adult cutthroat trout encountered must be released.

Generally, when fish species are impacted by Puget Sound salmon and steelhead fishing, it is due to bycatch and derelict fishing gear. All fish benefit from marine-derived nutrients resulting from salmon spawning (Holtgrieve and Schindler 2011; Rex and Petticrew 2008; Scheuerell et al. 2005; Vanni 2002; Wipfli et al. 1998), and some fish species that are prey of salmon and steelhead benefit from their harvest (Bureau of Indian Affairs 2017).

3.4 Marine Ecosystem and Fish Habitat Affected by Steelhead Fishing

Fish habitat affected by Puget Sound salmon and steelhead fishing includes open water, marine/benthic substrates, river sediments and bottoms, and aquatic vegetated areas in fresh and marine water. These habitats are affected by boat use and human disturbance and waste, light, and noise during fishing activities. Seines, reef nets, gill nets, and tangle nets may scour the seabed or river bottom. Fish gear may be lost and left as derelict fishing gear, which may cover fish habitat. A description of the effects of derelict fishing gear to wildlife is provided in Subsection 3.4.6, Derelict Fishing Gear. Stream wading by fishers can also result in trampling of salmon spawning redds. However, this latter impact has decreased through recent closures of fishing at important spawning areas.

3.4.1 Marine-derived Nutrients from Steelhead Spawners

Steelhead carcasses, which occur in freshwater streams after spawning, provide a direct food source for juvenile salmonids and other fish, aquatic invertebrates, and terrestrial animals (Cederholm et al. 2000; Merz and Moyle 2006). The decomposition of carcasses supplies nutrients that increase primary and secondary production and benefit the ecosystem. Carcass biomass may be from both hatchery-origin and natural origin fish. Carcasses may be placed in streams by hatchery operators in addition to natural spawning of salmon and steelhead, although hatchery steelhead are not released in the Skagit River at this time.

3.5 Environmental Justice

NOAA's Policy and Procedures for Compliance with NEPA (Companion Manual for NAO 216-6A) requires that a determination be made as to "whether the proposed action has a disproportionately high and adverse human health or environmental impact on minority or low-income populations and on subsistence use in affected areas."

This subsection was prepared in compliance with Presidential Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 Fed. Reg. 7629, February 16, 1994) and Title VI of the Civil Rights Act of 1964. Executive Order 12898 states that federal agencies shall identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of [their] programs, policies and activities on minority populations and low-income populations."

For this analysis, the one approach used for determining a meaningful different population included:

- **Meaningful Greater Analysis.** Considering examples in the Guidance from NMFS (2014), a threshold of 10 percent was considered for this evaluation (i.e., the community represents more than 10 percent of the minority or low-income community that resides in the state of Washington).

3.5.1 Low Income

Using the USDA Economic Research Service Data for 2015, the poverty levels for Washington State and counties within the project area were calculated (Table 3-7). The total 2014 poverty level (including rural and urban areas) is $49,610. This is the most recent information available, which is based on the median household income for Washington State (USDA 2014). In Washington State, there are four counties: 1) Clallam; 2) Whatcom; 3) Skagit; and 4) Mason that have a percent poverty level greater than 10 percent of the state percent poverty level. Two of those counties are located in the proposed Skagit River project area: 1) Whatcom and 2) Skagit. Thus, these two counties are considered environmental justice communities of concern for this analysis. It is important to note that, although we were not able to locate poverty level statistics for tribal communities within Whatcom and Skagit counties, the tribal poverty levels are believed to be much lower than those represented by the state percent poverty level described in Table 3-13 (Schuyler 2018).

Table 3-13. Percent of population below poverty level within the project area.

State/County	Percent below Poverty Level (2014)[1]	Per Capita Income (2014)[2]
Washington State	12.2	$64,080
Whatcom County	14.4	$55,073
Skagit County	14.9	$56,891

[1] Source: http://ers.usda.gov/data-products/county-level-data-sets/poverty.aspx.
[2] Source: http://www.ofm.wa.gov/economy/hhinc/medinc.pdf.

3.5.2 Minority

Using Washington State Office of Financial Management data (Washington State Office of Financial Management 2016), which relies on U.S. Census Bureau information to calculate percent minority for Washington State and each county within the project area, the percent minority populations were calculated (Table 3-14). The following county minorities were identified to be greater than 10 percent of the state minority population or identified as having no counties falling within this criteria (i.e., none):

- Asian – Snohomish and King Counties greater than 10 percent
- Black/African American – none
- Hispanic – Skagit, Snohomish, King, and Pierce Counties greater than 10 percent
- American Indian/Alaska Native – none
- Native Hawaiian/Pacific Islander – none

Table 3-14. Percent of minority persons by county and race within the project area.

State/County	Total Population (2014)	Hispanic (%)	Black/African American (%)	American Indian/Alaska Native[1] (%)	Asian (%)	Native Hawaiian/ Pacific Islander (%)
Washington State	6,968,170	12.4	4.1	1.9	8.4	0.7
Clallam	72,500	6.0	1.0	5.6	1.7	0.2
Jefferson	30,700	3.8	1.0	2.3	1.8	0.2
Island	80,000	7.3	3.1	1.1	4.9	0.5
San Juan	16,100	6.1	0.6	0.9	1.5	0.1
Whatcom	207,600	9.2	1.2	3.2	4.4	0.3
Skagit	119,500	**17.9**	1.0	2.8	2.3	0.3
Snohomish	741,000	**9.9**	3.2	1.6	**10.4**	0.6
King	2,017,250	**9.5**	6.8	1.1	**16.9**	0.9
Pierce	821,300	**10.5**	7.4	1.7	6.7	1.6
Thurston	264,000	8.6	3.5	1.7	6.0	1.1
Mason	62,000	9.2	1.3	4.5	1.4	0.5
Kitsap	255,900	7.5	3.0	1.8	5.4	1.0

Numbers in bold represent communities that exceed the threshold criteria.
Source: http://www.ofm.wa.gov/pop/asr/default.asp.

The above counties in bold are considered to support minority environmental justice communities of concern. The communities that contain Black/African American and Native Hawaiian/Pacific Islander peoples fall outside the analysis area; thus not needing an analysis under Environmental Justice. Hispanic peoples fall within the analysis area for the Skagit County. Despite not falling within the 10% threshold, American Indian/Alaska Native are considered separately below.

3.5.3 Native American

USEPA guidance regarding environmental justice extends beyond statistical threshold analyses to consider explicit environmental justice effects on Native American tribes (USEPA 1998). Federal duties under Executive Order 12898, the presidential directive on government-to-government relations and the trust responsibility to Indian Tribes may merge when the action proposed by another federal agency or the USEPA potentially affects the natural or physical environment of a tribe. The natural or physical environment of a tribe may include resources reserved by treaty or lands held in trust; sites of special cultural, religious, or archaeological importance (e.g., sites protected under the National Historic Preservation Act); and other areas reserved for hunting, fishing, and gathering (i.e., usual and accustomed area), which may include

“ceded” lands that are not within reservation boundaries. Potential effects of concern may include ecological, cultural, human health, economic, or social impacts when the impacts are interrelated to impacts on the natural or physical environment (USEPA 1998).

As described in Section 3.6, Cultural Resources, and 3.7, Socioeconomics and Tourism and Recreation, below, salmon and steelhead fishing has been central to tribal economics, cultures, lifestyles and identities for over 2,000 years (Schuyler 2018). These activities continue to be important today both economically and for subsistence and ceremonial purposes (Stay 2012; Bureau of Indian Affairs 2017). Tribal fishing (including commercial, subsistence, and ceremonial) is considered a very important lifestyle for all Puget Sound tribes. The following tribes are considered Federally-recognized Treaty Indian Tribes in the proposed project area for the Skagit RMP: Upper Skagit, Sauk-Suiattle, and Swinomish Tribes.

In summary, the following are identified as environmental justice communities or user groups, which includes the following counties, and target populations:

- Low income – Whatcom and Skagit Counties
- Minority – Skagit County
- Indian Tribes – Federal trust responsibility

3.6 Cultural Resources

In *United States v. Washington* (1974), the United States District Court for the Western District of Washington ruled that the Puget Sound Treaty Tribes "shall have" the right to take up to 50 percent of the harvestable number of fish that may be taken by all fishermen at usual and accustomed grounds and stations in the state that would pass through tribal fishing grounds and that non-treaty fisherman would also have the right to take up to 50 percent to be calculated on a river-by-river, run-by-run basis, subject to certain adjustments (*United States v. Washington*, 384 F. Supp. 312, 343 (W.D. WA 1974)). Initially the state did not implement this ruling, leading to clashes between Indian and non-Indian fishermen on fishing grounds. The unrest continued until 1979 when what is known at the Boldt Decision was upheld by the U.S. Supreme Court. This decision resulted in the Tribes and WDFW becoming co-managers of the Project Area fisheries. The United States, acting through the BIA, as the plaintiff in *United States v. Washington,* has supported the Tribes’ co-management activities. The WDFW then adopted regulations protecting Indian treaty rights. Like other treaty obligations of the United States, Indian treaties are considered to be “the supreme law of the land,” and they are the foundation upon which Federal Indian law and the Federal Indian trust relationship is based.

Indian trust assets are legal interests in property held in trust by the United States for Indian tribes or individuals. The U.S. Secretary of the Interior, acting as the trustee, holds Indian trust assets, which may either be on or off Indian reservations. Puget Sound treaty tribes who signed the Stevens Treaties, particularly those during 1854 and 1855 (10 Stat 1132, 12 Stat 927, 12 Stat 933, 12 Stat 939, 12 Stat 951, 12 Stat 971), secured the "right of taking fish at usual and accustomed grounds and stations…in common with all citizens of the Territory," which provided these Indian Tribes the right to harvest a share of each run of anadromous fish passing through tribal fishing grounds in return for relinquishing their interest in certain lands in Washington State, including Puget Sound. The United States, and thus Federal agencies, have a trust responsibility to protect and maintain these rights reserved by or granted to Indian Tribes or Indian individuals by treaties, statutes, and executive orders.[31] Fishing is considered an Indian trust asset because Puget Sound Indian Treaties (as well as other treaties) with the United States government guaranteed treaty tribes the right to fish.

To annually confirm an equitable sharing of the anadromous fisheries resource Puget Sound Indian Tribes and WDFW meet during the spring of each year to review expected salmon and steelhead returns and agree on sharing of the fisheries resource for the upcoming year's harvest during the North of Falcon process.[32] The annual agreement is then published as the Co-Managers' List of Agreed Fisheries, the most recent of which is described by (PSIT and WDFW 2017).

3.6.1 Treaty Indian Ceremonial and Subsistence Fish Uses

Ceremonial and subsistence uses pertain to fish that are caught non-commercially by members of Puget Sound Indian Tribes. Steelhead harvested for ceremonial and subsistence purposes provide basic nutritional benefits to their members, and help to maintain the intrinsic and essential cultural values imbued in traditional fishing practices and spiritual links with natural resources (WDFW and PSIT 2004). Thus, ceremonial and subsistence fishing are important to maintaining cultural viability, and provide valuable food resources, among other traditional foods, in tribal ceremonies. Examples of ceremonies that use traditional foods include winter ceremonies, first salmon ceremonies (Amoss 1987), naming ceremonies, giveaways, feasts, and funerals (Meyer Resources Inc. 1999). Subsistence refers to ways in which Native Americans use environmental resources, such as steelhead, to meet the nutritional needs of tribal members.

Members of the Puget Sound treaty tribes prioritize their ceremonial and subsistence needs over commercial sales. Tribes may fish for ceremonial and subsistence uses when there are no concurrent commercial fisheries, and may use some of their commercial harvest for ceremonial

[31] For more information on Sovereign Relations, please visit the National Marine Fisheries Service, West Coast Region website at: http://www.westcoast.fisheries.noaa.gov/whatwedo/sovereign_relations/index.html.
[32] For more information on the North of Falcon process, please visit: http://wdfw.wa.gov/fishing/northfalcon/.

and subsistence purposes. For an overall summary of treaty Indian ceremonial and subsistence salmon uses, refer to (NMFS 2003).

3.7 Socioeconomics and Tourism and Recreation

Skagit River steelhead fisheries have contributed to the regional economy in the past when directed fisheries occurred in the proposed action area (Figure 1-1). The counties found in this area include: Skagit County and Whatcom County. The cities along the Skagit River include: Mount Vernon, Burlington, Sedro-Woolley, Lyman, Hamilton, Concrete, Rockport, and Newhalem.

In addition to the value to steelhead fishers and the regional economy, Skagit River steelhead are considered to be a source of value to persons who do not directly use or consume these resources (Bureau of Indian Affairs 2017). Reducing the likelihood for species extinction, or by providing more certainty that these resources would exist even if no personal use is intended are concepts of economic value that are widely recognized (NMFS 2004a). These values are commonly referred to as non-use or passive use values (Bureau of Indian Affairs 2017). Although we are not able to quantify or analyze these values for this assessment, their existence is acknowledged.

Co-managers have not conducted directed steelhead fisheries in the proposed action area of the Skagit River Basin (Figure 1-1) since the mid 1990s to conserve natural origin steelhead. Shortly after the listing of Puget Sound steelhead in 2007, NMFS issued a final 4(d) Rule that provided for a delay in the effective date for take prohibitions associated with tribal and recreational steelhead harvest until June 1, 2009, so long as that harvest was not directed at naturally spawning stocks and was authorized either by a federally-recognized Treaty Tribe or the State of Washington (73 FR 55454, September 25, 2008). NMFS recognized the economic and cultural importance of steelhead harvest in context with the lack of directed steelhead fisheries in Puget Sound, which includes the Skagit River proposed action area (Figure 1-1), and determined that allowing these incidental fisheries to continue would not impede survival and recovery of the Puget Sound Steelhead DPS. Nonetheless, past directed steelhead fisheries likely provided an economic benefit to the communities within the Skagit River proposed action area. Since there is currently not a directed steelhead fishery, there is no quantitative baseline data on economics. The socioeconomic analysis in this EA, described in Chapter 4, will be qualitative.

3.8 Climate Change

Because NEPA reviews require decision makers to consider the impacts of proposed actions and alternatives into the future, these analyses must consider these actions in the context of the future state of the environment, which includes consideration of the impacts of climate change on the

environment. Decision makers need not undertake new research or analysis of potential climate change impacts in the proposed project area, but may instead summarize and incorporate by reference the existing relevant scientific literature.

According to NOAA (2016), climate change is projected to have the following effects on the Pacific Northwest environment, in summary:

- Increased air temperature (high certainty)
- Increased winter precipitation (low certainty)
- Decreased summer precipitation (low certainty)
- Reduced winter and spring snowpack (high certainty)
- Reduced summer stream flow (high certainty)
- Earlier spring peak flow (high certainty)
- Increased flood frequency and intensity (moderate certainty)
- Higher summer stream temperatures (moderate certainty)
- Higher sea level (high certainty)
- Higher ocean temperatures (high certainty)
- Intensified upwelling (moderate certainty)
- Delayed spring transition (moderate certainty)
- Increased ocean acidity (high certainty)

For the proposed Skagit River project area, the combined effects of climate change and dam operation on the hydrology and sediment loading of the Skagit River were assessed by (Lee et al. 2016). Anticipated effects from the analysis projected: 1) a shift from dual peak flows in winter and spring to a single dominant peak in December; 2) a 23 percent increase in the 100-year flood by the 2040s; 3) a 23 percent reduction in the lowest consecutive 7-day flow with a 10-year return interval; and 4) a 376 percent increase in sediment load from December – February by the 2080s (Sauk-Suiattle Indian Tribe et al. 2016). The effects of the above environmental changes on Skagit River steelhead are difficult to predict due to the complex interactions of biotic and abiotic factors, the plasticity of steelhead life history patterns, and uncertainties in our understanding of the rate at which adaption would occur (Sauk-Suiattle Indian Tribe et al. 2016).

4. ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

The four alternatives being evaluated in this EA are described in Chapter 2, *Alternatives*, and consist of Alternative 1 (No Action/Status Quo), Alternative 2 (Proposed Action/Preferred

Alternative), Alternative 3 (Intermediate Fixed Harvest Rate), and Alternative 4 (Escapement-Based Management). The No Action/Status Quo, Alternative 1, represents the existing estimated incidental take rate for listed natural origin Puget Sound steelhead in treaty and non-treaty fisheries (Figure 1-1) of 4.2% of total natural origin steelhead abundance in any given year.[33] The actual rate of incidental catch is expected to average, roughly, 3.1% based on data from 2007 to 2011 (NMFS 2017b). The Proposed Action/Preferred Alternative, Alternative 2, represents a stepped harvest regime with allowable harvest rates (direct and incidental take combined) ranging from 4% to 25% of varying abundance between 4,001 to 8,001 (Sauk-Suiattle Indian Tribe et al. 2016).

The two remaining alternatives represent intermediate and escapement-based harvest regimes for a broader comparison of environmental effects. The Intermediate Fixed Harvest Rate, Alternative 3, represents an incidental take rate of 4.2% at abundances less than or equal to 4,000 steelhead, while allowing for a fixed harvest rate (direct and incidental take combined) of 10 percent annually for abundances equal to or greater than 4,001 steelhead. The Escapement-Based Management, Alternative 4, represents incidental take of 4.2 percent at abundances equal to or less than 5,999 fish, while allowing for a fixed harvest rate (direct and incidental take combined) of 16 percent for abundance equal to or greater than 6,000 steelhead annually.

The baseline conditions for 8 resources (wildlife; fish; marine ecosystems and fish habitat; environmental justice; cultural resources; socioeconomics and tourism and recreation; and climate change) that may be affected by the four alternatives described above are described in Chapter 3, *Affected Environment*. This chapter provides an analysis of the direct and indirect environmental effects associated with the four alternatives on these eight resources (tourism and recreation is combined with socioeconomics). Cumulative effects of these alternatives are presented in Chapter 5, *Cumulative Effects*.

The analysis area for each resource is the same as that described in Chapter 3.

4.2 Wildlife

Described in this section are predator/prey relationships, steelhead carcass nutrient benefits, transfer of toxins from steelhead to wildlife, harvest habitat disturbance, fisheries bycatch, and derelict fishing gear.

[33] Aggregate annual average across the: Skagit, Snohomish, Stillaguamish, Green, and Puyallup, populations.

4.2.1 Predator/Prey Relationships

Listed Species. Southern Resident Killer Whale (SRKW) have a strong predator/prey relationship with salmon. Based on best available science, they have a weaker predator/prey relationship with steelhead (Section 3.2.1, *Predator/Prey Relationships*).

Under the No Action/Status Quo Alternative, Alternative 1, harvest would continue at existing levels and the effects of the existing incidental fisheries would remain the same as the current conditions. In 2017, NMFS considered the effects of the current Puget Sound salmon and steelhead fisheries on ESA listed species, including SRKW, and determined that those fisheries were not likely to jeopardize the continued existence of the SRKW species or adversely modify its critical habitat (NMFS 2017b). Significant impacts to SRKW are not anticipated because the fish have already passed through the Strait of Juan de Fuca and Puget Sound, the geographic range of available prey for SRKW, before they are harvested, particularly for the majority of fish that will be harvested in freshwater areas of the Skagit Basin. SRKW are not found to migrate outside of the marine area (Skagit Bay) and the majority of the project area occurs in freshwater (in-river).

Under the Proposed Action/Preferred Alternative, Alternative 2, harvest of adult Skagit steelhead would increase up to 25%. Harvest rates would be based on the abundance of Skagit steelhead (Section 2.2, *Alternative 2*). Under the Proposed Action/Preferred Alternative, Alternative 2, impacts would not rise to the level of significant impact because, based on the best available science, steelhead make up a very small component of the SRKW diet (< 3%) and SRKW are less likely to be in the action area. The SRKW population has been detected in Puget Sound marine waters averaging 4 days per month, January through March, and primarily feeding on Chinook salmon (*Section 3.2.1, Predator/Prey Relationships*). For the remaining days per month, the SRKW population was detected in coastal waters (outside the action area) also primarily feeding on Chinook salmon. Thus, during the majority of months the proposed steelhead fisheries would operate (December through April), SKRW are likely to be outside the proposed action area (Section 3.2.1, *Predator/Prey Relationships*). Although the SRKW may feed on other salmon species, such as steelhead, during the winter months when Chinook salmon is less abundant, Alternative 2 is likely to result in negligible effects to the SRKW population due to diet composition and location of feeding Data on steelhead as a prey resource for SRKW has yet to be analyzed specifically (such as the Chinook salmon data just described) but studies are ongoing to help further refine our knowledge of SRKW diets in the near future, particularly for other species of salmon (Section 3.2.1, *Predator/Prey Relationships*).

The Intermediate Fixed Harvest Rate, Alternative 3, and the Escapement-Based Management, Alternative 4, fall within the effects of harvest described under Alternative 2 (10% to 16% steelhead harvest rate), Alternatives 3 and 4 are also likely to result in negligible effects to

SKRW that are not likely to rise to the level of significant impacts for the same reasons described under Alternative 2.

Marine Mammals (non-listed). Marine mammals that have a *Recurrent* (Cederholm et al. 2000) relationship with salmonids are Steller sea lions, California sea lions, and harbor seals, particularly where salmon and but not primarily where steelhead congregate (Section 3.2.1, *Predator/Prey Relationships*). Because these mammals are opportunistic fish feeders, they seek other foraging locations and search out other prey when salmon and steelhead are not as plentiful or are not present during specific times of the year. Direct effects of steelhead harvest include reducing the availability of prey in the form of adult steelhead. Indirect effects of harvest include reducing the availability of prey in the form of juvenile steelhead by removing adults from the Skagit River Basin and potentially reducing future productivity.

Under the No Action/Status Quo Alternative, Alternative 1, harvest would likely continue at existing levels and the effects of the existing incidental fisheries would remain the same. Under the existing fisheries, there are no negative impacts to marine mammals that would rise to the level of significance. This is because, although marine mammals prey on salmon and steelhead, their opportunistic behavior and ability to prey on a variety of fish species allows them to accommodate slightly changing foraging conditions (Section 3.2.1, Predator/Prey Relationships). Since the Marine Mammal Protection Act was passed in 1972, the populations of marine mammals, such as harbors seals, and Steller and California sea lions, have rebounded exponentially. For example, the California sea lion population has increased steadily at an average rate of more than 5% since the mid-1907s (NWFSC 2014). Counts of sea lions in the inland waters of Washington average 300 to 500 animals from 1986 to 1994 to more than 1,100 after 1995. Scat samples from California sea lions have been examined from two sites in northern Puget Sound (Everett and Shilshole Bay). In both areas, predominate prey in scats was Pacific whiting and Pacific hearing, and salmonids occurred in only 6% of the samples (NWFSC 2014). Likewise, the number of harbor seals have increased by 7.7% annually since 1978 when systematic counts began (NWFSC 2014).

Under the Proposed Action/Preferred Alternative, Alternative 2, during low abundance years ($\leq$ 4,000 adults), impacts to adult Skagit steelhead would remain likely remain the same as under the No Action/Status Quo Alternative, Alternative 1 and would not affect the amount of adult and juvenile steelhead that would be available as prey for marine mammals. At higher abundances of 4,001 fish and above, a higher harvest rate and number of adult steelhead would be allowed (10% to 25%, based on abundance estimates). These harvest rates would decrease the availability of adult and juvenile steelhead as a prey species for marine mammals compared to the No Action/Status Quo Alternative, Alternative 1. Considering that the majority of the fishery removals would occur in freshwater, after marine mammals have had the opportunity to prey on steelhead, and that the harvest rates are abundance based (less steelhead would be harvested at

low abundances and more steelhead would be harvested at higher abundances vs. a fixed rate regardless of abundance), Alternative 2 is not likely to have a significant impact on marine mammal prey-base.

Under the Intermediate Fixed Harvest Rate, Alternative 3, take of adult steelhead would remain the same (4.2%) as the No Action/Status Quo Alternative, Alternative 1 (existing incidental take rate), during low abundance years ($\leq$ 4,000 adults), which would not affect the amount of adult steelhead that would be available as prey for marine mammals. At higher abundances of 4,001 fish and above, a fixed steelhead harvest rate of 10% would be allowed. This harvest rate would decrease the availability of adult and juvenile steelhead as a prey species for marine mammals compared to the No Action/Status Quo Alternative, Alternative 1 but would not have significant impacts. The majority of the fishery removals would occur in freshwater after marine mammals have already had the opportunity to prey on steelhead. Thus, Alternative 3 is not likely to have a significant impact on marine mammal prey base.

Under the Escapement-Based Management, Alternative 4, harvest of adult steelhead would remain the same (4.2%) as the No Action/Status Quo Alternative, Alternative 1 (existing incidental take rate), during low abundance years ($\leq$ 5,999 adults), which would not affect the amount of adult steelhead that would be available as prey for marine mammals. At higher abundances of 6,000 and above, a fixed steelhead harvest rate of 16% would occur. This harvest rate would decrease the availability of adult steelhead as a prey species for marine mammals, compared to the No Action/Status Quo Alternative, Alternative 1 even more so than the Intermediate Fixed Harvest Rate, Alternative 3. However, the majority of the fishery removals occur in freshwater after marine mammals have already had the opportunity to prey on steelhead. Thus, Alternative 4 is not likely to have a significant impact on marine mammal prey base.

Bald Eagles. As described under Section 3.2.1, *Predator/Prey Relationships*, bald eagles have a strong, consistent (Cederholm et al. 2000) relationship with salmon and, but not primarily, steelhead. Harvest effects to bald eagles include reducing their prey base because they feed on adult salmon carcasses that have escaped the fishery and made it to the spawning grounds to breed as well as juvenile salmon.

Under the No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the existing incidental fisheries would likely remain the same. Under the current incidental harvest rate, bald eagles would continue to feed on steelhead carcasses and juvenile steelhead, where available. Incidental harvest is likely to have a negligible effect because bald eagles are opportunistic feeders and have the ability to prey on a variety of other species, including dead animals, which allows them to accommodate changing foraging conditions (Section 3.2.1, *Predator/Prey Relationships*). Steelhead are not their primary salmonid prey.[22] Thus, Alternative 1 is not likely to have a significant impact on bald eagles.

Under the Proposed Action/Preferred Alternative, Alternative 2, the availability of adult steelhead carcasses would remain the same at low abundance steelhead runs (≤ 4,000), resulting in a negligible effect.[34] At run abundances higher that 4,001, the availability of steelhead carcasses would decrease from existing conditions (No Action/Status Quo, Alternative 1), due to the increase in harvest rates (ranging from 10 percent to 25 percent, relative to the run size) and, thus, would result in fewer steelhead carcasses available for eagles. The increase in steelhead harvest is likely to have a negligible effect because bald eagles are opportunistic feeders and have the ability to prey on a variety of other species, including dead animals, which allows them to accommodate changing foraging conditions (Section 3.2.1, Predator/Prey Relationships). Steelhead are not their primary salmonid prey. Additionally, steelhead carcasses are less likely to be available to predators than salmon carcasses due to their winter-run timing that occurs during winter flood and storm events. Thus, Alternative 2 is not expected to have a significant impact to bald eagles.

Under the Intermediate Fixed Harvest Rate, Alternative 3, the availability of adult steelhead carcasses would remain the same at low abundance steelhead runs (≤ 4,000) and effects would be the same as Alternative 2. At run abundances equal to or higher than 4,001, the availability of steelhead carcasses would decrease from existing conditions (No Action/Status Quo, Alternative 1), due to the 10 percent fixed harvest rate relative to the run size, and would result in fewer carcasses available for eagles. The increase in steelhead harvest is likely to have a negligible effect because bald eagles are opportunistic feeders and have the ability to prey on a variety of other species, including dead animals, which allows them to accommodate changing foraging conditions (Section 3.2.1, Predator/Prey Relationships). Steelhead are not their primary salmonid prey.[34] Thus, Alternative 3 is not expected to have a significant impact to bald eagles.

Under the Escapement-Based Management, Alternative 4, the availability of adult steelhead carcasses would remain the same at low abundance steelhead runs (≤ 6,000). Steelhead could not be harvested until a larger run size was achieved. At run abundances equal to or higher than 6,000, the availability of steelhead carcasses would decrease from existing conditions (No Action/Status Quo, Alternative 1), due to the 16 percent fixed harvest rate relative to the run size, and would result in fewer carcasses available for eagles. The increase in steelhead harvest is likely to have a negligible effect because bald eagles are opportunistic feeders and have the ability to prey on a variety of other species, including dead animals, which allows them to accommodate changing foraging conditions (Section 3.2.1, Predator/Prey Relationships). Steelhead are not their primary salmonid prey.[34] Thus, Alternative 4 is not expected to have a significant impact to bald eagles.

[34] Steelhead carcasses are less likely to be available to predators than salmon carcasses due to their winter-run timing that occurs during winter flood and storm events.

Migratory Birds. As described under Section 3.2.1, *Predator/Prey Relationships*, migratory birds have a variety of relationships with salmon and steelhead including some species having a strong, consistent (Cederholm et al. 2000) relationship. The relationship is primarily bird predators that consume steelhead as prey. Generally, the birds prey on salmonid juveniles, including steelhead, or sometimes adult steelhead carcasses. The harvest of adult steelhead would not primarily affect the food supply of migratory birds, but may indirectly affect the number of juvenile steelhead produced in the system.

Migratory birds migrate twice a year, once in the spring and again in the fall. Many species migrate south during the winter and are not in the project area when steelhead fisheries occur. Some migratory bird species, such as pigeons, crows, ravens, and blackbirds, stay in the northern hemisphere all year round (Idaho National Laboratory 2018). These species do not feed on adult or juvenile salmon. Crows and raven are opportunistic feeders and have the ability to prey on a variety of other species, including dead animals (Seattle Audubon Society 2017), which allows them to accommodate changing foraging conditions if adult steelhead carcasses are not available.

Under No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the effects of the existing incidental fisheries would remain the same. Existing fisheries do not directly affect the food supply of migratory birds because the majority of the bird species have migrated out of the action area by the time the currently-operating incidental fisheries commence. Those bird species that do remain, either do not feed on adult or juvenile steelhead, or are opportunistic feeders and have the ability to prey on a variety of other species, which allows them to accommodate changing foraging conditions if carcasses are not available. Thus, no significant impacts on migratory birds are anticipated.

Under the Proposed Action/Preferred Alternative, Alternative 2, harvest effects would be the same as the No Action/Status Quo, Alternative 1, at run sizes of $\leq$ 4,000. At run sizes of 4,001 fish or greater, the availability of juvenile steelhead as prey for migratory birds (as an indirect result of adult steelhead harvest) would decrease due to increased harvest rates of 10% to 25%, depending on steelhead abundance. However, we do not consider this to be a significant impact, because the majority of bird species will have migrated out of the action area by the time proposed steelhead fisheries commence. Those bird species that do remain, either do not feed on adult or juvenile steelhead, or are opportunistic feeders and have the ability to prey on a variety of other species, which allows them to accommodate changing foraging conditions if carcasses are not available.

Under the Intermediate Fixed Harvest Rate, Alternative 3, harvest effects would be the same as the No Action/Status Quo, Alternative 1, at run sizes of $\leq$ 4,000 steelhead. At run sizes of 4,001 fish or greater, the availability of juvenile steelhead as prey for migratory birds (as an indirect result of adult steelhead harvest) would decrease due to an increased harvest rate of 10%. At run

sizes of 4,001 fish or greater, the availability of juvenile steelhead as prey for migratory birds… However, these are not considered to be significant impacts Alternative 3 would not have significant impacts because the majority of bird species will have migrated out of the action area by the time steelhead fisheries commence. Those bird species that do remain, either do not feed on adult or juvenile steelhead, or are opportunistic feeders and have the ability to prey on a variety of other species, which allows them to accommodate changing foraging conditions if carcasses are not available.

Under the Escapement-Based Management, Alternative 4, harvest effects are the same as the No Action/Status Quo, Alternative 1, at run sizes of ≤ 5,999. At run sizes of 6,000 steelhead or greater, the availability of juvenile steelhead as prey for migratory birds (as an indirect result of adult steelhead harvest) would decrease due to a fixed harvest rate of 16 percent. Alternative 4 would not have significant impacts because the majority of bird species will have migrated out of the action area by the time steelhead fisheries commence. Those bird species that do remain, either do not feed on adult or juvenile steelhead, or are opportunistic feeders and have the ability to prey on a variety of other species, which allows them to accommodate changing foraging conditions if carcasses are not available.

4.2.2 Steelhead Carcass Nutrient Benefits

Steelhead carcasses provide a source of nutrients to all aquatic organisms (Section 3.2.2, *Steelhead Carcass Nutrient Benefits*). Harvest reduces the number of steelhead that reach the spawning grounds and, thus, reduces the number of steelhead carcasses as a nutrient source to aquatic organisms.

Under the No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the effects of the existing incidental fisheries remain the same. Under the existing incidental fisheries, incidental take of steelhead has remained low and fairly constant while steelhead abundance (escapement estimates) for the Skagit Basin have increased by an average of 7% annually since 2011. This has led to increased availability overall of steelhead carcasses as a nutrient source for aquatic organisms over the past several years (Section 3.3.1.1.2, *Skagit River Steelhead; Figure 3-1; Table 3-4*).

Under the Proposed Action/Preferred Alternative, Alternative 2, harvest rates of 4% to 25% would decrease the number of spawning carcasses available for nutrient enhancement, with a higher rate of decrease associated with the higher harvest rates at moderate to high steelhead abundances (4,001 to 8,001 fish). By removing adults that would otherwise return to spawning areas, harvest could decrease the return of marine derived nutrients to aquatic organisms in spawning and rearing areas. However, removal of marine derived nutrients has not been identified as a limiting factor for the Puget Sound Steelhead DPS (NMFS 2017b). Alternative 2

incorporates management for maximum spawner escapement at different harvest levels to maintain an adequate number of steelhead carcasses as a nutrient sources for aquatic species and implements best harvest management practices and conservation measures to prevent over-fishing (Section 1.2, *Proposed Action/Preferred Alternative*). These actions have been identified as ways to address the potential impacts of removing marine derived nutrients represented by carcasses that support aquatic organisms (PFMC 2014). Because these measures are part of the Proposed Action/Preferred Alternative, there is likely to be no significant impact as a result of reduced steelhead carcass levels.

Under the Intermediate Fixed Harvest Rate, Alternative 3, effects would be similar to the No Action/Status Quo, Alternative 1 at steelhead abundances of $\leq$ 4,000 steelhead. At abundances greater than 4,001 fish, an increased fixed harvest rate of 10 percent would decrease the percentage of steelhead carcasses available for nutrient benefits. However, the impacts be not be significant under Alternative 3 because harvest in the Puget Sound Steelhead DPS is generally managed for maximum spawner escapement levels to maintain an adequate number of steelhead carcasses as a nutrient source for aquatic species and implements best harvest management practices and conservation measures to minimize fishery impacts. These actions have been identified as ways to address the potential impacts of removing marine derived nutrients represented by carcasses that support aquatic organisms (PFMC 2014). Thus, Alternative 3 is not likely have significant impacts as a result of reduced steelhead carcass levels.

Under the Escapement-Based Management, Alternative 4, effects would be similar to the No Action/Status Quo, Alternative 1, at steelhead abundances equal to or less than 5,999 fish. At abundances equal to or greater than 6,000 fish, an increased fixed harvest rate of 16 percent would further reduce the percentage of steelhead carcasses available for nutrient benefits. However, the impacts would not be significant under Alternative 3 because harvest in the Puget Sound Steelhead DPS is generally managed for maximum spawner escapement levels to maintain an adequate number of steelhead carcasses as a nutrient source for aquatic species and implements best harvest management practices and conservation measures to minimize fishery impacts. These actions have been identified as ways to address the potential impacts of removing marine derived nutrients represented by carcasses that support aquatic organisms (PFMC 2014). Thus, Alternative 3 is not likely have significant impacts as a result of reduced steelhead carcass levels.

4.2.3 Transfer of Toxins from Steelhead to Wildlife

Because Puget Sound has substantial contaminated sediments, steelhead prey can transfer their pollutant levels to juvenile and adult steelhead, and in turn, steelhead can transfer their pollutant loadings to their predators. The extent of contamination in the different trophic levels of prey and predators is unknown, although it is hypothesized that salmon toxins transferred to Southern

Resident killer whales as predators may have impacted their overall health (including reproductive capability) and life span (Section 3.2.3, *Transfer of Toxins from Salmon to Wildlife*). Although cleanup of toxins in Puget Sound is ongoing, there is continuing potential to introduce additional pollutants into Puget Sound through increased development and residential populations contributing to pollution sources. However, fisheries harvest as an activity does not contribute to the transfer of toxins among biological organisms.

Under the No Action/Status Quo, Alternative 1, Proposed Action/Alternative 2, Intermediate Fixed Harvest Rate, Alternative 3, and Escapement-Based Management, Alternative 4, fisheries harvest would not result in an effect regarding the likely or unlikely transfer of toxins to steelhead since fisheries cannot influence this transfer. Therefore, all four alternatives would not result in significant adverse effects.

4.2.4 Harvest Habitat Disturbance

As described in Section 3.2.4, *Harvest Habitat Disturbance*, fisheries harvest can result in impacts to fish and wildlife habitat through disturbance from the presence of boats, people, and noise. These activities often cause animals to temporarily depart fishing areas where boating or fishing activity occurs. Generally, the impact is short in duration and does not result in loss or injury to non-targeted animals, but when fishing activity is a sustained, significant effort and localized to a specific area, the effects from human presence could result in increased stress and energy expenditure to marine and freshwater wildlife while these animals pursue other places to forage and seek cover. These effects are limited to animals in or around fishing areas.[35]

Fish habitat affected by fishing activities includes benthic substrate and associated plant and animals communities in marine areas where gillnets or artificial lures are used (Section 3.2.4, *Harvest Habitat Disturbance*). Marine habitat may be affected from actively-fished net gear; spawning and riparian habitat may be affected by in-river fisheries, by wading fishermen, their gear making contact with the substrate, the wakes of fishing craft, or other mechanical disturbances (Section 3.2.4, *Harvest Habitat Disturbance*).

Under No Action/Status Quo, Alternative 1, harvest would continue at the existing levels and the effects of the existing incidental fisheries would remain the same. Under the existing incidental fisheries, there are no significant impacts from wildlife habitat disturbance because although the effects of fishing activities may result in increased stress and energy expenditure of wildlife to avoid human interaction, the impacts from fishery activities to listed species habitat from harvest activities, as determined by the U.S. Fish and Wildlife Service, are considered negligible and not

[35] The action does not include new infrastructure to support fishing activities. Fishermen would be using existing roads, parking lots, boat launches, and trails.

significant because they are short in duration and are not anticipated to result in loss or injury to wildlife (USFWS 2017). Under the existing incidental fisheries, there are no significant impacts from fish habitat disturbance because although marine and freshwater habitats may be affected from net and lure gear, wading fishermen, boat wakes, or other mechanical disturbances, overall, it is unlikely that the impacts are detectable from fishing activities within the Puget Sound (NMFS 2004b). Thus, since the existing incidental fisheries under Alternative 1 affect only one steelhead basin in the broader Puget Sound (much smaller action area), these impacts are also not likely to be significant (Figure 1-1 as compared to Figure 3-7).

Under the Proposed Action/Preferred Alternative, Alternative 2, there would be an increase in the number of steelhead harvested (i.e., up 4% to 25% harvest rate) resulting in increased traffic, fishing, and boating activity if steelhead abundance reached 4,001 fish or above. No significant impacts from wildlife habitat disturbance are anticipated to occur because, although the effects of increased fishing activities may result in increased stress and energy expenditure of wildlife to avoid human interaction, the impacts from fishery activities in the broader Puget Sound Steelhead DPS, as determined by the U.S. Fish and Wildlife Service, are considered negligible and not significant because they are short in duration and are not anticipated to not result in loss or injury to wildlife (USFWS 2017). Thus, since the proposed fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (i.e., much smaller action area), habitat disturbance impacts are considered negligible and not significant due to their short duration, in which loss or injury to wildlife would be considered rare. No significant impacts from fish habitat disturbance are anticipated to occur because, although the effects of increased fishing activities may result in benthic substrate, plant and animal community, and steelhead spawning redd disturbance as well as potential bank erosion, it is unlikely the impacts are detectable from fishing activities within the Puget Sound (NMFS 2004b). Thus, since the existing incidental fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (much smaller action area), these impacts are also not likely to be detectable (Figure 1-1 as compared to Figure 3-7).

Under the Fixed Harvest Rate, Alternative 3, there would also be an increase in the number of steelhead harvested (i.e., 10 percent harvest rate) resulting in increased traffic and boating activity, if steelhead abundance reached 4,001 fish or above. No significant impacts from wildlife habitat disturbance are anticipated to occur because although the effects of fishing activities may result in increased stress and energy expenditure of wildlife to avoid human interaction, the impacts from fishery activities in the broader Puget Sound Steelhead DPS, as determined by the U.S. Fish and Wildlife Service, are considered negligible and not significant because they are short in duration and are not anticipated to result in loss or injury to wildlife (USFWS 2017). Thus, since the proposed fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (i.e., much smaller action area), habitat disturbance impacts are considered negligible and not significant due to their short duration, in which loss or injury to

wildlife would be considered rare. No significant impacts from fish habitat disturbance are anticipated to occur because, although the effects of increased fishing activities may result in benthic substrate, plant and animal community, and steelhead spawning redd disturbance as well as potential bank erosion, it is unlikely the impacts are detectable from fishing activities within the Puget Sound (NMFS 2004b). Thus, since the existing incidental fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (much smaller action area), these impacts are also not likely to be detectable (Figure 1-1 as compared to Figure 3-7).

Under the Escapement-Based Management, Alternative 4, there would also be an increase in the number of steelhead harvest (i.e., 16 percent harvest rate) resulting in increased traffic and boating activity, if steelhead abundance reached 6,000 fish or above. No significant impacts from wildlife habitat disturbance are anticipated to occur because although the effects of fishing activities may result in increased stress and energy expenditure of wildlife to avoid human interaction, the impacts from fishery activities in the broader Puget Sound Steelhead DPS, as determined by the U.S. Fish and Wildlife Service, are considered negligible and not significant because they are short in duration and are not anticipated to result in loss or injury to wildlife (USFWS 2017). Thus, since the proposed fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (i.e., much smaller action area), habitat disturbance impacts are considered negligible and not significant due to their short duration, in which loss or injury to wildlife would be considered rare. No significant impacts from fish habitat disturbance are anticipated to occur because, although the effects of increased fishing activities may result in benthic substrate, plant and animal community, and steelhead spawning redd disturbance as well as potential bank erosion, it is unlikely the impacts are detectable from fishing activities within the Puget Sound (NMFS 2004b). Thus, since the existing incidental fisheries under Alternative 2 affect only one steelhead basin in the broader Puget Sound (much smaller action area), these impacts are also not likely to be detectable (Figure 1-1 as compared to Figure 3-7).

Overall, Alternatives 2 through 4 introduce varying increased fishing activity that may or may not lead to increased effects related to traffic, fishing, and boat operations. These activities are not considered to have significant impacts because they are temporary, limited to when fishing occurs, and is not expected to be greater in magnitude, based on action area, from the No Action/Status Quo, Alternative 1. We would anticipate additional energy expenditure during wildlife departure but wildlife is expected to return to use habitat during times when traffic, fishing, and boat activity ceases (USFWS 2017). Impacts to benthic substrate, plant and animal community, and steelhead spawning redd disturbance as well as potential bank erosion, may occur but it is unlikely the impacts are detectable (NMFS 2004b).

4.2.5 Marine Mammal and Seabird Bycatch

As described in Section 3.2.5, *Fisheries Bycatch*, bycatch of wildlife species includes Steller sea lions, marbled murrelet, and common murres. Effects include injury, latent release mortality, and acute direct mortality. There is a continuing effort to reduce bycatch in all types of salmon and steelhead fisheries, including recent fishing restrictions by WDFW and Skagit River Tribes on specific fishing methods that cause bycatch so effects are anticipated to have no to negligible effects for Alternatives 1 through 4. Additionally, co-manager best management practices are in place to reduce and report bycatch (NMFS 2017b).

Under the No Action/Status Quo, Alternative 1, harvest would continue at the existing levels and the effects of the incidental fisheries would likely remain the same. Under the existing fisheries, serious injuries or mortality is considered unlikely for marine mammals and minimal for seabirds (NMFS 2003). In 2017, the USFWS evaluated the incidental take of the ESA-listed marbled murrelet in the existing Puget Sound salmon and steelhead fisheries and issued a biological opinion, which determined that effects of bycatch were found to be low and not likely to impede the survival and recovery of this species (USFWS 2017). Bycatch from existing fisheries is anticipated to have no to low negligible impacts because there is a continuing effort to reduce bycatch in all types of salmon and steelhead fisheries, which includes recent fishing restrictions. Best management practices, such as fishing in areas where marine mammals and seabirds are not present or actively feeding, are in place to reduce and report bycatch. Since fishermen limit their fishing activities to areas where these species are not present or actively feeding and reporting of lost gear within 24 hours can be retrieved sooner, then affects to marine mammals and seabirds are likely negligible. Thus, anticipated impacts from bycatch under Alternative 1 are not likely to be significant.

Under the Proposed Action, steelhead harvest activities are likely to increase from 10% to 25% at steelhead abundances of 4,001 to greater than 8,001 fish. However, due to increased co-manager actions to decrease overall bycatch in fisheries, including recent fishing restrictions and best management practices to reduce and report bycatch, such as fishing in areas where marine mammals and seabirds are not actively feeding and reporting of lost gear within 24 hours (NMFS 2017b), Alternative 2 is not expected to cause any changes in the extent of bycatch during the 5-year duration of the Skagit RMP. Since fishermen limit their fishing activities to areas where these species are not present or actively feeding and reporting of lost gear within 24 hours can be retrieved sooner, then affects to marine mammals and seabirds are likely negligible. Thus, anticipated impacts from bycatch under Alternative 2 are not likely to be significant.

Under the Intermediate Fixed Harvest Rate, Alternative 3, steelhead harvest activities are also likely to increase at a fixed harvest rate of 10% at steelhead abundances of 4,001 fish or greater. However, due to increased co-manager actions to decrease overall bycatch in fisheries, including

recent fishing restrictions and best management practices to reduce and report bycatch, such as fishing in areas where marine mammals and seabirds are not actively feeding and reporting of lost gear within 24 hours (NMFS 2017), Since fishermen limit their fishing activities to areas where these species are not present or actively feeding and reporting of lost gear within 24 hours can be retrieved sooner, then affects to marine mammals and seabirds are likely negligible. Thus, anticipated impacts from bycatch under Alternative 3 are not likely to be significant.

Under Escapement-Based Management, Alternative 4, steelhead harvest activities are also likely to increase at a fixed harvest rate of 16% at steelhead abundances of 6,000 fish or greater. However, due to increased co-manager actions to decrease overall bycatch in fisheries, including recent fishing restrictions and best management practices to reduce and report bycatch, such as fishing in areas where marine mammals and seabirds are not actively feeding and reporting of lost gear within 24 hours (NMFS 2017). Since fishermen limit their fishing activities to areas where these species are not present or actively feeding and reporting of lost gear within 24 hours can be retrieved sooner, then affects to marine mammals and seabirds are likely negligible. Thus, anticipated impacts from bycatch under Alternative 4 are not likely to be significant. .

4.2.6 Derelict Fishing Gear

Derelict fishing gear occurs from harvest of fish and shellfish, and is predominantly from crab pots and salmon gill nets in Puget Sound (Section 3.2.6, *Derelict Fishing Gear*). Derelict fishing gear can affect habitat in a number of ways including barring passage, harming eelgrass beds or other estuarine benthic habitats, or occupying space that would otherwise be available to salmonids. Co-managers are required to report lost fishing nets within 24 hours of loss and have established a no-fault reporting system for lost gear (NMFS 2017). However, there are no devices installed on nets to track their location if they are lost, which complicates the recovery effort (NMFS 2017). In 2013, a NOAA-funded report was issued that assessed the reasons for gill net loss, best practices to prevent loss, and potential gear changes that may aid in the prevention of derelict nets (Gibson 2013 in NMFS 2017). It is likely that some nets and hook-and-line gear would become derelict and kill some species in the project area, though we are unable to quantify the number of fish killed from derelict gear at this time.

Under the No Action/Status Quo, Alternative 1, the existing Puget Sound salmon and steelhead fisheries would likely continue at the existing rates, and their effects would remain the same. Impacts from derelict fishing gear are not anticipated to be significant because co-managers are required to report lost fishing nets within 24 hours of loss, have established a no-fault reporting system for lost gear so efforts to retrieve lost gear can occur quickly, and have adopted NOAA's best practices for preventing derelict fishing gear. Because of these best management practices, we anticipate the amount of lost fishing nets in Puget Sound to be low, and thus, derelict nets are not likely to have a significant impact. Additionally, NMFS assessed the effects of derelict gear

in our biological opinion for existing Puget Sound salmon and steelhead fisheries, and determined that they would not impede the survival and recovery of Puget Sound steelhead (NMFS 2017).

Under the Proposed Action/Preferred Alternative, Alternative 2, steelhead fisheries are likely to result in the loss of fishing equipment and deposit of derelict fishing gear in Puget Sound (Skagit Bay) and the Skagit River. Although there are potential harvest similarities and differences between the No Action/Status Quo, Alternative 1, (4.2% harvest rate) and the Proposed Action/Preferred Alternative, Alternative 2, (4% to 25% harvest rate at varying abundances), impacts from derelict fishing gear are not anticipated from Alternative 2 to be significant because co-managers are required to report lost fishing nets within 24 hours of loss, have established a no-fault reporting system for lost gear so efforts to retrieve lost gear can occur quickly, and have adopted NOAA's best practices for preventing derelict fishing gear, which are required actions under the Skagit RMP.. Although we are unable to quantify the amount of fish killed from derelict gear at this time, because best management practices and gear changes are in place to prevent fishing gear loss, we anticipate the amount of derelict fishing nets in Puget Sound to be low, and thus, derelict nets are not likely to have a significant impact. Additionally, NMFS assessed the effects of derelict gear in our biological opinion for the Skagit River Steelhead Fishery Resource Management Plan, and determined that it would not impede the survival and recovery of Skagit River steelhead or the Puget Sound Steelhead DPS as a whole (NMFS 2018).

Under the Intermediate Fixed Harvest Rate, Alternative 3, steelhead fisheries are likely to result in the loss of fishing equipment and deposit of derelict fishing gear in Puget Sound (Skagit Bay) and the Skagit River. Although there are potential harvest similarities and differences between the No Action/Status Quo, Alternative 1, (4.2% harvest rate) and the Intermediate Fixed Harvest Rate, Alternative 3, (4.2% and 10% harvest rate at varying abundances), impacts from derelict fishing gear from Alternative 3 are not anticipated to be significant because co-managers are required to report lost fishing nets within 24 hours of loss, have established a no-fault reporting system for lost gear so efforts to retrieve lost gear can occur quickly, and have adopted NOAA's best practices for preventing derelict fishing gear. Although we are unable to quantify the amount of fish killed from derelict gear at this time, best management practices and gear changes are in place to prevent fishing gear loss. Under these best management practices, we anticipate the amount of derelict fishing nets in Puget Sound to be low, and thus, derelict nets are not likely to have a significant impact.

Under Escapement-Based Management, Alternative 4, steelhead fisheries are likely to result in the loss of fishing equipment and deposit of derelict fishing gear in Puget Sound (Skagit Bay) and the Skagit River. Although there are potential harvest similarities and differences between the No Action/Status Quo, Alternative 1, (4.2 percent harvest rate) and Escapement-Based Management, Alternative 4, (4.2 percent and 16 percent harvest rate at varying abundances),

impacts from derelict fishing gear from Alternative 4 are not anticipated to be significant because co-managers are required to report lost fishing nets within 24 hours of loss, have established a no-fault reporting system for lost gear so efforts to retrieve lost gear can occur quickly, and have adopted NOAA's best practices for preventing derelict fishing gear. Although we are unable to quantify the amount of fish killed from derelict gear at this time, best management practices and gear changes are in place to prevent fishing gear loss. Under these best management practices, we anticipate the amount of lost fishing nets in Puget Sound to be low, and thus, derelict nets are not likely to have a significant impact.

4.3 Fish

Fish species are managed based on pre-season abundance forecasts and in-season updates.

4.3.1 Listed Salmon and Steelhead

This section describes the effects of the Skagit RMP for listed Puget Sound steelhead only. As discussed in Section 3.3.1, none of the alternatives are expected to affect threatened Chinook salmon or threatened Hood Canal summer-run chum salmon, therefore effects on these species are not further analyzed (Section 3.3.1, *Listed Salmon and Steelhead*).

4.3.1.2 Puget Sound Steelhead

As described in Section 3.3.1.1, *Puget Sound Steelhead,* the Puget Sound steelhead DPS is comprised of 32 demographically independent populations (DIPs) from three major population groups, of which 23 populations are winter-run, 5 populations are summer-run, and 4 populations are summer/winter-runs (Myers et al. 2015). The proposed action would affect four Skagit River DIPs within the Northern Cascades MPG. The average steelhead encounters for the five Puget Sound watersheds combined was 1.58 percent from 2007 to 2016 and was limited to incidental take from fisheries for salmon and unlisted steelhead, as well as take due to non-retention in the research fishery (Section 3.3.1.2, *Puget Sound Steelhead*). This average includes bycatch of steelhead from the Skagit River Basin. Direct effects from harvest include release mortality, injury, and death. Indirect effects from harvest include potential decreases in juvenile productivity.

Under the No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the existing fisheries would remain the same. Under the existing fisheries, there are no significant impacts to Puget Sound steelhead because abundances of steelhead increased over time under Alternative 1 (Section 3.3.1.1, *Puget Sound Steelhead*). Incidental effects, such as release mortality, injury, and death, were evaluated in a separate biological

opinion for Puget Sound salmon and hatchery steelhead fisheries and were found not to impede the survival and recovery of Puget Sound steelhead (NMFS 2017). Steelhead harvest has averaged 1.58% over the last 9 years (Section 3.3.1.1, *Puget Sound Steelhead*, Table 3-3) resulting in lower harvest impacts to the Puget Sound Steelhead DPS than at the time of listing when harvest was determined not to be a limiting factor.

Under the Proposed Action/Preferred Alternative, Alternative 2, the allowable harvest rate on Skagit River steelhead would increase to between 4 percent and 25 percent, depending on the total abundance of the run. This would have a range of effects on the Puget Sound Steelhead DPS, relative to contributions from the Skagit River steelhead populations (Section 3.3.1.1, *Puget Sound Steelhead*). Potential effects include removal of steelhead adults from the Puget Sound Steelhead DPS, reducing abundance and juvenile and adult productivity as well as limiting expansion of spatial structure and genetic diversity. As described in Section 4.3.1.1, *Skagit River Steelhead*, implementation of the proposed fishery regime would have little effect upon the frequency with which the viable and rebuilding thresholds would be achieved. This means that Alternative 2 would not result in significant changes to the Skagit SMU level[36] that include the four DIPs within the Skagit Basin. This, in turn, would not result in significant impacts to the MPG level, that are not likely to have a significantly impact the Puget Sound Steelhead DPS overall. In addition, the total amount of Skagit Basin steelhead recruits is not predicted to vary substantially between the 4.2% incidental harvest rate from existing salmon and hatchery steelhead fisheries and Skagit RMP stepped harvest rate (SBT and WDFW 2018; Appendix Figure 3) (Figure 4-2). The co-managers also took into consideration spatial structure and diversity VSP parameters by incorporating fishery conservation measures to protect the summer run, early returning winter run, and repeat spawners (Section 2.4.6, *Consideration of Viable Salmonid Population Parameters*).

NMFS found that, in general, broad patterns of steelhead abundance across the Puget Sound were similar to those found in the prior status review (NWFSC 2015). Since 2009, 10 of the 22 populations, where data are available, indicate small to moderate increases in abundance (Section 3.3.1.2, *Puget Sound Steelhead DPS*). Between the two most recent five-year periods (2005-2009 and 2010-2014), the geometric mean of estimated abundance in the Puget Sound DPS increased by an average of 5.4% (NWFSC 2015). For the 7 out of 16 steelhead populations in the Northern Cascades MPG, that includes the Skagit SMU (four DIPs), there was a 3% increase; for 5 of the 8 steelhead populations in the Central & South Puget Sound MPG, there was a 10% increase; for 6 of the 8 steelhead populations in the Hood Canal & Strait of Juan de Fuca MPG, there was a

[36] Under the 4(d) Rule, populations may be aggregated for management purposes when dictated by information scarcity, if consistent with the survival and recovery of the listed DPS (NOAA 2003). Because limited data exists that prevent NMFS from determining impacts on the individual DIP level, NMFS will determine impacts on the management unit level (Skagit SMU) as identified by the co-managers in the Skagit RMP (Sauk-Suiattle Indian Tribe et al. 2016) (Section 4.3.1.1, *Skagit River Steelhead*).

4.5% increase in abundance across the Puget Sound DPS (Section 3.3.1.2, *Puget Sound Steelhead DPS).*

Puget Sound steelhead productivity has been temporally variable for most populations since the mid-1980s with most populations below replacement since 2000 (NWFSC 2015). That said, some steelhead populations are showing signs of productivity that have been above replacement in all three MPGs (Northern Cascades, Central & South Puget Sound and Hood Canal & Strait of Juan de Fuca). From 1977 to 2016, estimates of productivity as represented by growth rates were near, but slightly below replacement (1.0) for the Skagit SMU (Sauk-Suiattle Indian Tribe et al. 2016). Considering steelhead growth rates over the long-term period (1977 to 2016), the Skagit SMU has been in a period of decreasing to stable population growth rate, with recent potential increases in productivity (NMFS 2018).

The proposed action under Alternative 2 is a short-term harvest plan. Harvest would be enforced and monitoring of steelhead would occur annually (Sauk-Suiattle Indian Tribe et al. 2016). Information collected from annual steelhead fisheries monitoring would be used to adaptively manage harvest in-season to protect listed steelhead (Section 2.4.5, *Management of Adults on the Spawning Grounds*). At the end of five years, 4(d) authorization would cease and the co-managers would have to submit a new harvest plan.

In summary, the (1) viability thresholds can be achieved under the proposed action and were found not to significantly impact the Skagit SMU (four DIPs combined) (Sauk-Suiattle Indian Tribe et al. 2016) (Section 4.3.1.1, *Skagit River Steelhead*); (2) fishery conservation measures to protect summer-run, early returning winter-run, and repeat spawners are required under Alternative 2 to maintain spatial structure and diversity for the Skagit SMU (Sauk-Suiattle Indian Tribe et al. 2016) (Section 2.4.6, *Consideration of Viable Salmonid Population Parameters*); (3) increases in abundance estimates for the Skagit SMU (7%), Northern Cascade MPG (3%), and the Puget Sound DPS as a whole (5.4%) have been observed since the last status review (NWFSC 2015) (3.3.1.2 *Puget Sound Steelhead DPS)* and steelhead abundances increased by an average of 10% annually in the Puget Sound Steelhead DPS from 2011 to 2015 (Section 3.3.1.2, *Puget Sound Steelhead DPS*); (4) despite overall decreases in productivity of the DPS over time (NWFSC 2015), the Skagit SMU has demonstrated decreasing to, most recently, stable population growth from 1977 to 2016 (NMFS 2018) (Section 3.3.1.2, *Puget Sound Steelhead DPS*); and (5) annual harvest monitoring results would be used to adaptively manage the fishery in-season over the short-term duration of the proposed action (5 years) (Sauk-Suiattle Indian Tribe et al. 2016) (Section 2.4.5, *Management of Adults on the Spawning Grounds*). Therefore, Alternative 2 is not likely to appreciably slow the achievement of the steelhead DPS to viable function and is not likely to have a significant impact on the Puget Sound Steelhead DPS as a whole.

NMFS determined in the biological opinion for the Skagit RMP that the proposed action was not likely to jeopardize the continued existence of the Puget Sound Steelhead DPS, as a whole, and destroy or adversely modify its critical habitat (NMFS 2018).

Since the Intermediate Fixed Harvest Rate, Alternative 3, falls within the effects of harvest described under Alternative 2 (4% to 10% steelhead harvest rate), Alternative 3 is not likely to rise to the level of significant impacts for the same reasons described under Alternative 2.

Since the Escapement Based Management, Alternative 4, falls within the effects of harvest described under Alternative 2, (4% to 16% steelhead harvest rate), Alternative 4 is not likely to rise to the level of significant impacts for the same reasons described under Alternative 2.

4.3.1.1 Skagit River Steelhead

As described in Section 3.3.1.2, *Skagit River Steelhead*, based on escapements from 2011 to 2015, Skagit River winter-run steelhead have increased by an average of 7% per year and terminal (freshwater) bycatch rates of Skagit River summer/winter-run steelhead populations have decreased from 3.4% in 2011 to 1.12% in 2015 and marine steelhead harvest rates for the entire Puget Sound have decreased from 325 fish in 2011 to 176 fish in 2016. Incidental take rates of Skagit River steelhead averaged 3.1% from 2007 to 2015 and 2.26 percent from 2011 to 2016 (Section 2.1, *Alternative 1*; Section 3.3.1.2, Table 3-5). Direct effects from bycatch include latent release mortality, injury, and direct mortality. Indirect effects from bycatch include potential decreases in future adult productivity (i.e., reduced juvenile fish production).

Since the ESA-listing of the Puget Sound steelhead DPS, there has been very limited to no directed fishing on Skagit steelhead. The current take of steelhead is limited to incidental take from fisheries targeting other species, e.g. spring Chinook fisheries.

As described in Section 2.2, *Alternative 2*, the co-managers of the proposed Skagit River steelhead fisheries developed an annual harvest plan based on the forecast of the returning run, intended to ensure that sufficient Skagit SMU steelhead (from the four DIPs) escape to the spawning grounds to support steelhead VSP parameters so as not to impeded the survival and recovery of listed Puget Sound steelhead while providing harvest opportunity. The proposed harvest plan, based on varying abundance[37] of steelhead, would limit the total allowable harvest rate on the overall Skagit Basin DIPs (Sauk-Suiattle Indian Tribe et al. 2016). Therefore, depending on the forecasted run size, the total proportion of the run that would "escape" the fisheries would vary. Higher abundance runs would result in a lower proportion of the total run

[37] The portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds of their natal stream(s).

reaching the spawning grounds, while lower abundance runs would result in a higher proportion of the total run reaching to the spawning grounds (Section 2.2, *Alternative 2; Table 2-2*) with the goal of maintaining the VSP parameters of abundance, productivity, spatial structure and diversity.

The Skagit RMP states that understanding population spawner-recruit dynamics of Skagit Basin steelhead is a fundamental step in development of a sustainable fisheries management plan (Sauk-Suiattle Indian Tribe et al. 2016). The co-managers estimated Skagit Basin steelhead spawner-recruit dynamics using the Ricker and Beverton-Holt spawner-recruit population dynamic models to determine the abundance thresholds (i.e., preseason forecast levels of escapement) and stepped allowable harvest rates described in Section 2.2, Table 2-2. Parameter and variance estimates are provided in Table 4-1.

Table 4-1. Skagit Steelhead Spawner-Recruit Analysis Transformed Parameter and Standard Deviation Estimates, Source: (Sauk-Suiattle Indian Tribe et al. 2016).

Parameter	Point Estimate	Standard Deviation
Ricker: $R = \alpha S e^{-\frac{S}{\beta}}$		
α	2.56	1.95
β	9,529	2,962
Error Variance	0.22	
Beverton-Holt: $R = \frac{S}{\alpha+\beta S}$		
α	7.23	14.12
β	10,321	3,574
Error Variance	0.27	

Steelhead data from brood years 1978 to 2007 for spawners and recruits are used for the Ricker and Beverton-Holt analyses. The co-managers used available annual total spawning ground abundance estimates from 1978 to 2007, as well as the resulting total adult recruits (offspring) from fully reconstructed brood lines associated with these spawning years (brood years). There were some years in this overall time frame (1978-2007) where not all of the necessary information to estimate the recruits per spawner or estimate the spawning abundance were available (1990-93 and 1996-97, respectively), so there are some data gaps (Section 1.2, *Proposed Action*). The resulting data set consists of 24 annual estimates of spawning abundance and the resulting, total adult recruitment. Data used for simulations of the proposed fishery management regime included tribal and test fishery and recreational harvest, natural origin

escapement, spawners, and recruitment information. Steelhead run timing overlaps the calendar year. It's important to note that escapement estimates from 1996 and 1997 were not available due to high water/flooding events that occurred in the Skagit River during the 1995/96 and 1996/97 steelhead seasons that prevented WDFW from completing steelhead escapement estimates for these time periods. Thus, any escapement estimates for the 1995/96 or 1996/97 steelhead seasons would have been anecdotal (i.e., assumptions that could not be accurately relied upon) and not appropriate for the spawner-recruit analyses and, therefore, not included in the 1978 to 2007 dataset (Leland 2018).

The co-managers used simulations of the proposed fishery management regimes using the following steps: 1) initiate the simulation with the number of spawners randomly drawn from a normal distribution with mean and standard deviation estimated from observed Skagit Basin steelhead spawners from 1978 to 2007; 2) apply the proposed harvest rate protocol (Table 2-2) and obtain a number of harvested fish; 3) subtract the number of harvested fish from the number of returning mature fish to obtain a number of adult steelhead spawners; 4) use the spawner recruit parameters to compute the next random number of steelhead recruits and multiply this by a random variable in order to incorporate environmental and demographic stochasticity; 5) run for 25 cycles; and 6) repeat for 1,500 simulations (Sauk-Suiattle Indian Tribe et al. 2016). Effects of the proposed fishing regime were compared by the co-managers using several abundance thresholds representing critical, viable, and rebuilding reference points (Sauk-Suiattle Indian Tribe et al. 2016).[38]

For critical threshold abundance, the co-managers considered several methods to calculate low threshold abundance levels, relative risks associated with productivity depensation, effective population breeder thresholds, and abundance levels associated with "Quasi-Extinction Thresholds" (QET) (Hard et al. 2015). The methods and final value used for the critical threshold are provided in Table 4-2.

Table 4-2. Methods and estimated Critical Threshold abundances considered in final critical threshold value for the Skagit RMP. (Source: **(NMFS 2018).**

Method	Source	Criteria	Critical Threshold
Depensation	Peterman (1977,1987)	5% of Equilibrium Spawners (8,949) (Sauk-Suiattle et al. 2016; Appendix B)	447
Effective Pop Size	Waples 1990, 2004; Heath et al. 2002; Arden and Kapuscinski 2003	For each Skagit DIP, $N_b \geq$ 50 if ratio of N_b/N_c is at least 0.4	375

[38] In terms of effects to DIPs, the number of fish must not fall below the critical threshold and not appreciably slow them from reaching viable function. The rebuilding thresholds take into account the main limiting factor for Puget Sound steelhead, which is the alteration and degradation of habitat.

Quasi-extinction Threshold	Hard et al. 2015	Nookachamps=27 Skagit S and W=157 Sauk S and W=103	287
Critical Threshold value used in RMP analysis			**500**

As described under Section 1.2, *Proposed Action*, the Puget Sound Steelhead Recovery Plan is still under development so steelhead viability criteria have not been finalized. The co-managers used the preliminary viability abundances from the PSSTRT viability assessment (Hard et al. 2015). These abundance levels are: Nookachamps winter-run of 616 fish; Skagit summer and winter-run of 32,388 fish; the Sauk summer and winter-run of 11,615 fish; for a total viable threshold of 44,619 steelhead for the Skagit Basin. The Skagit RMP does not include the Baker River summer and winter run DIP preliminary viability threshold of 2,514 fish in calculating the overall viability threshold for their analysis, citing that the PSSTRT noted that many of the PPSTRT members and reviewers considered this population to be extirpated (Sauk-Suiattle Indian Tribe et al. 2016{Myers, 2015 #4070)}. The co-managers used a critical threshold of 500 spawners and a viable threshold of 44,619 adult steelhead (based on Peterman 1977; 1987; Waples 2004; Hard et al. 2015) along with the model simulations to determine the effects of harvest on steelhead abundance and productivity. These results are used to develop the stepped harvest rates, with the intent that fisheries impacts would not impede the survival and recovery of Skagit River steelhead. The critical threshold is the minimum estimate for extant populations while the viability thresholds are the goal. For populations, such as the four DIPs within the Skagit SMU, that have a high degree of confidence to be above critical levels (500 spawners) (Avg. 8,800 2013-2015; Sauk-Suiattle Indian Tribe et al. 2016) but not yet viable levels (44,619 fish; Hard et al. 2015), harvest action must not appreciably slow the population's achievement of viable function (NOAA 2003). Using the data in NMFS' population identification and viability documents (Hard et al. 2015; Myers et al. 2015) to verify the Skagit RMP harvest rates, allows NMFS to ensure consistent treatment of listed steelhead across a diverse geographic and jurisdictional range.

In listing the Puget Sound steelhead DPS under the ESA, NMFS concluded that the principle factor for decline of Puget Sound steelhead was the present or threatened destruction, modification, or curtailment of its habitat or range (72 FR 26732, May 11, 2007). Co-managers have recognized this threat and state in the Skagit RMP that substantial improvements in habitat capacity and productivity would be needed before the Skagit steelhead populations can achieve the viable threshold. Therefore, the co-managers proposed two additional VSP thresholds, in addition to the critical and viable thresholds, for their harvest risk analysis: 1) R_{MSY} – a rebuilding threshold[39] equal to a spawner level that would maximize the long-term yield under

[39] For the Ricker and Beverton-Holt models, the R_{MSY} estimate would be 3,912 and 2,127, respectively.

current habitat conditions and 2) R_{60} – a rebuilding threshold[40] equal to 60% of the point of the spawner recruit function where less than one recruit is produced per spawner (Sauk-Suiattle Indian Tribe et al. 2016). These are meant to complement the existing productivity analyses. The additional reference points of R_{MSY} and R_{60} are interim measures to track progress of the Skagit steelhead populations to ensure that habitat productivity and capacity are examined on a regular basis and that sufficient spawners are available to recolonize underutilized habitat so as to not appreciably slow the Skagit DIPs from achieving viability (Sauk-Suiattle Indian Tribe et al. 2016) (Table 4-3).

Table 4-3. Critical, viable, and rebuilding thresholds used in the Skagit RMP harvest assessment (Source: (Sauk-Suiattle Indian Tribe et al. 2016).

Reference Point	Spawner-Recruit Function	
	Ricker	Beverton-Holt
Critical (C)	500	
Viable (V)	44,619	
Rebuilding – MSY (R_{MSY})	3,912	2,127
Rebuilding – 60% Equilibrium (R_{60})	5,370	4,844

The RMP assessment used available annual total spawning ground abundance estimates from 1978-2007, as well as the resulting total adult recruits (offspring) from fully reconstructed, brood lines associated with these spawning years (brood years). There were several years in this overall time frame (1978-2007) where not all of the necessary information to estimate the recruits per spawner or estimate the spawning abundance were available (1990-93 and 1996-97, respectively), so there are some data gaps. The resulting data set consists of 24 annual estimates of spawning abundance and the resulting, total adult recruitment.

From the derived dataset of annual spawning abundance and total adult recruitment, the co-managers used results of Ricker and Beverton-Holt spawner-recruit population models to determine how many steelhead adults would be required to reach the spawning grounds in order to maintain recruitment levels consistent with achieving the viability thresholds (Sauk-Suiattle Indian Tribe et al. 2016; Appendices B and C, respectively). The proposed action includes maintenance of the abundance and productivity parameters that were incorporated into the models so as not to slow the Skagit SMUs achievement of reaching viability among the three extant DIPs within the Skagit SMU.

NMFS considered these models in evaluating the proposed Skagit RMP under section 7(a)(2) of the ESA. Based on the co-manager risk analysis, implementation of the proposed fishery regime would have little effect upon the frequency with which the viable and rebuilding thresholds would be achieved. Thus, based on this analyses, we determined that the Skagit RMP was not likely to jeopardize the continued existence of the Puget Sound Steelhead DPS (NMFS 2018).

[40] For the Ricker and Beverton-Holt models, the R_{60} estimate would be 5,370 and 4,844, respectively.

The co-managers provided the following additional information to assist NMFS in evaluating the Skagit RMP. Actual and predicted adult spawners for the Skagit SMU are included in Figure 4-4. These spawners are based on data from 1978 through 2017 resulting from three alternative fishery regimes (SBT and WDFW 2018; Appendix Figure 1 and Appendix Figure 2). The alternative fishery regimes analyzed are: (1) no fishery; (2) 4.2% incidental take rate of listed natural origin and hatchery origin steelhead in Puget Sound; and (3) Skagit RMP stepped harvest rate on natural origin steelhead.

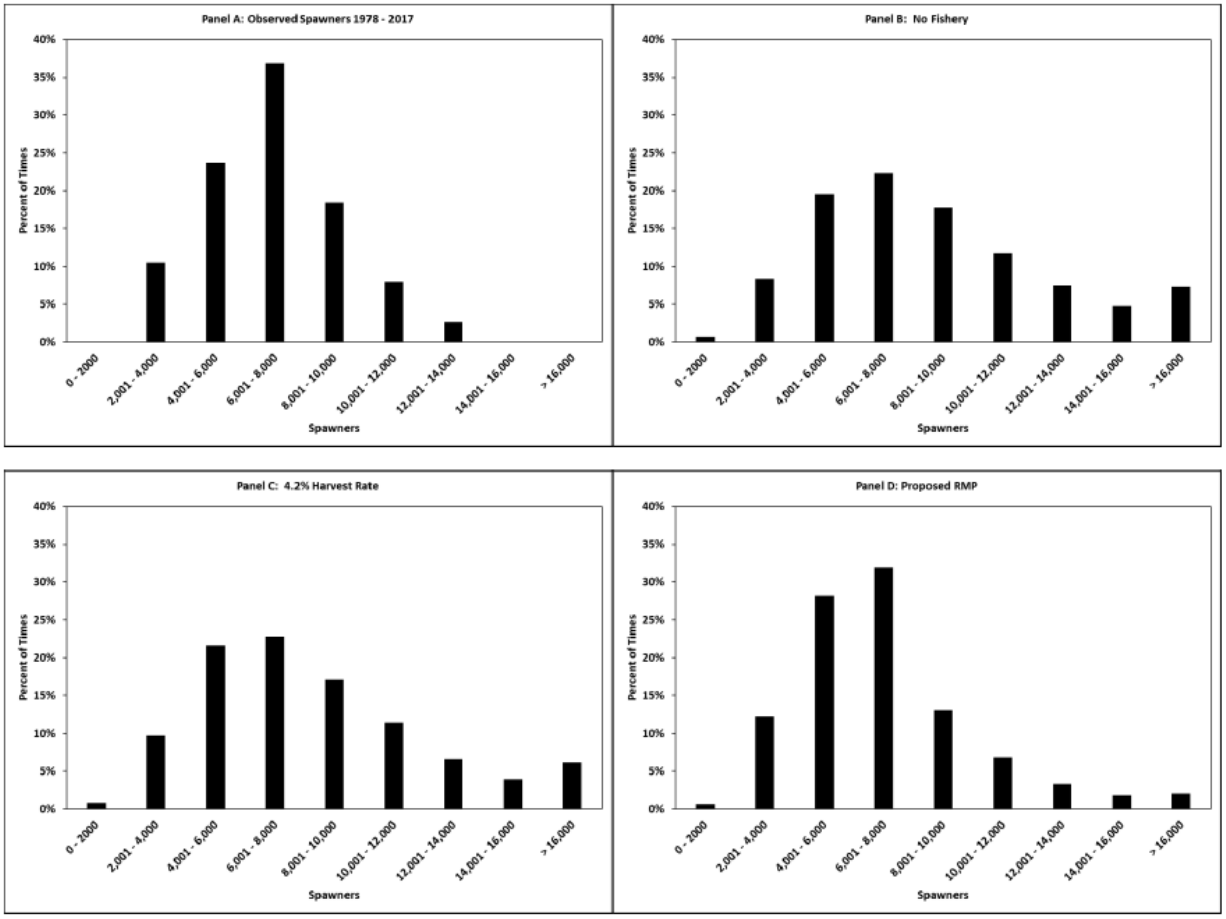

Figure 4-1. Distribution of observed spawners (Panel A); predicted spawners with no fishing (Panel B); predicted spawners with constant 4.2% harvest rate (Panel C); and predicted spawners with the proposed Skagit River RMP (Panel D). All prediction distributions are from simulations with a Ricker stock-recruit analysis. (Source: SBT and WDFW 2018; Appendix Figure 1).

As anticipated, the 4.2% harvest rate and Skagit RMP stepped harvest rate resulted in lower numbers of spawners relative to the no fishing regime but spawner estimates were not significantly different between the No Action/Status Quo (4.2% harvest rate) and the Proposed

Action/ Preferred Alternative (4-25% harvest rate) under the Ricker stock-recruit analysis (Figure 4-5).

Similarly, NMFS agrees that the number of Skagit Basin steelhead recruits do not vary substantially between the no fishing, 4.2% incidental harvest rate from existing salmon and hatchery steelhead fisheries, and the Skagit RMP stepped harvest rate in the co-manager analyses (SBT and WDFW 2018; Appendix Figure 3) (Figure 4-5).

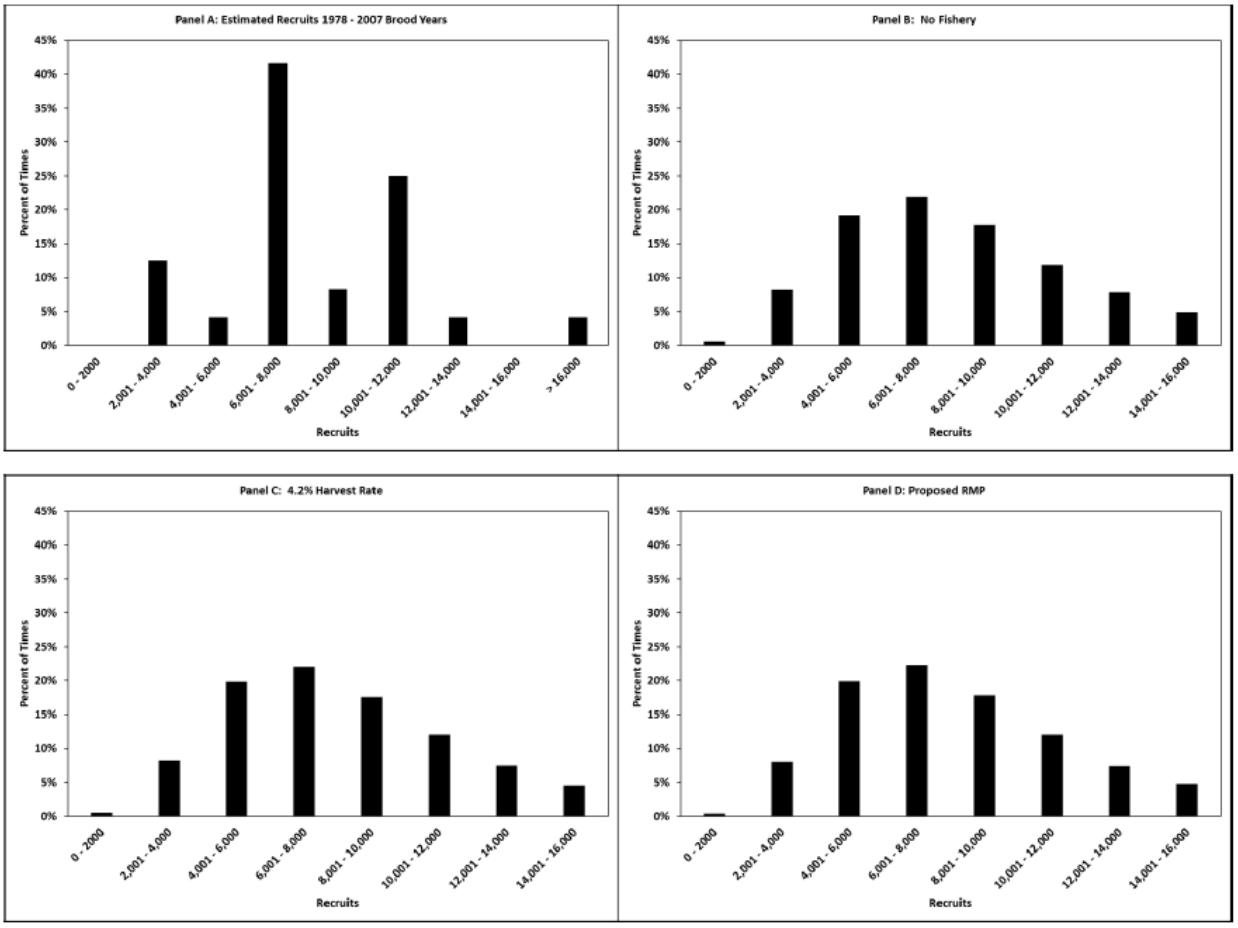

Figure 4-2. Distribution of estimated recruits for brood years 1978-2007 (Panel A), predicted recruits with no fishing (Panel B); predicted recruits with a constant 4.2% harvest rate (Panel C); and predicted recruits with the proposed Skagit RMP (Panel D). All predicted distribution are from simulations with a Ricker stock-recruit analysis. (Source SBT and WDFW 2018).

Similar results were obtained by the co-managers for the Beverton-Holt stock-recruit analysis so they were not included here. More detailed information on the spawner-recruit analyses can be found in the Skagit RMP (Sauk-Suiattle Indian Tribe et al. 2016; Appendices A-C), the Supplementary Information for the Skagit River Steelhead RMP (SBT and WDFW 2018) and NMFS' biological opinion on the Skagit River Steelhead Fishery Resource Management Plan (NMFS 2018).

The proposed action also includes several actions to protect important spatial structure and diversity components so as not to slow the Skagit DIPs in achieving viability within the Skagit SMU (Section 1.2, *Proposed Action*). This includes fishery actions that protect summer-run fish, the early-timed winter steelhead run, and repeat spawners (iteroparity) (Section 2.4.6, *Consideration of Viable Salmonid Population Parameters).*

As previously mentioned, on November 2016, the co-managers submitted a Skagit River Fishery Resource Management Plan under the 4(d) Rule, Limit 6, for joint tribal-state plans. NMFS recently completed a Proposed Evaluation and Pending Determination for the Skagit River Fishery Resource Management Plan (NMFS 2017a) and found the harvest rates of 4% to 25% described under the Proposed Action/Preferred Alternative, Alternative 2, to comply with the 4(d) Rule, Limit 6, for salmon and steelhead (NOAA 2003). In their analyses of harvest rates, the Skagit River Fishery Resource Management Plan included best available science from NMFS' PSSTRT to address all four viable salmonid population (VSP) parameters including abundance, productivity, spatial structure, and genetic diversity (NMFS 2017a) so as not to impede the survival and recovery of Skagit River steelhead populations or the overall Puget Sound Steelhead DPS. In December 2017, NMFS released the Proposed Evaluation and Pending Determination for the Skagit River Fishery Resource Management Plan for public comment.[41] In January 2018, the public comment period closed. NMFS has reviewed all public comments, requested supplemental information from the co-managers to address these comments, and incorporated this feedback and new information in this NEPA analysis.

NMFS has adopted the co-manager analysis in the Skagit RMP and used the results to determine impacts in this environmental assessment. In 4(i)(A) of the 4(d) Rule, populations may be aggregated for management purposes when dictated by information scarcity, if consistent with the survival and recovery of the listed DPS (NOAA 2003). Because limited data exists that prevent NMFS from determining impacts on the individual DIP level, NMFS will determine impacts on the management unit level (Skagit SMU) as described by the co-managers in the Skagit RMP (Sauk-Suiattle Indian Tribe et al. 2016).

Under the No Action/Status Quo, Alternative 1, harvest would likely continue at the existing levels and the effects of the existing fisheries would remain the same. Under Alternative 1, no significant impacts to listed steelhead are likely to occur because although the No Action/Status Quo incidental take of 4.2% would result in lower number of spawners, the Skagit Basin steelhead recruits are not predicted to vary substantially between no salmon fishing and the No Action/Status Quo bycatch rate of 4.2% (Figure 4-2). Also, NMFS previously evaluated the effects of the current Puget Sound salmon and steelhead fisheries under section 7(a)(2) of the ESA and determined that the fisheries were not likely to jeopardize the continued existence of the Puget Sound Steelhead DPS or destroy or adversely modify its critical habitat.

Under the Proposed Action/Preferred Alternative, Alternative 2, harvest rates are proposed to range from 4 percent to 25 percent, depending on steelhead abundances of ≤ 4,000 to ≥ 8,001 fish. This would potentially reduce the number of Skagit River steelhead by removing steelhead adults from the four Skagit River extant steelhead populations, reducing abundance and resulting adult productivity (juveniles) as well as reducing expansion of spatial structure and genetic diversity. However, no significant effects are likely to occur under Alternative 2 because NMFS recognizes that the co-manager risk analysis took into consideration abundance and productivity VSP parameters, which shows under implementation of the proposed fishery regime, the number of Skagit Basin steelhead adult spawners or recruits are not predicted to vary substantially between no fishing, 4.2% incidental harvest rate from existing salmon and hatchery steelhead fisheries, and Skagit RMP stepped harvest rate (SBT and WDFW 2018; Appendix Figure 3 (Figure 4-1). In addition, Skagit River steelhead abundances (four DIPs combined) have increased by 7% annually since 2011 (Section 3.1.1.1, *Skagit River Steelhead*; Table 3-1; Table 3-4), while productivity has been hovering at or just below replacement (Section 3.1.1.1, *Skagit River Steelhead*; Table 3-2). For spatial structure and diversity, the co-managers incorporated fishery management strategies to protect repeat spawners (kelts), summer-run steelhead, early run winter steelhead, and the smaller Nookachamps Creek population (Section 2.2, *Alternative 2 (Proposed Action/Preferred Alternative and Section 2.4.6, Consideration of Viable Salmonid Population Parameters*). In addition, there are no steelhead hatchery programs in the Skagit Basin that would affect the genetic diversity of natural origin fish (Section 1.2, *Description of Proposed Action*). Thus, with these actions combined to protect VSP parameters (abundance, productivity, spatial structure, and diversity, the proposed action is not likely to appreciably slow the Skagit SMU's achievement of viable function. Thus, no significant impacts are likely to occur

NMFS evaluated the effects of the Skagit RMP under section 7(a)(2) of the ESA and issued a biological opinion. This finding determined that the effects to the overall viability to the Skagit steelhead DIPs would be low and would allow the Skagit Basin DIPs to maintain their current moderate status. Thus, NMFS concluded that the effects of the Proposed Action on the viability of the Puget Sound steelhead DPS would be low. Our biological opinion concluded that the Skagit RMP is not likely to jeopardize the Puget Sound steelhead DPS and destroy or adversely modify critical habitat (NMFS 2018).

Since the Intermediate Fixed Harvest Rate, Alternative 3, falls within the range of effects of harvest described under Alternative 2 (4% to 10% steelhead harvest rate), Alternative 3 is likely to result in effects that are not likely to rise to the level of significant impact since the effects are found not to appreciably slow the Skagit SMU (four DIPs combined) from reaching viable function (see Alternative 2 above).

Since the Escapement Based Management, Alternative 4 (4% to 16% steelhead harvest rate), falls within the range of effects of harvest described under Alternative 2 (4% to 25% steelhead harvest rate), Alternative 4 is likely to result in effects that are not likely to rise to the level of significant impacts since the effects are found not to appreciably slow the Skagit SMU (four DIPs combined) from reaching viable function (see Alternative 2 above).

4.3.2 Non-listed Salmon

4.3.2.1 Coho Salmon

As described in Section 3.3.2.1, *Coho Salmon*, there are 40 populations of coho salmon within the Puget Sound/Strait of Georgia ESU divided into seven management units with five primary natural origin management units and two hatchery-origin management units. One coho salmon population is located in the proposed project area: Skagit River coho salmon (WDFW and WWIT 1993). The Skagit River coho, which had historically the largest escapements of coho salmon in Puget Sound, has experienced unexpectedly low escapement in recent years (2015/16) (Section 3.3.2.1, *Coho Salmon*). The 2006 to 2015 average Skagit coho escapement was 43,133 fish, with a 2015 estimate of only 5,476 fish.[42] Coho salmon harvest estimates are not available at this time. Direct effects of harvest on coho salmon include injury, latent mortality, and death. Indirect effects include decreased juvenile productivity and increased susceptibility to predation shortly after release.

Under the No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the existing fisheries would remain the same. Under the existing incidental harvest rate, there are no significant impacts to coho salmon because no directed steelhead fisheries occur that incidentally harvest coho salmon.

Under the Proposed Action/Preferred Alternative, Alternative 2, a maximum of up to 100 coho are anticipated to be encountered during tribal steelhead fisheries and up to 10 coho are anticipated to be encountered during non-tribal steelhead fisheries (total 110 coho salmon) under the highest proposed direct steelhead harvest rate of 25% (McClure 2017). The proposed steelhead fisheries would occur near the end of the coho spawning season in January and February (McClure 2017). Because there are no steelhead directed fisheries in the Skagit River, estimates for coho salmon harvest are not available at this time. Under the average coho salmon escapement estimate of 43,113 fish (2006 to 2015), the coho salmon harvest rate would be 0.3% under a steelhead harvest rate of up to 25%. The low number of coho salmon encountered at the end of the spawning season (100 tribal fisheries + 10 non-tribal fisheries = 110 fish) compared to the lowest coho salmon escapement estimate on record (5,476 fish in 2015) represents a maximum incidental coho salmon harvest rate of up to 2%, under steelhead harvest rate of up to

[42] WDFW SCoRE database (https://fortress.wa.gov/dfw/score/score/), accessed 12/1/2017.

25%, that would occur at the end of the season when the majority of the coho salmon run has spawned. Coho salmon harvest rates ranging from 0.3% (average coho salmon run) to 2% (lowest coho salmon run on record) are likely to result in undetectable to negligible effects, to the Skagit River coho salmon population, respectively. Therefore, Alternative 2 is not likely to result in significant impacts to coho salmon.

Under the Intermediate Fixed Harvest Rate, Alternative 3,effects during tribal (100 steelhead) and non-tribal steelhead fisheries (10 steelhead) are likely to be higher (10% direct steelhead harvest rate) than the No Action/Status Quo, Alternative 1 (up to 4.2% incidental steelhead harvest rate). The timing of the steelhead fisheries occur near the end of the coho spawning season after the majority of the run have already spawned in January and February (McClure 2017). The encounter rate of 110 coho salmon is proposed for a maximum harvest rate of up to 25% under Alternative 2. The proposed steelhead harvest rate for Alternative 3 results in a maximum harvest rate of 10%. Coho salmon encounter rates are not available for Alternative 3 but the steelhead harvest rates are less than Alternative 2, where proposed encounter rates are available (110 fish; up to 25% harvest rate). Therefore, Alternative 3 is not likely to result in significant impacts to coho salmon for the reasons described under Alternative 2.

Under Escapement Based Management, Alternative 4, effects during tribal (100 steelhead) and non-tribal steelhead fisheries (10 steelhead) are likely to be higher (16% direct steelhead harvest rate) than the No Action/Status Quo, Alternative 1 (up to 4.2% incidental steelhead harvest rate). The timing of the steelhead fisheries occur near the end of the coho spawning season after the majority of the run have already spawned in January and February (McClure 2017). The encounter rate of 110 coho salmon is proposed for a maximum harvest rate of up to 25% under Alternative 2. The proposed steelhead harvest rate for Alternative 4 results in a maximum harvest rate of 10%. Coho salmon encounter rates are not available for Alternative 3 but the steelhead harvest rates are less than Alternative 2, where proposed encounter rates are available (110 fish; up to 25% harvest rate). Therefore, Alternative 4 is not likely to result in significant impacts to coho salmon for the reasons described under Alternative 2.

4.3.2.2 Chum Salmon

As described in Section 3.3.2.2, *Chum Salmon,* one fall-run chum salmon population is located in the proposed project area: Mainstem Skagit River fall chum salmon (WDFW and WWIT 1993). Historically, the Skagit River has had one of the largest escapements of chum salmon in Puget Sound. This population experienced unexpectedly low escapement during the 2015 season with only 9,700 fish, with a 2007 to 2015 average Skagit chum salmon escapement of 31,800 fish (WDFW 2017). Harvest estimates for Puget Sound tribal chum salmon fisheries have averaged 4,300 fish from 2007 to 2016, with the most recent tribal chum salmon harvest of 500 fish in 2016 (WDFW 2017).

The Skagit River fall chum salmon run peaks in the fall of the year but there may be a small proportion of adult chum salmon in the project area during the proposed fisheries. Estimates of up to 31 chum salmon may be encountered in the tribal fishery and no chum in the non-tribal recreational fishery (McClure 2017). Direct effects of harvest on chum salmon include injury, latent mortality, and death. Indirect effects may include decreased juvenile productivity.

Under No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the fisheries would remain the same. Under the existing incidental take rates, there are no significant adverse impacts to chum because no directed steelhead fisheries occur that incidentally harvest chum salmon.

Under the Proposed Action/Preferred Alternative, Alternative 2, we estimate that up to 31 chum salmon may be encountered in the tribal fishery and no chum in the non-tribal recreational fishery (McClure 2017). Although the Mainstem Skagit River fall chum salmon run peaks in the fall, there may be a small proportion of adult chum salmon in the project area during the proposed directed steelhead fisheries. Under the average chum salmon escapement estimate of 31,800 fish (2007 to 2015), the chum salmon harvest rate would be 0.1% under the maximum steelhead harvest rate of up to 25%. The low number of chum salmon (31 fish) encountered at the end of the spawning season compared to the lowest chum salmon escapement estimate on record (9,700 fish in 2015) represents a maximum incidental chum salmon harvest rate of up to 0.3%, under steelhead harvest rate of up to 25%. Chum salmon harvest rates ranging from 0.1% (average coho salmon run) to 0.3% (lowest coho salmon run on record) are likely to result in undetectable (no effect) to the mainstem Skagit River chum salmon population, respectively. Therefore, Alternative 2 is not likely to result in significant impacts to chum salmon.

Under the Intermediate Fixed Harvest Rate, Alternative 3, effects during tribal (31 fish) and non-tribal (0 fish) fisheries are likely to be less than those described above for the Proposed Action/Preferred Alternative, Alternative 2 (up to 25% steelhead harvest rate), because the timing of the fisheries are identical, near the end or after the mainstem Skagit River fall chum population spawning season and the proposed steelhead harvest rates are lower under Alternatives 3 at 10%. Therefore, Alternative 3 is not likely to result in significant impacts to chum salmon for the reasons described under Alternative 2.

Under Escapement Based Management, Alternative 4, effects during tribal (31 fish) and non-tribal (0 fish) fisheries are likely to be less than those described above for the Proposed Action/Preferred Alternative, Alternative 2 (up to 25% steelhead harvest rate), because the timing of the fisheries are identical, near the end or after the mainstem Skagit River fall chum population spawning season and the proposed steelhead harvest rates are lower under Alternatives 4 at 16%. Therefore, Alternative 4 is not likely to result in significant impacts to chum salmon for the reasons described under Alternative 2.

4.3.3 Other Fish

Table 3-6, in Section 3.3.3, *Other Fish,* describes other fish that occur in Puget Sound and their relationship with salmon and steelhead. Some fish are predators of steelhead, whereas other fish are prey of steelhead. Considering both types of relationships, harvest of steelhead would result in a beneficial impact for fish that are prey of adult steelhead, a negative impact for fish that prey on adult steelhead, and result in indirect negative effects for prey and predators of juvenile steelhead (which are not harvested). Direct effects of harvest on other fish also include injury, latent mortality, and death. Indirect effects include decreased juvenile productivity. Other fish such as groundfish, forage fish, eulachon, and green sturgeon are not found in the majority of the action area because they reside in marine waters, which is a small component of the action area (Skagit Bay) (Figure 1-1). The vast majority of steelhead harvest would occur in freshwater areas (Skagit Basin).

For groundfish (such as rockfish), forage fish, eulachon, and green sturgeon, under the No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the existing fisheries would remain the same. Effects of the current Puget Sound salmon and steelhead fisheries were analyzed under a Puget Sound fisheries biological opinion, which found current harvest not likely to impede the survival and recovery of threatened Puget Sound/Georgia Basin Yelloweye, endangered Bocaccio rockfish, threatened eulachon, and threatened green sturgeon (NMFS 2017b). Unlisted groundfish and forage fish populations exist in much larger numbers than ESA-listed rockfish, eulachon, and green sturgeon. Significant impacts to other fish are not likely to occur because they are not found in the majority of the action area because they reside in marine waters, which is a small component of the action area (Skagit Bay) (Figure 1-1). The vast majority of steelhead harvest would occur in freshwaters areas (Skagit Basin).

Under the Proposed Action/Preferred Alternative, Alternative 2, impacts are likely to increase due to increases in overall steelhead harvest rates from 4.2% to 25% under various steelhead abundances ($\leq$ 4,000 to $\geq$ 8,001). However, for groundfish, including ESA-listed rockfish, forage fish, and green sturgeon, harvest is not likely to have a significant impact because the majority of the proposed steelhead fisheries would occur in freshwater under Alternatives 2, which is outside the usual range for groundfish, forage fish and green sturgeon (marine waters) (Figure 1-1).

For the Lower Skagit River bull trout core area population, the majority of fish are unlikely to be in the action area during the proposed fishery. Spawning of bull trout primarily occurs in the Skagit River in early September to early November (Section 3.3.3, *Other Fish*) prior to when the proposed steelhead fishery occurs. Direct impacts to adult bull trout may occur when they are outmigrating to the Skagit Bay estuary during late spring when the end of the timing of the steelhead fishery overlaps (Section 3.3.3, *Other Fish*). However, there is extremely limited data available to determine direct impacts. Indirect effects may also occur because bull trout feed on

juvenile steelhead (Section 3.3.3, *Other Fish*). However, there is no data at this time to determine indirect impacts.

Under the No Action/Status Quo, Alternative 1, harvest would likely continue at existing levels and the effects of the existing fisheries would remain the same. Under the existing fisheries, no significant impacts are anticipated because there are currently no directed steelhead fisheries in the Skagit Basin. Bull trout encounters in tribal and non-tribal salmon fisheries are likely to continue as under existing conditions and no changes to baseline conditions are anticipated.

Under the Proposed Action/Preferred Alternative, Alternative 2, the co-managers estimated that 797 encounters with bull trout in tribal fisheries and 200 encounters in non-tribal fisheries are likely to occur based upon the overlap in timing and location of bull trout and the proposed the steelhead fishery based on tribal test fishery data and recreational fishing methods (McClure 2017). Bull trout caught in the tribal test fishery would not be retained and returned to the water; release mortality rates are unknown. Bull trout caught in non-tribal fisheries are more likely to be retained but retention rates are also unknown. The most recent bull trout population estimate is between 13,000 to 16,000 fish for the Lower Skagit River bull trout core area population where the action area occurs (Section 3.3.3, *Other Fish*). A total estimate of 992 encounters (tribal 792 fish + non-tribal 200 fish = 992 fish combined) may occur. Since release mortality and retention rates are unknown at this time, NMFS will assume all 992 encounters result in mortality. However, the actual rate in likely to be lower. This results in an approximate 6.2% to 7.6% mortality rate on Lower Skagit River bull trout core area population. Alternative 2 is not likely to have a significant impact on the Lower Skagit River bull trout core area population because it is classified as "healthy", native char are protected from harvest by a 20" minimum size limit in mainstem trout fisheries to allow the majority of females to spawn at least once, other Skagit Basin tributaries are closed to native char fishing (Section 3.3.3, *Other Fish*), and based on the above estimated bull trout harvest rates of 6.2% to 7.6%, 92.4% to 93.8% of the adult bull trout population are likely to outmigrate to the estuary in late spring.

The U.S. Fish and Wildlife issued a special 4(d) Rule, which provides that the ESA's prohibition on the take of listed species does not apply to bull trout caught in fisheries regulated by tribal and state entities (64 FR 58910, November 1, 1999). Illegal harvest and ongoing incidental take of bull trout by recreational fishers catch and releasing fish or pursuing other species were identified as concerns at the time of the bull trout listing (63 FR 31647, June 10, 1998). Since the listing, angling regulations have restricted direct bull trout harvest to only a handful of locations since the early and mid-1990s where populations are considered healthy, such as in the Skagit Basin. These actions resolved most pre-listing concerns about the overutilization of bull trout by anglers who legally harvest fish (USFWS 2008). In some core areas, bull trout numbers appear to have responded positively to those angling restrictions, such as in the Skagit River (USFWS 2005).

Under the Intermediate Fixed Harvest Rate, Alternative 3, (up to 10% steelhead harvest rate), encounters with bull trout are likely to be less than the Proposed Action/Preferred Alternative, Alternative 2 (up to 25%). Bull trout also caught in the tribal test fishery would not be retained and would be returned to the water; however, release mortality rates are unknown. Bull trout caught in non-tribal fisheries are more likely to be retained but retain rates are also unknown. Since Alternative 3 represents a lower overall steelhead harvest rate than Alternative 2, it is not likely to have a significant impact on bull trout because of the reasons described above under Alternative 2.

Under the Intermediate Fixed Harvest Rate, Alternative 4, (up to 16% steelhead harvest rate), encounters to bull trout are likely to be less than the Proposed Action/Preferred Alternative, Alternative 2 (up to 25%). Bull trout also caught in the tribal test fishery would not be retained and would be returned to the water; however, release mortality rates are unknown. Bull trout caught in non-tribal fisheries are more likely to be retained but retain rates are also unknown. Since Alternative 4 represents a lower overall steelhead harvest rate than Alternative 2, it is not likely to have a significant impact on bull trout because of the reasons described above under Alternative 2.

For rainbow trout, under the No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the effects of the existing fisheries would remain the same. No comprehensive data exists for all Skagit River rainbow trout populations to evaluate current harvest effects at this time. Under the existing fisheries, significant impacts to rainbow trout are unlikely to occur because the majority of rainbow trout escape the larger mesh size used in tribal salmon fisheries and the majority of the rainbow trout populations exist in Skagit River tributaries and above dams where salmon and steelhead fisheries currently do not occur (McClure 2017).

Under the Proposed Action/Preferred Alternative, Alternative 2, up to 50 encounters with rainbow trout are anticipated to occur because the proposed non-tribal steelhead fishery would not occur in tributaries entering the mainstem Skagit, Sauk, or Suiattle Rivers where this species is found to be more concentrated (McClure 2017). No data are available to evaluate steelhead harvest impacts on Skagit River rainbow trout populations at this time. However, significant impacts to rainbow trout are unlikely to occur because they are ubiquitous across the Skagit SMU (occupied 95% of the sites surveyed) (J. P. Shannahan, Upper Skagit Tribe, unpubl. data; Section 3.3.3, *Other Fish*). Additionally, the majority of rainbow trout escape the larger mesh size used in tribal steelhead fisheries. Some rainbow trout may be caught in steelhead recreational fisheries but the majority of the rainbow trout populations exist in Skagit River tributaries and above dams where steelhead fisheries would not occur (Section 4.3.3, *Other Fish*) likely resulting in no significant impacts.

Under the Intermediate Fixed Harvest Rate, Alternative 3 (up to 10%), impacts to rainbow trout would likely be lower than the 50 encounters under the Proposed Action/Preferred Alternative, Alternative 2 (up to 25%). No data are available to estimate encounters under the 10% steelhead harvest rate on Skagit River rainbow trout populations at this time. However, significant adverse impacts to rainbow trout are unlikely to occur because they are ubiquitous and found in high numbers across the Skagit SMU (occupied 95% of the sites surveyed) (J. P. Shannahan, Upper Skagit Tribe, unpubl. data; Section 3.3.3, *Other Fish*). The overall harvest impacts would be lower (less than 50 encounters under 10% compared to the maximum 25% harvest rate under Alternative 2). Some rainbow trout may be caught in steelhead recreational fisheries but the majority of the rainbow trout populations exist in Skagit River tributaries and above dams where steelhead fisheries currently do not occur (Section 4.3.3, *Other Fish*) likely resulting in no significant impacts.

Under Escapement Based Management, Alternative 4 (up to 16%), impacts to rainbow trout would likely be lower than the 50 encounters under the Proposed Action/Preferred Alternative, Alternative 2 (up to 25%). No data are available to estimate encounters under the 16% steelhead harvest rate on Skagit River rainbow trout populations at this time. However, significant adverse impacts to rainbow trout are unlikely to occur because they are ubiquitous and found in high numbers across the Skagit SMU (occupied 95% of the sites surveyed) (J. P. Shannahan, Upper Skagit Tribe, unpubl. data; Section 3.3.3, *Other Fish*). The overall harvest impacts would be lower (less than 50 encounters under 16% compared to the maximum 25% harvest rate under Alternative 2). Some rainbow trout may be caught in steelhead recreational fisheries but the majority of the rainbow trout populations exist in Skagit River tributaries and above dams where steelhead fisheries currently do not occur (Section 4.3.3, *Other Fish*) likely resulting in no significant impacts.

For coastal cutthroat trout, under the No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the effects of the existing fisheries would remain the same. Knowledge of population abundance, trends, productivity, and status of cutthroat trout overall are lacking (Section 3.3.3, *Other Fish*). Under the existing fisheries, there are no significant impacts to cutthroat trout because what available monitoring information we do have suggests that coastal cutthroat trout are widespread and ubiquitous, and that all life history strategies are represented within suitable habitat (Anderson 2008b). Therefore, any take is not likely to cause a meaningful reduction in the population.

Under the Proposed Action/Preferred Alternative, Alternative 2, few impacts to cutthroat trout, if any, are projected to occur as the tribal fishery rarely encounters this species and the fishery would occur in the mainstem Skagit, not in the tributaries entering the mainstem Skagit, Sauk, or Suiattle Rivers where this species is found to be more concentrated (McClure 2017). Less than 10 encounters are anticipated in the non-tribal steelhead fishery as it would occur upstream of

river mile 54 on the mainstem Skagit River but not in the tributaries entering the mainstem Skagit, Sauk, or Suiattle Rivers where this species is found to be more concentrated (McClure 2017). In 1997, the WDFW estimated 13,000 coastal cutthroat trout spawners in the Skagit River system (PSE 2003). Less than 10 cutthroat trout is 0.08% of the last know population estimate likely resulting in undetectable (no effects) effects to the overall Skagit River cutthroat trout population. Thus, we anticipate no significant impacts to cutthroat trout.

Under the Intermediate Fixed Harvest Rate, Alternative 3, impacts to cutthroat trout are likely the same as the Proposed Action/Preferred Alternative, Alternative 2, because of the location of the steelhead fisheries are the same. Thus, we anticipate no significant impacts to cutthroat trout for the same reasons described above under Alternative 2.

Under Escapement Based Management, Alternative 4, impacts to cutthroat trout are likely the same as the Proposed Action/Preferred Alternative, Alternative 2, because of the location of the steelhead fisheries are the same. Thus, we anticipate no significant impacts to cutthroat trout for the same reasons described above under Alternative 2.

For sucker fish and whitefish, under the No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the effects of the existing fisheries would remain the same. Since there are no population data available to evaluate effects of current harvest under the existing fisheries, we are unable to determine the exact level of impacts to suckerfish and whitefish at this time.

Under the Proposed Action/Preferred Alternative, Alternative 2, few impacts to whitefish in tribal fisheries (< 25 fish) are anticipated to occur due to the larger mesh size used during the proposed tribal steelhead fishery that allows for greater numbers of fish to escape the steelhead gillnet fishery (McClure 2017). Estimates of suckerfish encounters would be less than 400 fish in tribal fisheries. Suckerfish would not be retained but released back into the river. Release mortality estimates are not available at this time. Some impacts are likely to occur during the proposed non-tribal steelhead fishery but data are not available to estimate the number of suckerfish and whitefish encounters. We anticipate suckerfish and whitefish encounters in non-tribal steelhead fisheries are likely to be similar to tribal steelhead fisheries. However, due to the lack of available population data and encounters in directed steelhead fisheries, the exact level of impacts to suckerfish and whitefish under Alternative 2 cannot be determined at this time.

Under the Intermediate Fixed Harvest Rate, Alternative 3 (up to 10% steelhead harvest rate) impacts to suckerfish and whitefish would likely be lower than the Proposed Action/Preferred Alternative, Alternative 2 (up to 25% steelhead harvest rate), because of lower proposed steelhead harvest rates. Impacts to suckerfish and whitefish in the non-tribal fishery are unknown but likely to be similar to tribal steelhead fisheries. However, due to the lack of available

population data and encounters in directed steelhead fisheries, the exact level of impacts under Alternative 3 cannot be determined at this time.

Under Escapement Based Management, Alternative 4 (up to 16% steelhead harvest rate), impacts to suckerfish and whitefish would likely be lower than the Proposed Action/Preferred Alternative, Alternative 2 (up to 25% steelhead harvest rate), because of lower proposed steelhead harvest rates. Impacts to suckerfish and whitefish in the non-tribal fishery are unknown but likely to be similar to tribal steelhead fisheries. However, due to the lack of available population data and encounters in directed steelhead fisheries, the exact level of impacts under Alternative 4 cannot be determined at this time.

4.4 Marine Ecosystem and Fish Habitat

As described in Section 3.4, *Marine Ecosystem and Fish Habitat*, harvest and associated boat operations can impact fish habitat through fishing equipment scouring the seabed or river bottom, disruption of spawning beds or degradation of streamside habitat by wading fisherman and boat traffic, noise and light disturbance, and the presence of derelict fishing gear, among other fishing activities. This may result in negligible to low negative effects on marine ecosystem and fish habitat.

Most of the harvest related activities in Puget Sound occur from boats or along river banks (NMFS 2017b). If hooks, lines, or nets come in contact with the substrate or other habitat features, their capture efficiency is dramatically reduced. As a result, fishermen endeavor to keep gear from being in contact or entangled with substrate and habitat features because of the resultant interference with fishing and potential loss of gear (NMFS 2017b).

Under the No Action/Status Quo, Alternative 1, the Proposed Action/Preferred Alternative, Alternative 2, Intermediate Fixed Harvest Rate, Alternative 3, and Escapement-Based Management, Alternative 4, all effects are likely to continue as under existing conditions, such as fishermen who endeavor to keep gear off the bottom and entangled with fish habitat because it results in reduced fishing efficiency, and are, therefore, not considered to be significantly adverse. In addition, recent closures of fishing at impacted spawning locations have been implemented and anticipated handling of fishing gear to reduce encounters would remain the same or be very similar.

4.4.1 Marine Derived Nutrients from Steelhead Spawners

Steelhead carcasses, which occur in freshwater streams after spawning, provide a direct food source for juvenile salmonids and other fish, aquatic invertebrates, and terrestrial animals

(Cederholm et al. 2000; Merz and Moyle 2006) as described in Section 3.4.1, *Marine Derived Nutrients from Steelhead Spawners*. The decomposition of carcasses supplies nutrients that increase primary and secondary production and benefit the ecosystem. By removing steelhead adults that would otherwise return to spawning areas, harvest could negatively affect forage for juveniles by decreasing the return of marine derived nutrients to spawning and rearing areas.

Under the No Action/Status Quo, Alternative, the current conditions would continue to occur in spawning or rearing habitat. Under Alternative 1, the present harvest rate on Skagit steelhead removes only a very small percentage of the steelhead in Puget Sound (< 1%) (NMFS 2017b), which make up an even smaller percentage of the total salmon spawning in the system, tens of thousands of salmon of various species, annually (e.g. chum, pink, coho, Chinook salmon), that increases primary and secondary production and benefits the ecosystem. Therefore, effects are considered negligible and the impacts are not considered significantly adverse.

Under the Proposed Action/Preferred Alternative, Alternative 2, an increased proportion (4% to 25%) and total number of Skagit steelhead would be harvested, across a range of abundances ($\leq$ 4,000 to $\geq$ 8,001 fish), relative to the existing condition. At the higher end of the harvest rate, the number of adult steelhead removed from the system could amount to a potentially small proportion of the total salmon spawners (all species), depending on the abundance of the other salmon species. These impacts may have low negative effects but are not considered a significant impact because the proposed steelhead harvest rates are only a small percentage of steelhead fisheries in Puget Sound.

Under the Intermediate Fixed Harvest Rate, Alternative 3, the increased proportion (4 percent to 10 percent) and total number of Skagit steelhead would fall within the harvest rates and effects described above under the Proposed Action/Preferred Alternative, Alternative 2. Impacts under Alternative 3 is not considered to be a significant impact for the reasons described above under Alternative 2.

Under Escapement Based Management, Alternative 4, the increased proportion (4% to 16%) and total number of Skagit steelhead would fall within the harvest rates and effects described above under the Proposed Action/Preferred Alternative, Alternative 2. Impacts under Alternative 4 is not considered to be a significant impact for the reasons described above under Alternative 2.

4.4 Environmental Justice

NOAA's Policy and Procedures for Compliance with NEPA (Companion Manual for NAO 216-6A) requires that a determination be made as to "whether the proposed action has a disproportionately high and adverse human health or environmental impact on minority or low-income populations and on subsistence use in affected areas."

Environmental justice is not an impact category standing alone. First, it must be determined if impacts in other impacts categories are adverse under any alternative, and, if so, whether such impacts may be felt disproportionately by environmental justice populations. Under Section 3.6, *Environmental Justice*, low income and minority communities were identified in the project area and Native American Tribes in the Skagit River, as a group, were considered an Environmental Justice community. These were identified under the Meaningful Greater Analysis.

In summary, the following were identified as environmental justice communities or user groups, which includes the following counties, and target populations (Section 3.6, *Environmental Justice*):

4.4.1 Low income

The following low income environmental justice communities or user groups include Whatcom and Skagit Counties.

4.4.2 Minority

The following minority environmental justice communities or user groups include Skagit County.

4.4.3 Native American – Federal trust responsibility

Native Americans residing within the proposed action area are included in this analysis and may be affected to a larger degree based on cultural ties to this resource. NMFS' Federal trust responsibility to Native American Tribes is described in Section 1.5.6, *Federal Trust Responsibility*.

Because the effects to the above low income, minority, and Native American user groups are the same, the effects are combined and described below under two categories.

Effects of the alternatives on fish and wildlife resources, themselves, would not directly impact environmental justice populations. The following addresses the effects to Cultural Resources and Economics, both of which may have beneficial impacts to environmental justice populations and are likely to affect these communities positively:

- Cultural Resources - As described in Section 4.5, *Cultural Resources*, Alternatives 1 through 4 have a positive or beneficial effect on cultural resources among Indian tribes in that all alternatives allow for continued fishing and for the tribes to maintain the important Ceremonial & Subsistence (C&S) fishing for steelhead in the Skagit River basin. Under the No Action/Status Quo, Alternative 1, these benefits would continue to be low. The proposed increases in total allowable steelhead harvest, under the Proposed Action/Preferred Alternative, Intermediate Fixed Harvest Rate, Alternative 3, and Escapement-Based Management, Alternative 4, could increase levels of fish taken for C&S purposes, which could increase this beneficial effect, though it would likely still remain low due to the small scope of Skagit River steelhead fisheries compared to the broader Puget Sound salmon fisheries. While the proposed steelhead fishery is important for non-tribal recreational fishermen, the fishery is not considered a cultural resource for them in the same way that it is considered for Indian tribes.

- Economics - As described in Section 4.6, *Socioeconomics*, the No Action/Status Quo, Alternative 1, which would continue the current low levels of steelhead harvest on the Skagit River, would result in minimal (low) economic benefit to environmental justice communities, including the affected Indian tribes in the project area, who may sell some of the steelhead caught in commercial fisheries directed at other species, affecting catch revenue, overall per capita income, poverty rates, and community health. The Proposed Action Alternative/Preferred Alternative, Alternative 2, Intermediate Fixed Harvest Rate, Alternative 3, and Escapement-Based Management, Alternative 4 would allow for various increased harvest rates on the Skagit steelhead that could allow for more fish available for commercial sales in tribal fisheries. Additionally, increased opportunity for recreational fisheries on steelhead may benefit environmental justice communities of concern through a general increase in seasonal economic benefit in the project area, however, these increases would likely be at a low level. Alternative 2 through 4 would result in the continuation of the low positive economic effects of the existing conditions. However, these economic effects would not be significantly beneficial due to the small scope of steelhead fisheries in the Skagit Basin compared to the broader Puget Sound salmon fisheries.

4.5 Cultural Resources

Puget Sound Indian Tribes, who signed the Stevens Treaties, such as the Upper Skagit, Sauk-Suiattle, and Swinomish Tribes, secured the "right of taking fish at usual and accustomed grounds and stations…in common with all citizens of the Territory". These treaties provided the Skagit Indian Tribes the right to harvest a share of each run of anadromous fish passing through tribal fishing grounds in return for relinquishing their interest in certain lands in Washington State. The United States, and, thus, Federal agencies, have a trust responsibility to protect and maintain these rights reserved by or granted to Indian Tribes or Indian individuals. The proposed commercial, ceremonial and subsistence, and recreational fisheries would not affect cultural resources as physical components but would affect cultural resource values.

4.5.1 Treaty Indian Ceremonial and Subsistence Fish Uses

Steelhead historically supplied the Skagit Basin Tribes with salmon for five months out of the year due to their extended time in the Skagit River to gather food for ceremonial and subsistence purposes (S. Schuyler, Upper Skagit Tribe, pers comm., 2018). Treaty tribes prioritize their ceremonial and subsistence needs over commercial sales and may fish for ceremonial and subsistence uses when there are no concurrent commercial fisheries (Section 3.5.1, *Treaty Indian Ceremonial and Subsistence Salmon Uses*). Beneficial effects occur in the form of increased economic income due to increased harvest opportunities, increased dietary nutrients due to increased subsistence fisheries, and increased supply of fish for ceremonial purposes. Negative effects include decreased economic income due to decreased harvest opportunities, decreased dietary nutrients in lower subsistence opportunity, and decreased supply of fish for ceremonial purposes.

Under the No Action/Status Quo Alternative, Alternative 1, harvest would continue at existing levels and the effects of the fisheries would remain the same. Under the existing fisheries, there are no significant adverse impacts to treaty ceremonial and subsistence steelhead uses because, although current harvest is limited to incidental steelhead catch in salmon fisheries only, ceremonial and subsistence harvest is prioritized over commercial fisheries. The treaty right to harvest steelhead for ceremonial and subsistence purposes is considered to have a high positive effect under existing conditions because it supports their ceremonial and subsistence needs that are consistent with their ancestral heritage.

Under the Proposed Action/Preferred Alternative, Alternative 2, tribes have the opportunity to harvest steelhead for ceremonial and subsistence uses. Although treaty tribes may desire increased harvest of steelhead for ceremonial and subsistence purposes, existing conditions have shown that a similar portion of steelhead for these purposes would be harvested, and that the

treaty tribes have been able to determine the amount needed for ceremonial and subsistence purposes (NMFS 2017b). Because ceremonial and subsistence harvest is prioritized over commercial fisheries, there is no expected reduction in harvest for ceremonial and subsistence harvest. The treaty right to harvest steelhead for ceremonial and subsistence purposes is considered to have a high positive effect under existing conditions. Since Alternative 2 represents continued and expanded harvest opportunity for ceremonial and subsistence purposes similar to baseline conditions, it would not result in significant adverse impacts.

Under the Intermediate Fixed Harvest Rate, Alternative 3 and Escapement-Based Management, Alternative 4, the anticipated ceremonial and subsistence uses of steelhead would fall within the effects described above under the Proposed Action/Preferred Alternative, Alternative 2. Impacts under alternatives 3 and 4 are not considered to be significantly adverse for the reasons described above under Alternative 2.

4.6 Socioeconomics and Tourism and Recreation

Socioeconomic impacts include personal income from fisherman purchasing good and services related to harvest activities. Those purchases can in many forms including, but not limited to, food, fishing gear, bait, fishing licenses, guide services, boats, gas, hotel lodging, etc.

As mentioned in Section 3.7, *Socioeconomics and Tourism and Recreation*, tourism and recreation in the Skagit River Basin are considered to be a source of value to persons who do not directly use or consume these resources (Bureau of Indian Affairs 2017). Reducing the likelihood for species extinction, or by providing more certainty that these resources would exist even if no personal use is intended are concepts of economic value that are widely recognized (NMFS 2004a). These values are commonly referred to as non-use or passive use values (Bureau of Indian Affairs 2017). Although we are not able to quantify or analyze these values for this assessment, their existence is acknowledged here.

Because directed fisheries on natural origin Skagit River steelhead (or other Puget Sound steelhead populations) have not occurred since the early 1990s, there are no current data to use for a quantitative socioeconomic analysis. Thus, NMFS will conduct the following qualitative analysis of effects.

Under the No Action/Status Quo, Alternative 1, harvest would continue at existing levels and the existing fisheries would remain the same. Under the existing fisheries, there are no significant impacts to socioeconomics and tourism and recreation because only a minimal amount of incidental fisheries are occurring to provide socioeconomic benefits, and tourism and recreational activities would remain the same.

Under the Proposed Action/Preferred Alternative, Alternative 2, an increase in steelhead fisheries harvest rates from 4 percent to 25 percent may occur under a range of steelhead abundances from $\leq$ 4,000 to $\geq$ 8,001 fish. Local tribal and non-tribal communities are likely to benefit from socioeconomic and tourism and recreation impacts. Effects include increases in purchased goods, such as fishing supplies and gear, food, boat purchases, fishing licenses, guided trips, hotels, parking and launch fees, and other expenditures related to fishing and non-fishing tourist and recreational activities that may increase personal income. However, due to the small scope of the Skagit River steelhead fisheries (e.g., all of the indirect fisheries,[43] which are the majority of fisheries described in the Skagit RMP, are part of the existing baseline, with the exception of the added directed catch-and-release recreational fishery), the socioeconomic and tourism and recreational impacts are considered low and not likely to have significant beneficial effects.

Under the Intermediate Fixed Harvest Rate, Alternative 3 and Escapement-Based Management, Alternative 4, the increase in steelhead fisheries fall within the range of harvest rates and abundances described under Alternative 2. Local tribal and non-tribal communities are likely to benefit from the same impacts to personal income described under Alternative 2. Therefore, the socioeconomic and tourism and recreation impacts are considered low and are not likely to have significant beneficial effects for the same reasons described under Alternative 2.

4.7 Climate Change

For the proposed Skagit River project area, the effects of climate change are likely to include increases in air temperature, reduced winter/spring snowpack and summer flows, earlier spring peak flows, increased flooding, higher summer stream temperatures, higher sea levels and ocean temperatures, higher upwelling, delayed spring transition, and increased ocean acidity. Climate effects may also include increased winter and decreased summer participation. The negative effects of the above climate changes on Skagit River steelhead are difficult to predict due to the complex interactions of biotic and abiotic factors, the plasticity of steelhead life history patterns, and uncertainties in our understanding of the rate at which adaption would occur (Sauk-Suiattle Indian Tribe et al. 2016).

Climate change has been occurring for at least the past 50 years and is expected to continue for decades into the future (IPCC 2014). Multi-decadal projections of future climate change are available. However, the "signal" of climate change in these projections cannot be distinguished from the "noise" of natural climate variability over short time periods (i.e., < 10 years) (NMFS

[43] This includes all indirect salmon fisheries that incidentally catch steelhead.

2016c). After reviewing available literature, NMFS determined that for at least 10 years into the future, and up to 50 years on the regional scale, expected climate change is dominated by annual and decadal natural variability and the signal of climate change is difficult to distinguish (NMFS 2016c). We would assume that, under all alternatives, the effects of continued, varying levels of steelhead harvest in the project area, under the 5-year duration of the alternatives, including the Proposed Action/Preferred Alternative, Alternative 2, would have similar effects, when amplified by the effects of continued climate change.

The Skagit RMP is proposed for a period of five years. Direct and indirect effects of the proposed action described above are of relatively short duration (i.e., < 10 years) and climate change predications for that period are not likely to differ from current climate conditions and their associated variability (Thom 2016).

5. CUMULATIVE IMPACTS

NEPA defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Past, present, and reasonably foreseeable future actions include those that are Federal and non-Federal. For this EA analysis, the focus is on the contribution of the No Action/Status Quo, Alternative 1, (4.2% incidental take of listed steelhead) or Proposed Action/Preferred Alternative, Alternative 2, (4% to 25% steelhead harvest rate based on forecasted steelhead adult returns for the next five years) to cumulative effects considering other past, present, and future actions that occurred, are occurring, or are expected to occur in Puget Sound. The Intermediate Fixed Harvest Rate, Alternative 3 and Escapement-Based Management, Alternative 4, are assumed harvest scenarios that fall between the ranges of effects described under Alternatives 1 and 2 and are used for the purposes of comparison of further environmental effects.

Section 3, *Affected Environment*, describes existing conditions and reflects environmental effects from past and existing conditions for 7 resource areas. Chapter 4, *Environmental Consequences*, evaluates the direct and indirect effects of the No Action/Status Quo, Alternative 1, Proposed Action/Preferred Alternative, Alternative 2, Intermediate Fixed Harvest Rate, Alternative 3, and Escapement-Based Management, Alternative 4 on these resources. This chapter considers the cumulative effects of Alternatives 1 through 4 in the context of past actions, present conditions, and reasonably foreseeable future actions and conditions.

5.1 Geographic and Temporal Scales

The cumulative effect area considers Puget Sound marine (Skagit Bay) and freshwater (Skagit River system) as the geographic extent of the cumulative effects area (Figure 1-1). Although steelhead produced in Puget Sound waters migrate to Alaska, Oregon, and British Columbia, harvest of these fish in the Skagit Basin is considered the primary project effect. The temporal scope of past, present, and future actions includes archaeological and historical context of fishing in the Skagit Basin through projected environmental conditions over the next 5-10 years.

5.2 Past Actions

The earliest evidence of human presence in the Pacific Northwest was about 8000 B.P. (and much earlier in Alaska) where there was evidence of human remains found at the mouth of the Fraser River and lower Columbia River (Bureau of Indian Affairs 2017). Over the next several thousands of years, there was archaeological evidence of fishing villages and fish supplies used at the villages. Fishing continued to the present by Native Americans and by Europeans who migrated to the Pacific Northwest, British Columbia, and Alaska. In the 1800s, declines in salmon runs started occurring from hydropower development, logging, farming, and fishing (Bureau of Indian Affairs 2017). In addition, salmon canneries and hatcheries were constructed and operated. Harvest peaked in 1883 when 3,000,000 Chinook salmon and 25 million pounds of other salmon species and steelhead were harvested in one season, the catch of which declined subsequently over the years to present conditions (Ecology 2016).

Conservation laws and regulations to protect salmon and steelhead runs were initially passed in the 1800s and continued to the present including restrictions on gear, species caught, area harvested, and extent of removal of eggs and natural origin spawning fish for hatchery use. However, hydropower and industrial development continued to result in loss of substantial fish habitat, particularly in the Columbia and Snake Rivers and Puget Sound. With the continued decrease in salmon and steelhead and listing of threatened and endangered salmon and steelhead throughout the Pacific Northwest, salmon fisheries were either closed or reduced substantially in size over time. Conservation measures to protect listed species have been ongoing with more recent efforts to better estimate salmon and steelhead returns and propose harvest plans that would better protect salmon and steelhead over the long term (WDFW and PSIT 2004). Directed steelhead fisheries have been closed in the Skagit Basin since the mid-1990s.

5.3 Development and Habitat Loss

Development that has occurred over the past century and is ongoing has affected the abundance, distribution, and health of salmon and steelhead, other fish, economic income, wildlife, air, and

water quantity and quality. Generally, development has resulted in the loss of fish habitat along marine shorelines, estuaries, and freshwater streams and rivers. Most of the impacts have occurred from hydropower, logging alongside streams, farming and chemical releases, stormwater releases, and industrial and wastewater discharges. The effects include loss of spawning habitat and cover, and degraded water quality conditions, which has resulted in a decrease in overall fish abundance (Quinn 2010).

Human activity continues to impact key aquatic habitat attributes, such as streamside vegetation, habitat connectivity, and stream flow. This loss and degradation of aquatic habitat threatens both salmon and tribal culture and treaty rights. In 2012, an assessment of current habitat trends revealed that salmon habitat is being damaged and destroyed faster than it can be recovered within western Washington (NWIFC 2012).

5.4 Hatcheries

Hatchery development in the Pacific Northwest was initially responsible for loss of natural origin salmon and steelhead through genetic introgression of hatchery-origin fish into natural origin fish populations; competition and predation by hatchery-origin fish on natural origin fish; and impacts from construction and operation of hatchery facilities that blocked fish passage, removed water from streams, and released contaminated water into streams (HSRG 2004). Over time, many of these hatchery impacts to natural origin fish have been corrected and some hatcheries are now being operated to help recover listed and/or declining populations ((WDFW and PSIT 2004); WDFW 2016). There is currently no steelhead hatchery program in the proposed project area (i.e., Skagit Basin) (Figure 1-1).

5.5 Hydropower and Culvert Blockage

Use of hydropower and placement of incorrectly sized culverts at stream crossings have been responsible for blocking fish passage to upstream habitat (Harrison 2008). Over time, many dams have attempted to restore fish passage and fish habitat through a series of fish ladders upstream and trucking fish downstream of the dams. Dams have also modified operations to restore river flows, more effectively control sediment and manage erosion, and provide more natural temperature and oxygen levels of water released from dams. Some hydropower projects are being removed altogether. Culverts are being restored and/or replaced to allow increased fish passage (WDOT 2016). Implementation of this corrective action has taken on a greater emphasis in response to the culvert decision within *U.S. v. Washington*[44] in which Washington State was

[44] *United States v. Washington* is the ongoing federal court proceeding that enforces and implements reserved tribal treaty fishing rights with regard to salmon and steelhead returning to western Washington. Five treaties between the United States and various Washington tribes (1854 through 1856) described the reserved tribal fishing rights in

required to replace blocked culverts over time. As a result, the impact of hydropower development and culvert blockage has decreased over time.

5.6 Harvest

During the 18th and 19th centuries when Europeans began to populate Puget Sound, harvest of salmon and steelhead was uncontrolled, which resulted in substantial decreases in salmon and steelhead abundance. Over time, as regulations to protect salmon and steelhead resources were developed, harvest decreased to protect and conserve remaining salmon and steelhead resources. With implementation of the Puget Sound Chinook Harvest Management Plan (WDFW and PSIT 2004), planned harvest relied on escapement estimates to protect and conserve weaker stocks. In addition, *U.S. v. Washington* also helped in fisheries management through the sharing of the fishery resource between treaty tribes and Washington State. Currently, and as expected in the future, harvest management plans between WDFW and the Treaty Tribes, as co-managers, would continue to help conserve salmon while allowing for harvest that would not result in depletion of fish stocks. Other regulations, policies, treaties, and practices that help protect Puget Sound fishery resources, while allowing for controlled harvest, include the Magnuson-Stevens Fishery Conservation and Management Act, U.S./Canada Pacific Salmon Treaty, exercise of treaty rights, WDFW fish policies and regulations, PFMC's Framework Salmon Management Plan (PFMC 2016), pertinent state/tribal agreements, and the North of Falcon and PFMC processes. NMFS also reviews and advises on planned fisheries harvest so that listed salmon and steelhead stocks are protected as needed from excessive exploitation. Based on these practices, WDFW and the Puget Sound Treaty Tribes, as co-managers, issue agreed-upon harvest regulations to protect salmon and steelhead resources over the long term.

5.7 Cumulative Effects by Resource

Cumulative effects identified by resource area and alternative are described as either having significant positive (beneficial), or negative (adverse) effects under Table 5-1 and Table 5-2.

common with citizens of the territory. The "Culvert Case" is a designated subproceeding of *United States, et al., v. State of Washington, et al*., C70-9213. The United States, in conjunction with the Tribes, initiated this sub-proceeding in early 2001, seeking to compel the State of Washington to repair or replace any culverts that are impeding salmon migration to or from the spawning grounds. On March 29, 2013, United States District Judge Ricardo S. Martinez ordered the state of Washington to replace culverts under state-owned roads that block the passage of salmon to critical habitat. The court earlier found those culverts violated tribal treaty rights. The reasoning is that the Stevens treaties of 1855 require protection of the environment including protecting the viability of treaty-protected fish. The Ninth Circuit Court of Appeals affirmed the lower court decision. *United States v. Washington*, No. 13-35474, June 27, 2016. The Supreme Court has accepted the State of Washington's petition for certiorari. While that decision is pending, the Ninth Circuit decision stands.

Table 5-1. Summary of Cumulative Effects by Resource for Alternatives 1 and 2.

Resource Area	No Action/Status Quo, Alternative 1	Proposed Action/Preferred Action, Alternative 2
Wildlife – Predator/Prey Relationships (listed species, non-listed marine mammals, and birds)	No to negligible effect; no significant effects	Negligible effects; no significant effect
Wildlife – Steelhead Carcass Nutrient Benefits	Negligible or low beneficial effect; no significant effects	Negligible effect; no significant effect
Wildlife- Transfer of Toxins from Steelhead to Wildlife	No effect	Same as No Action
Wildlife – Harvest Habitat Disturbance	Negligible effect; no significant effects	Same as No Action
Wildlife - Fisheries Bycatch	No to low effect; no significant effects	Same as No Action
Wildlife – Derelict Fishing Gear	Low negative effect; no significant effects	Same as No Action
Fish (ESA-listed) – Puget Sound Chinook Salmon	No effect	Same as No Action
Fish (ESA-listed) – Hood Canal Summer-run Chum Salmon	No effect	Same as No Action
Fish (ESA-listed) – Skagit River Steelhead **(includes target species)**	Negligible effect; no significant effects	Low effect; no significant effects
Fish (ESA-listed) – Puget Sound Steelhead **(target species)**	Negligible effect; no significant effects	Low effect; overall no significant effects
Fish – Coho Salmon	No effect	Same as No Action
Fish – Chum Salmon	No effect	Same as No Action
Fish – Pink Salmon	No effect	Same as No Action
Fish – Sockeye Salmon	No effect	Same as No Action
Fish – Other Fish	Undetectable (no) to Low effect; no significant effect	Undetectable (no) to Moderate effect; no significant effect
Fish – Marine Ecosystem and Fish Habitat	Negligible to Low effect; no significant effect	Same as No Action
Fish – Marine-derived Nutrients	Negligible effect; no significant effect	Low effect; no significant effect
Environmental Justice – Low income, minority, and Native American	Low beneficial effect; no significant effect	Same as No Action
Cultural Resources - Treaty Indian Ceremonial and Subsistence Fish Uses	High beneficial effect; no significant effect	Same as No Action

Socioeconomics and Tourism and Recreation	Negligible positive effect; no significant effect	Low beneficial effect; no significant effect
Climate Change	Negative effects are likely but the extent of negative effects are indiscernible (no effect) under the timeframe of the action (≤ 10 years)	Same as No Action

Table 5-2. Summary of Cumulative Effects by Resource for Alternatives 3 and 4.

Resource Area	Intermediate Fixed Harvest Rate, Alternative 3	Escapement-Based Management, Alternative 4
Wildlife – Predator/Prey Relationships (listed species, non-listed marine mammals, and birds)	Negligible effect; no significant effect	Negligible effect; no significant effect
Wildlife – Steelhead Carcass Nutrient Benefits	Negligible effect; no significant effect	Negligible effect; no significant effect
Wildlife- Transfer of Toxins from Steelhead to Wildlife	Same as No Action	Same as No Action
Wildlife – Harvest Habitat Disturbance	Same as No Action	Same as No Action
Wildlife - Fisheries Bycatch	Same as No Action	Same as No Action
Wildlife – Derelict Fishing Gear	Same as No Action	Same as No Action
Fish (ESA-listed) – Puget Sound Chinook Salmon	Same as No Action	Same as No Action
Fish (ESA-listed) – Hood Canal Summer-run Chum Salmon	Same as No Action	Same as No Action
Fish (ESA-listed) – Skagit River Steelhead **(includes target species)**	Negligible effect; no significant effect	Low effect; no significant effect
Fish (ESA-listed) – Puget Sound Steelhead **(target species)**	Negligible effect; overall no significant effect	Low effect; overall no significant effect
Fish – Coho Salmon	Undetectable (no) to negligible effect; no significant effect	Undetectable (no) to negligible effect; no significant effect
Fish – Chum Salmon	Same as No Action	Same as No Action
Fish – Pink Salmon	Same as No Action	Same as No Action
Fish – Sockeye Salmon	Same as No Action	Same as No Action

Fish – Other Fish	Undetectable (no) to moderate effect; no significant effect	Undetectable (no) to moderate effect; no significant effect
Fish – Marine Ecosystem and Fish Habitat	Same as No Action	Same as No Action
Fish – Marine-derived Nutrients	Low effect; no significant effect	Low effect; no significant effect
Environmental Justice - Low income, minority, and Native American	Low beneficial effect; no significant effect	Low beneficial effect; no significant effect
Cultural Resources – Treaty Indian Ceremonial and Subsistence Fish Uses	Same as No Action	Same as No Action
Socioeconomics and Tourism and Recreation	Low beneficial effect; no significant effect	Low beneficial effect; no significant effect
Climate Change	Same as No Action	Same as No Action

5.7.1 Wildlife

Predator/Prey Relationships. As described in Section 3.2, *Wildlife* and Section 3.2.1, *Predator/Prey Relationships*, salmon and steelhead serve as predators and prey of wildlife, including that for threatened and endangered species, marine mammals, bald eagles and golden eagles, and migratory birds. Harvest effects include loss of a food source or a decrease in prey abundance for these species. The proposed fishing activities would reduce adult steelhead and carcasses available as a food source for marine mammals, eagles, and migratory birds and may indirectly decrease future juvenile steelhead abundance by reducing adult steelhead in fisheries. Future residential and industrial development and climate change would reduce wildlife habitat while restoration activities would help to restore lost habitat. With the substantial effects to wildlife in general from other sources outside of harvest, and the overall neutral effect of harvest to wildlife with no strong or recurrent relationship to steelhead (Cederholm et al. 2000), the overall cumulative effect to wildlife prey under Alternative 1 (No Action/Status Quo), Alternative 2 (Proposed Action/Preferred Alternative), Alternative 3 (Intermediate Fixed Harvest Rate), or Alternative 4 (Escapement-Based Management) is not likely to be significant. For those species that have a strong, recurrent relationship with steelhead (e.g., bald eagle (Cederholm et al. 2000)) the cumulative effects from Alternative 1 (No Action/Status Quo), Alternative 2 (Proposed Action/Preferred Alternative, Alternative 3 (Intermediate Harvest Rate), or Alternative 4 (Escapement-Based Management) are not a significant impact because escapement would continue to provide a source of prey for these species in an amount proportional to steelhead abundance (Tables 5-1 and 5-2).

Steelhead Carcass Nutrient Benefits. As described in Section 3.2.2, *Steelhead Carcass Nutrient Benefits*, steelhead carcasses provide nutrient benefits to wildlife but not in the same high quantity as salmon due to steelhead spawning timing often occurring during winter or spring high water or flood events. Benefits occur as steelhead carcasses are used as a nutrient source during foraging of wildlife. Steelhead carcasses also provide nutrients for aquatic life such as invertebrates and insects as the result of adult escapement to spawning grounds. Aquatic life is affected by increasing habitat from restoration activities, as well as decreasing habitat from direct loss and disturbance. If steelhead adults are harvested, this would decrease the amount of carcass nutrients for wildlife. The cumulative effects to the level of total steelhead carcass nutrients, under Alternative 1 (No Action/Status Quo), Alternative 2 (Proposed Action/Preferred Alternative), Alternative 3 (Intermediate Fixed Harvest Rate), or Alternative 4 (Escapement-Based Management) would not result in a cumulative significant impact to wildlife because, while steelhead carcasses be reduced, to varying degrees, under all alternatives, the carcasses are not considered a primary source of nutrient benefits as compared to salmon due to the nature of steelhead spawn timing (winter/spring months) when carcasses are often washed away due to high water and flooding events (Tables 5-1 and 5-2).

Transfer of Toxins from Steelhead to Wildlife. Wildlife that consume steelhead are susceptible to toxic contaminants and/or pathogens that may be within the fish they consume (Section 3.2.3, *Transfer of Toxins from Steelhead to Wildlife*). However, harvest does not affect this transfer of toxins from steelhead to wildlife. Thus, there is no cumulative impact to wildlife through toxins from Alternative 1 through 4 (Tables 5-1 and 5-2).

Harvest Habitat Disturbance. As described in Section 3.2.4, *Harvest Habitat Disturbance*, fisheries harvest can temporarily impact wildlife habitat while harvest operations are occurring through disturbance and can cause avoidance behaviors in some species. Wildlife species would be expected to return to their habitat once harvest activities are completed. Considering development and human presence caused by other activities, habitat disturbance through harvest activities would not result in a cumulative impact for Alternatives 1 through 4 (Tables 5-1 and 5-2).

Fisheries Bycatch. Wildlife species of concern in Puget Sound that can be caught as bycatch are seals and Steller sea lions, and common murrres, as well as other seabirds (Section 3.2.5, *Fisheries Bycatch*). Effects of bycatch include injury and death. Bycatch can result from all fishing methods, locations, and timing. Although the co-managers have worked to reduce bycatch, the potential for bycatch cannot be eliminated altogether. Co-managers have best management practices and fishing measures in place to reduce fisheries bycatch regardless of the extent or volume of fisheries implemented (Tables 5-1 and 5-2) so fisheries bycatch is not likely to have a significant cumulative impact under Alternatives 1 and 4.

Derelict Fishing Gear. As described in Section 3.2.6, *Derelict Fishing Gear*, the accidental loss of fishing gear on the seafloor can trap, wound, and/or kill seabirds and marine mammals. In addition to steelhead harvest, the remains of derelict fishing gear are also left behind by harvest of other fish and shellfish. Considering all contributors to derelict fishing gear, the contribution from steelhead harvest would be low and not result in a significant cumulative impact for Alternatives 1 through 4 (Tables 5-1 and 5-2). Best management practices and fishing measures are in place to reduce, report, and recover derelict fishing gear within 24 hours of loss so impacts continue to remain low into the future (NMFS 2017b).

5.7.2 Fish

Skagit River Steelhead (Listed species). Skagit River steelhead would be directly and incidentally harvested under Alternatives 1 through 4 as described in Section 3.1.1.1, *Skagit River Steelhead*, and Section 3.1.12, *Puget Sound Steelhead*. Direct effects of harvest activities on listed steelhead DIPs within the Skagit Basin include release mortality, injury, and death of adults. Indirect effects include the potential loss of productivity for future steelhead generations (i.e., juvenile recruitment). In consideration of other factors influencing the survival and productivity of Skagit River steelhead – climate change, development and habitat loss, hydropower and culvert blockages, and hatcheries – the impacts from Alternatives 1 through 4 would not be significant because impacts from the above described factors are no to low, existing incidental fishing levels would be part of the current baseline fisheries; the stepped harvest regime would result in a slight difference between the amount of total adult spawners or steelhead recruits for the Skagit SMU (four DIPs combined) under the No Action/Status Quo, Alternative 1 and a reduced number of spawners but a slight difference in the number of steelhead recruits under the Proposed Action/Preferred Alternative, Alternative 2; and the harvest regime under Alternatives 3 and 4 would fall within the range of effects described in Alternatives 1 and 2 (Tables 5-1 and 5-2).

Puget Sound Steelhead (Listed species). Puget Sound Steelhead would be directly and incidentally harvested under Alternatives 1 through 4 as described in Section 3.1.1.1, *Skagit River Steelhead*, and Section 3.1.1.2, *Puget Sound Steelhead*. Direct effects of harvest activities on listed steelhead in the Puget Sound Steelhead DPS include release mortality, injury, and death of adults. Indirect effects include potential loss of productivity for future steelhead generations (i.e., juvenile recruitment). In consideration of other factors influencing the survival and productivity of Puget Sound Steelhead as a whole – climate change, development and habitat disturbance, hydropower and culvert blockages, and hatcheries – the impacts from Alternatives 1 through 4 would not be significant because impacts are no (in the case of hatchery effects) to low (in the case of climate change, existing development and habitat loss, current hydropower and culvert blockages), the existing incidental fishing levels are part of the current baseline and the effects of the harvest regimes are likely to result in a slight difference in the amount of total adult

spawners or steelhead recruits for the Skagit SMU (four DIPs combined). The Skagit SMU is a part of the Northern MPG, thus, the Puget Sound Steelhead DPS is also unlikely to be significantly impacted as a whole (Tables 5-1 and 5-2).

Coho Salmon (Non-listed species). Puget Sound Coho Salmon would be harvested under Alternatives 1 through 4 as described in Section 3.3.2.1, *Coho Salmon*, and Section 4.3.2.1, *Coho Salmon*. Direct effects of harvest activities on coho salmon include release mortality, injury, and death of adults. Indirect effects include loss of productivity for future coho generations (i.e., juvenile recruitment). In consideration of other factors influencing the survival and productivity of Puget Sound Coho Salmon – climate change, development and habitat loss, hydropower and culvert blockages, and hatcheries – the impact from Alternatives 1 through 4 would not be a significant adverse cumulative impact because the low number of coho salmon encounters due to little overlap in timing of the species (Tables 5-1 and 5-2).

Chum Salmon (Non-listed species). Puget Sound chum Salmon would be harvested by Alternatives 1 through 4 as described in Section 3.3.2.2, *Chum Salmon*, and Section 4.3.2.2, *Chum Salmon*. Direct effects of harvest activities on chum salmon include release mortality, injury, and death of adults. Indirect effects includes loss of productivity for future chum generations (i.e., juvenile recruitment). In consideration of other factors influencing the survival and productivity of Puget Sound Chum Salmon – climate change, development and habitat loss, hydropower and culvert blockages, and hatcheries – the impact from Alternatives 1 through 4 would not be a significant adverse cumulative impact because of the low number of chum salmon encounters due to little overlap in timing of the species (Tables 5-1 and 5-2).

Other Fish. Some fish species benefit (salmon and steelhead prey) and other fish species are negatively impacted (salmon and steelhead predators) from harvest of salmon and steelhead (Section 3.3.3, *Other Fish* and Section 4.3.3, *Other Fish*). Direct effects of harvest activities other fish species include release mortality, injury, and death of adults. Indirect effects includes loss of productivity for future chum generations (i.e., juvenile recruitment). Considering development, climate change, hydropower, culvert blockage, and other cumulative effects to other fish, the impact of fisheries harvest to survival and reproduction of other fish would range from undetectable cumulative effects to low negative cumulative effects under Alternative 1 (No action/Status Quo) and from negligible to medium negative cumulative effects under Alternatives 2 through 4 (Tables 5-1 and 5-2). However, these effects are not considered to have significant impacts because of the low number of encounters for most fish species. Bull trout may encounter the greatest effects but even these impacts are not considered significant because the lower Skagit River bull trout population is healthy and can withstand harvest (Section 3.3.3, *Other Fish*). When combined with the cumulative effects of agricultural practices, residential development and urbanization, climate change, and hydropower facilities, bull trout redds continue to remain stable in the Skagit Basin (Section 3.3.3, *Other Fish*).

Fish Habitat. Fish habitat can be temporarily impacted by steelhead harvest from nets scouring the seabed, derelict fishing gear covering habitat, and human disturbance and waste (i.e., stream wading, light, noise, contaminants) as described in Section 3.3.4 and Section 4.3.4, *Fish Habitat Affected by Steelhead Fishing*. Under cumulative effects and considering all temporary and long-term contributors that impact fish habitat, the contribution of fish harvest would be a low negative cumulative effect for Alternatives 1 through 4 (Tables 5-1 and 5-2). However, these impacts are not considered to be significantly because best management practices and fishing measures are in place to reduce, report, and recover derelict fishing gear within 24 hours of loss. The co-managers conduct outreach and education for the public on the importance of not trampling fish redds, avoiding light and noise pollution, and reducing contaminants to avoid significant impacts.

Marine-Derived Nutrients from Steelhead. Marine-derived nutrients provide a direct food source for aquatic organisms and increase primary and secondary production, which benefits the ecosystem by providing additional nutrients for growth and development of species and stream health (Section 3.2.5, *Marine-Derived Nutrients from Steelhead Spawners*). Escapement, spawning, and resulting carcass deposition in freshwater streams would continue under Alternatives 1 through 4 in proportion to the abundance of adult returning steelhead. Considering overall cumulative effects, fisheries effects to marine-derived nutrients would continue to occur under Alternative 1 (No Action/Status Quo), at a negligible cumulative effect, and Alternatives 2 through 4 at a low negative cumulative effect (Tables 5-1 and 5-2). However, these impacts are not considered to be significant because steelhead carcasses are not a primary source of nutrient enhancement due to their spawn timing during high water/flood events (winter/spring) that have a tendency to wash steelhead carcasses out of the system.

5.7.3 Environmental Justice

The environmental justice communities of concern within the Skagit River proposed action area (Figure 1-1) include low income, minority populations, and Native Americans (Section 3.5, *Environmental Justice*). Harvest of steelhead increases income for these communities of concern and provides fish for ceremonial and subsistence purposes, particularly for Native Americans who benefit from an economic, subsistence, and ceremonial perspective. Cumulative effects such as modification, degradation, and curtailment of steelhead habitat, increased predation of marine mammals, and climate change have reduced the overall abundance of steelhead in the Skagit River, which has resulted in substantial declines over the past 200 years that has impacted environmental justice communities of concern. The long-term decline in steelhead abundance that lead to the listing of Puget Sound steelhead in 2007 has resulted in the loss of fishing opportunity and income over the long-term. However, Skagit River steelhead populations have experienced annual increases in natural origin steelhead escapement in recent years (Section 3.3.1.1.2, *Skagit River Steelhead*; Table 3-4). Alternative 1 (No Action/Status Quo) would

provide a high negative cumulative effect to environmental justice communities of concern considering the historical overall decrease in steelhead fishing opportunity caused by human development, marine mammal predation, and climate change because no directed fishing would occur and impacts would be confined to incidental catch in other Puget Sound salmon fisheries. However, Alternatives 2 through 4 are likely to provide low to high cumulative beneficial effects to environmental justice communities of concern, which would vary in scale according to the proposed harvest rates, due to the increase in fishing opportunities in which these alternatives would provide to low income, minority, and Native American peoples.

5.7.4 Cultural Resources

5.7.4.1 Treaty Indian Ceremonial and Subsistence Salmon Uses

Ceremonial and subsistence fishing maintain cultural viability and provide valuable food resources that also are important for use in tribal ceremonies (Section 3.6.1, *Treaty Indian Ceremonial and Subsistence Fish Uses).* Steelhead harvest effects include increased catch of a valuable food resource and key nutrients for use in tribal ceremonies that have important cultural benefits to Indian communities. When considering past and present development and climate change effects to treaty Indian ceremonial and subsistence uses, Alternatives 1 through 4 provide a high positive cumulative effect to treaty tribes (Table 5-1). However, the effect is not likely to be beneficially significant because steelhead fisheries are a very small component of the overall magnitude of fisheries occurring in Puget Sound.

5.7.5 Socioeconomics and Tourism and Recreation

Commercial and recreational fisheries in the Puget Sound region that generate economic activity are characterized by various economic measures. However, no estimates of economic activity are available for the proposed project area specifically at this time since directed steelhead harvest has not occurred since the mid 1990s. Harvest activities contribute to the economy through personal income associated with expenditures of goods and services including food and supplies, fishing gear, vessels, guide services, etc. Under Alternatives 1 through 4, there would likely be continued low to moderate positive socioeconomic cumulative effects associated with steelhead fishing activities in the project area (Section 3.7 and Section 4.7, *Socioeconomics and Tourism and Recreation*). However, this effect is not likely to be beneficially significant because steelhead fisheries are a very small component of the overall magnitude of fisheries occurring in Puget Sound.

6. AGENCIES CONSULTED

Sauk-Suiattle Indian Tribe
Swinomish Indian Community
Upper Skagit Tribe
Skagit River System Cooperative
Bureau of Indian Affairs
U.S. Fish & Wildlife Service
Washington Department of Fish & Wildlife
Northwest Indian Fisheries Commission

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FINDING OF NO SIGNIFICANT IMPACT

NMFS' ESA 4(d) Rule Limit 6 Determination on the Skagit River Steelhead Fishery Resource Management Plan

April 12, 2018

Background:

The proposed action is NMFS' determination, under Limit 6 of the 4(d) Rule of the Endangered Species Act (ESA), for the Skagit River Steelhead Fishery Resource Management Plan (Skagit RMP), describing fishery management activities for natural-origin steelhead in the Skagit River Basin, submitted by the co-managers (Skagit River Tribes, Skagit River Cooperative, and Washington Department of Fish and Wildlife (WDFW)) pursuant to *U.S. v. Washington*. No mitigation measures are included in the proposed action.

Alternatives Evaluated in the Environmental Assessment:

- Alternative 1 (No Action/Status Quo) – Do Not Approve the Skagit RMP Under the 4(d) Rule Limit 6
- Alternative 2 (Proposed Action/Preferred Alternative) –Approve the Skagit RMP Under the 4(d) Rule Limit 6
- Alternative 3 (Intermediate Fixed Harvest Rate) – Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend a Fixed Harvest Rate
- Alternative 4 (Escapement Based Management) – Do Not Approve the Skagit RMP under the 4(d) Rule Limit 6, Recommend a Escapement-Based Management

Selected Alternative:

Alternative 2 (Proposed Action/Preferred Alternative) – Approve the Skagit RMP under the 4(d) Rule Limit 6

Related Consultations:

In 2018, NMFS completed an ESA section 7(a)(2) biological opinion on the selected alternative for the following species: Puget Sound Chinook salmon and steelhead, Southern Resident killer whale, Puget Sound/Georgia Basin rockfish and Pacific eulachon. NMFS' biological opinion on the ESA Section 4(d), Limit 6, determination for the Skagit Steelhead Fishery RMP concluded that the action is not likely to adversely affect threatened Puget Sound Chinook salmon, endangered Southern Resident killer whales, the threatened southern distinct population segment (DPS) of green sturgeon, or the threatened southern DPS of Pacific eulachon.

The targeted species described in the proposed action is the threatened Puget Sound steelhead DPS. Actions affecting the Skagit River steelhead populations within the ESA-listed Puget Sound steelhead DPS are not considered lightly by NMFS. Given that the effects of the proposed action to the overall viability of the Skagit steelhead demographically independent populations (DIPs) would be low and allow the Skagit Basin DIPs to maintain their current moderate status without appreciably reducing their ability to achieve viable function, NMFS concludes that the impacts of the proposed action on the viability of the Puget Sound steelhead DPS would not be low and, thus, the impacts from implementation of the proposed action are not likely to be significant. After reviewing and analyzing the current status of the listed species and the critical

habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, NMFS' biological opinion determined that the proposed action is not likely to jeopardize the continued existence of the Puget Sound steelhead DPS or destroy or adversely modify its designated critical habitat.

Significance Criteria Review:

The Council on Environmental Quality (CEQ) Regulations state that the determination of significance using an analysis of effects requires examination of both context and intensity, and lists ten criteria for intensity (40 CFR 1508.27). In addition, the Companion Manual for National Oceanic and Atmospheric Administration Administrative Order 216-6A provides sixteen criteria, the same ten as the CEQ Regulations and six additional, for determining whether the impacts of a proposed action are significant. Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

1. Can the proposed action reasonably be expected to cause both beneficial and adverse impacts that overall may result in a significant effect, even if the effect will be beneficial?

The proposed action cannot reasonably be expected to cause both beneficial and adverse impacts that, overall, are likely to result in a significant impact, even if the impact would be beneficial to the Skagit Basin steelhead fishery activities because the co-manager risk analysis took into consideration abundance and productivity viable salmonid population (VSP) parameters, which shows implementation of the proposed fishery regime would have little effect upon the frequency with which the viable and rebuilding thresholds would be achieved. In addition, the total amount of Skagit Basin steelhead recruits is not predicted to vary substantially between the 4.2 percent incidental harvest rate from existing salmon and hatchery steelhead fisheries and Skagit RMP stepped harvest rate (SBT and WDFW 2018; Appendix Figure 3) (Figure 4-2). Since the co-managers also took into consideration spatial structure and diversity VSP parameters by incorporating fishery conservation measures to protect the summer run, early-timed winter run, and repeat spawners (Section 2.4.6, *Consideration of Viable Salmonid Population Parameters*), spatial structure and diversity impacts are also likely to be low, resulting in no significant impacts.

As described above, NMFS evaluated the Skagit RMP under a separate biological opinion and determined that the proposed action would not jeopardize the continued existence of the Puget Sound steelhead DPS as a whole and destroy or adversely modify its critical habitat.

2. Can the proposed action reasonably be expected to significantly affect public health or safety?

Pollutants from boat operations are a source of toxic chemicals that can accumulate in salmonids, which may affect human health. There is limited consumption of steelhead compared to other salmon species. Health standards for consumption of salmonids are in place to reduce the risk to human health if an increase in steelhead harvest occurs as a result of the proposed action (Section 5.8.4, *Human Health*). Additionally, the increase in

harvest under the proposed action may result in an increase in accidents or mortality associated with boat operations (Section 3.12.2, *Safety*). However, the proposed action is not reasonably expected to significantly affect public safety due to safety measures in place associated with mandatory boating training required in Puget Sound.

3. Can the proposed action reasonably be expected to result in significant impacts to unique characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?

The Skagit River has been designated under the Wild and Scenic Rivers Act because the Skagit systems' exceptional fisheries, wildlife, and scenic resources were determined to have outstanding and remarkable values (USDA 2005). The fisheries management activities described in the proposed action would occur in-river, outside of park lands, prime farmlands, wetlands, and ecological critical areas. The fisheries management activities are in close proximity to and involve cultural resources, such as the Puget Sound Steelhead DPS. However, the Skagit RMP was written by the Skagit River Tribes[1] who took into consideration protection of their historic and cultural resources when developing the steelhead fisheries plan so it would not result in significant impacts. If harvest rates increase, boat access sites, parking lots, and trails are already established and would not likely result in significant impacts to this *wild and scenic* river beyond existing baseline fishing conditions.

Surveys conducted by WDFW stated that the public desired more fishing opportunities (Section 3.8.2, *Recreational Fishing*). The proposed action has the potential for beneficial effects through increased steelhead fishing opportunity. As described above, the harvest rate of Skagit River steelhead and resulting effects are incorporated into an abundance based stepped harvest regime described in the proposed action. If steelhead abundances are low, harvest rates remain low and may result in low beneficial effects for desired fishing opportunities. If harvest rates increase, this would create a potential increase in beneficial effects due to increased steelhead fishing opportunity.

4. Are the proposed action's effects on the quality of the human environment likely to be highly controversial?

Wild fish conservation groups and recreational fishing groups in Puget Sound and the Skagit River have provided comments on NMFS' Limit 6 4(d) analysis of the proposed action (NMFS 2017a). Currently there are no significant scientific findings in opposition of the fisheries management activities included in the proposed action regarding effects on the quality of the human environment that would rise to the level of being highly controversial. Some public comments recommended a lower steelhead harvest rate (i.e., 10%) than the proposed action (up to 25%) but the vast majority of public comments were in support of the Skagit RMP. NMFS' West Coast Region (WCR) coordinated with the NMFS Northwest Fisheries Science Center (NWFSC) to review the proposed action prior to acceptance of the plan. Input and recommendations from NMFS' WCR and

[1] Sauk-Suiattle Indian Tribe, Swinomish Indian Tribal Community, Upper Skagit Indian Tribe, as well as the Skagit River System Cooperative.

NWFSC was discussed with the applicants and later incorporated into the final Skagit RMP.

5. Are the proposed action's effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

As described earlier in this document, the proposed action is primarily a subset of the larger suite of directed and non-directed salmon and steelhead fisheries occurring within Puget Sound. The majority of the steelhead fishery activities described in the Skagit RMP are ongoing indirect fisheries that have been approved under the broader Puget Sound fisheries plan (NMFS 2017b) at the 4.2 percent harvest range or have occurred in the past (including the recreational catch-and-release fishery prior to the listing of Puget Sound steelhead). Thus, there are no components of the proposed action that would have effects on the human environment that are likely to be highly uncertain or involve unique or unknown risks.

6. Can the proposed action reasonably be expected to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

This action is not expected to establish a precedent for future fisheries actions with significant effects or represent a decision in principle about a future action. NMFS considers each action on its own merits and impacts.

7. Is the proposed action related to other actions that when considered together will have individually insignificant but cumulatively significant impacts?

No, the proposed action, when considered with other actions, is not expected to have individually insignificant but cumulatively significant impacts. For example, impacts to wildlife through removal of steelhead carcasses that would otherwise provide nutrient benefits; transfer of toxins from salmonids to wildlife and disturbance; removal of fish species through bycatch and derelict fishing gear; incidental impacts to ESA-listed Puget Sound Chinook salmon or Hood Canal Summer-run chum salmon through bycatch; impacts to salmon not listed under the ESA including Puget Sound coho, chum, pink, and sockeye salmon, including selectivity of biological characteristics of salmon through bycatch; and impacts to fish through habitat disturbance are not significantly different from the no action alternative. In addition, impacts to environmental justice, cultural resources, socioeconomics, and human health and safety also remain the same as the no action alternative, whether these impacts are beneficial or adverse.

Impacts that differ from the no action alternative, such as wildlife predator/prey relationships, impacts to ESA-listed Puget Sound steelhead and other fish species in the watershed, and potential reduction of marine-derived nutrients from removal of fish carcasses have negligible to low beneficial and adverse effects that when added together and considered with the above, do not have cumulative significant impacts whether these impacts are beneficial or adverse.

8. Can the proposed action reasonably be expected to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?

The proposed action described in the Skagit RMP occurs in Skagit Bay and the Skagit River system. Thus, the proposed action is not expected to adversely affect districts, sites, highway structures, or objects listed in or eligible for listing in the National Register of Historic Places. NMFS' WCR and NWFSC worked with the applicants[2] to ensure the proposed action would not cause loss or destruction of significant scientific, cultural, or historical resources. Fisheries monitoring activities are in place to accurately assess impacts upon implementation of the proposed action from year one to year five (Sauk-Suiattle Indian Tribe et al. 2016).

9. Can the proposed action reasonably be expected to have a significant impact on endangered or threatened species, or their critical habitat as defined under the Endangered Species Act of 1973?

The proposed action and resulting steelhead fisheries are not expected to impact threatened Puget Sound Chinook salmon or their critical habitat due to temporal and spatial differences in run timing between the species (NMFS 2017a). The proposed action is also not expected to impact endangered Hood Canal chum salmon or its critical habitat because the treaty and non-treaty steelhead fisheries fall outside this species' range (McClure 2017). In addition, the proposed action is not expected to have an impact on marine mammals such as the endangered Southern Resident killer whale or its critical habitat because the majority of treaty and non-treaty fisheries would occur upstream of river mile (RM) 54 and commercial fishing areas 78C and 78D in the Skagit River Basin, which are also outside this species' range (McClure 2017) and steelhead are not a primary prey of Southern Resident killer whale.

Under the Proposed Action/Preferred Alternative, Alternative 2, for the Skagit SMU (four DIPs combined) harvest rates are proposed to range from 4 percent to 25 percent, depending on steelhead abundances of $\leq$ 4,000 to $\geq$ 8,001 fish. This would potentially reduce the number of Skagit River steelhead by removing steelhead adults from the four Skagit River extant steelhead populations, reducing abundance and resulting adult productivity (juveniles) as well as reducing expansion of spatial structure and genetic diversity. However, no significant effects are likely to occur under Alternative 2 because NMFS recognizes that the co-managers' risk analysis took into consideration abundance and productivity VSP parameters, which shows under implementation of the proposed fishery regime, the number of Skagit Basin steelhead adult spawners or recruits are not predicted to vary substantially between no fishing, 4.2 percent incidental harvest rate from existing salmon and hatchery steelhead fisheries, and Skagit RMP stepped harvest rate (SBT and WDFW 2018; Appendix Figure 3 (Figure 4-1)). In addition, Skagit River steelhead abundances (four DIPs combined) have increased by 7 percent annually since 2011 (Section 3.1.1.1, *Skagit River Steelhead*; Table 3-1; Table 3-4), while productivity

[2] Sauk-Suiattle Indian Tribe, Swinomish Indian Tribal Community, Upper Skagit Indian Tribe, as well as the Skagit River System Cooperative and the Washington Department and Wildlife.

has been hovering at or just below replacement (Section 3.1.1.1, *Skagit River Steelhead*; Table 3-2). For spatial structure and diversity, the co-managers incorporated fishery management strategies to protect repeat spawners (kelts), summer-run steelhead, early run winter steelhead, and the smaller Nookachamps Creek population (Section 2.2, *Alternative 2 (Proposed Action/Preferred Alternative and Section 2.4.6, Consideration of Viable Salmonid Population Parameters*). In addition, there are no steelhead hatchery programs in the Skagit Basin that would affect the genetic diversity of natural origin fish (Section 1.2, *Description of Proposed Action*). Thus, with these actions combined to protect VSP parameters (abundance, productivity, spatial structure, and diversity, the proposed action is not likely to appreciably slow the Skagit SMU's achievement of viable function. Thus, no significant impacts are likely to occur.

Under the Proposed Action/Preferred Alternative, Alternative 2, for the Puget Sound steelhead DPS, the (1) viability thresholds can be achieved under the proposed action and were found not to significantly impact the Skagit Management Unit (SMU,four DIPs combined) (Sauk-Suiattle Indian Tribe et al. 2016) (Section 4.3.1.1, *Skagit River Steelhead*); (2) fishery conservation measures to protect summer-run, early returning winter-run, and repeat spawners are required under Alternative 2 to maintain spatial structure and diversity for the Skagit SMU (Sauk-Suiattle Indian Tribe et al. 2016) (Section 2.4.6, *Consideration of Viable Salmonid Population Parameters*); (3) increases in abundance estimates for the Skagit SMU (7%), Northern Cascade MPG (3%), and the Puget Sound DPS as a whole (5.4%) have been observed since the last status review (NWFSC 2015) (3.3.1.2 *Puget Sound Steelhead DPS)* and steelhead abundances increased by an average of 10% annually in the Puget Sound steelhead DPS from 2011 to 2015 (Section 3.3.1.2, *Puget Sound Steelhead DPS*); (4) despite overall decreases in productivity of the DPS over time (NWFSC 2015), the Skagit SMU has demonstrated decreasing to, most recently, stable population growth from 1977 to 2016 (NMFS 2018) (Section 3.3.1.2, *Puget Sound Steelhead DPS*); and (5) annual harvest monitoring results would be used to adaptively manage the fishery in-season over the short-term duration of the proposed action (5 years) (Sauk-Suiattle Indian Tribe et al. 2016) (Section 2.4.5, *Management of Adults on the Spawning Grounds*). Therefore, Alternative 2 is not likely to appreciably slow the achievement of the Puget Sound steelhead DPS to viable function and is not likely to have a significant impact on the Puget Sound steelhead DPS as a whole.

Negligible impacts to steelhead critical habitat are expected to occur due to derelict gear because fishermen endeavor to keep fishing gear off the bottom and in contact with fish habitat due to decrease catch efficiency. Impacts from derelict gear are not considered to be significant because the proposed action would not result in a major increase in fishing effort and, therefore, an increase in derelict fishing gear. Thus, even though there are harvest differences between the no action and proposed action, boat and fishing operations are expected to be similar or slightly increase but the impacts from these fishery activities are expected to remain low (Section 4.2.6, *Derelict Fishing Gear*). Best management practices and fishing measures are in place to reduce, report, and recover derelict fishing gear within 24 hours of loss (Sauk-Suiattle Indian Tribe et al. 2016).

The proposed action is not likely to have significant impacts on listed eulachon and green sturgeon because these species are not caught in Skagit Basin tribal commercial gillnet or non-tribal recreational steelhead fisheries, and, thus, are not likely to be impacted by the proposed action (Section 3.3.3, *Other Fish*). Listed rockfish are found in the proposed action marine area (Skagit Bay) and can be caught in non-tribal recreational fisheries. NMFS has provided funding to the Pacific States Marine Fisheries Commission and Puget Sound Anglers to distribute descending devices to local fishermen to prevent and reduce rockfish mortality (Section 3.3.3, *Other Fish*). Rockfish are rarely caught in tribal gillnet or purse seine fisheries (Section 3.3.3, *Other Fish*). Given that only a small proportion of the proposed action occurs in marine waters and the majority of steelhead fisheries would occur in freshwater areas (Figure 1-1), descending devices to prevent rockfish mortality during non-tribal recreational fisheries are readily available to prevent or decrease mortality in marine areas. As tribal salmon and steelhead marine fisheries rarely intercept rockfish, this species is unlikely to be significantly impacted by the proposed action (Section 3.3.3, *Other Fish*).

In addition to fishery mortality, listed rockfish are killed by derelict fishing gear. Due to recent changes in state law, additional outreach and assessment efforts, and recent lost net inventories, it is likely that fewer nets will become derelict in upcoming fishing seasons compared to several years ago. It is likely that few (if any) listed bocaccio or yelloweye rockfish mortalities will occur from new derelict gill nets, and that any additional mortality is would not induce additional risk to the populations resulting in significant impacts.

The proposed action is also likely to have impacts on the Lower Skagit River bull trout core area population of the threatened Coastal-Puget Sound bull trout due to incidental take in steelhead treaty and non-treaty fisheries because of some overlap in timing when adult bull trout are outmigrating to the Skagit Bay estuary (Section 3.3.3, *Other Fish*). Although bull trout caught in the tribal test fishery would be returned to the water, survival or latent mortality rates are unknown at this time. Bull trout caught in non-treaty fisheries are more likely to be retained resulting in incidental mortality but retention rates are also unknown (Section 3.3.3, *Other Fish*). In 1999, the U.S. Fish and Wildlife Service (USFWS) issued a 4(d) Rule for Coastal-Puget Sound bull trout allowing fishing to continue in accordance with Tribal, State, and National Park Service fishing regulations (USFWS 1999). The proposed action would result in an approximate harvest rate of 6.2 percent to 7.6 percent on bull trout (Section 4.3.3, *Other Fish*). The Lower Skagit River bull trout core area, where the action would occur, is classified as "healthy", and bull trout (native char) are protected under Washington regulations by a 20" minimum size limit in mainstem trout fisheries to allow the majority of females to spawn at least once, and by closures in other Skagit Basin tributaries (Section 3.3.3, *Other Fish*), and based on the above estimated bull trout harvest rates (6.2% to 7.6%), 92.4% to 93.8% of the adult bull trout population are likely to continue their outmigration to the Skagit Bay estuary in late spring (Section 4.3.3, *Other Fish*).

The co-managers coordinated with NMFS and USFWS staff during completion of the proposed Skagit RMP. The proposed action was written with the intent to comply with

the ESA Limit 6 4(d) Rule for salmon and steelhead, as well as bull trout. Steelhead harvest rates would be submitted by the co-managers and reviewed by NMFS during annual reporting to ensure consistency with ESA requirements for endangered and threatened animals or plants and their habitats.

As mentioned previously, NMFS' biological opinion on the ESA Section 4(d), Limit 6, determination for the Skagit River Steelhead Fishery RMP concluded that the action is not likely adversely affect threatened Puget Sound Chinook salmon, endangered Southern Resident killer whales, the threatened, southern DPS of green sturgeon, or the threatened southern DPS of Pacific eulachon (NMFS 2018).

10. Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection?

The proposed action is not expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection.

11. Can the proposed action reasonably be expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act?

As described in #9, the proposed action is not expected to have a significant impact on the endangered Southern Resident killer whale or its critical habitat because treaty and non-treaty fisheries described in the proposed action would primary occur outside the species' range.

The proposed action has the potential to impact other marine mammals as defined under the Marine Mammal Protection Act, such as pinnipeds, because they may become entangled in active and derelict fishing gear. However, these impacts are not expected adversely affect stocks of marine mammals due to the location of the fisheries and mandatory reporting and removal of derelict gear within 48 hours of loss (Section 4.2.6, *Derelict Fishing Gear*), which fisheries actions are likely to be outside pinniped primary feeding habitats (i.e., marine habitat). See also #13 regarding derelict gear.

12. Can the proposed action reasonably be expected to adversely affect managed fish species?

The proposed action is not expected to adversely affect other managed fish species such as non-listed coho, chum, pink, and sockeye salmon residing in Puget Sound. There would be no adverse effect to pink salmon under any of the alternatives since ongoing and proposed tribal and non-tribal steelhead fisheries would occur after the pink spawning season is completed in late September or October and before the pink salmon return in mid-August (Section 4.3.2, *Non-listed Salmon*). In addition, no impacts are anticipated to occur to sockeye salmon because the proposed fisheries would be implemented before adult sockeye return to the Skagit River in June and after spawning is completed in December (Section 4.3.2, *Non-listed Salmon*). Therefore, no pink or sockeye salmon would be in the Skagit River project area during the time of the proposed

action, resulting in no significant impacts (Section 5.8, *Cumulative Effects by Resource*; Table 5-1).

Under the proposed action, anticipated coho salmon harvest rates range from 0.3% (during an average coho salmon run) to 2 percent (during the lowest coho salmon run on record) resulting in undetectable to negligible effects, to the Skagit River coho salmon population, respectively (Section 4.3.2.1, *Coho Salmon*). Therefore, the proposed action is not likely to result in significant impacts to coho salmon (Section 5.8, *Cumulative Effects by Resource*; Table 5-1), Anticipated chum salmon harvest rates range from 0.1 percent (during an average coho salmon run) to 0.3% (during the lowest coho salmon run on record) resulting in undetectable (no effects) to the mainstem Skagit River chum salmon population (Section 4.3.2.2, *Chum Salmon*). Therefore, the proposed action is not likely to result in significant adverse impacts to chum salmon (Section 5.8, *Cumulative Effects by Resource*; Table 5-1).

13. Can the proposed action reasonably be expected to adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act?

The proposed Skagit RMP may have small negative effects on essential fish habitat in Puget Sound by removing steelhead via the proposed fisheries that may otherwise provide marine-derived nutrients through decomposition of fish carcasses that escape to spawn naturally. No new fishing areas are proposed but would remain in currently occurring salmon fishery locations. The proposed Skagit RMP may also have small negative effects on essential fish habitat through fishing activity and derelict gear. However, the types of fishing gear used in steelhead fisheries actively avoid contact with the substrate because of the resultant interference with fishing and potential loss of gear. Up to 75 percent of derelict nets would be removed within days of their loss and have little potential to damage essential fish habitat (Section 4.4; NMFS 2017b). Because these negative effects will be small in scope and remain in current fishing locations, the proposed action is not expected to significantly adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act.

14. Can the proposed action reasonably be expected to adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems?

The proposed Skagit RMP would have no to negligible adverse impacts on vulnerable marine or coastal ecosystems for any fish species, including ESA-listed Puget Sound Chinook salmon and steelhead, because the proposed Skagit RMP does not occur in the ocean, coastal habitats, or deep coral ecosystems.

15. Can the proposed action reasonably be expected to adversely affect biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)?

The Skagit RMP is not expected to have a substantial impact on biodiversity within the affected area. Although steelhead caught in the proposed fisheries would otherwise contribute to benthic productivity and interact with other species through predator/prey

interactions, the number of steelhead harvested would be a relatively small portion of benthic productivity or total prey species. As compared to salmon fisheries, steelhead fisheries are a much smaller component, and occur at a much lesser magnitude, of the broader Skagit River fisheries and steelhead are not a significant prey species for the majority of species impacted by the proposed Skagit RMP.

16. Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

The proposed action includes management of fisheries activities only and does not introduce species (indigenous or nonindigenous) to a new area.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for NMFS' determination, under Limit 6 of the 4(d) Rule, for the Skagit River Steelhead Fishery Resource Management Plan (Skagit RMP), it is hereby determined that the approval of the Skagit RMP under the 4(d) Rule Limit 6 will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.

April 12, 2018

Barry A. Thom
Regional Administrator
West Coast Region
National Marine Fisheries Service

Date