4(d) Rule Limit 6
Proposed Evaluation and Pending Determination

Title of RMP:	Joint Hatchery and Genetic Management Plans for Snohomish/Skykomish and Snohomish/Tokul Creek Early-Winter Steelhead
RMP Submitted by:	Washington Department of Fish and Wildlife and the Tulalip Tribes
ESU/DPSs:	Puget Sound Chinook Salmon ESU Puget Sound Steelhead DPS
4(d) Rule Limit:	ESA 4(d) Rule Limit 6
NMFS Tracking Number:	WCR-2015-3441

1 BACKGROUND

NOAA's National Marine Fisheries Service (NMFS) issued a final Endangered Species Act (ESA) 4(d) Rule adopting regulations necessary and advisable to conserve Puget Sound Chinook salmon (50 CFR 223.203(b); 70 FR 37160, June 28, 2005). The 4(d) protective regulations adopted for the two salmon evolutionary significant units (ESU) were subsequently applied to the Puget Sound steelhead distinct population segment (DPS) in a separate final rule (73 FR 55451, June 25, 2008). Under limit 6 of the Rule, ESA section 9 take prohibitions for these listed salmonid species do not apply to hatchery activities that are undertaken in compliance with a resource management plan (RMP) developed jointly by the Tribes and the State of Washington that is consistent with the 4(d) Rule criteria. The Washington Department of Fish and Wildlife (WDFW) and the Tulalip Tribes as co-managers of the fisheries resource under *United States v. Washington* (1974) (hereafter referred to as "the co-managers"), have provided NMFS with two Hatchery and Genetic Management Plans (HGMP) for hatchery programs and associated monitoring and evaluation actions in the Snohomish River watershed that will affect ESA-listed Puget Sound Chinook salmon and Puget Sound steelhead (Scott 2014; 2015). The HGMPs provide the framework through which the Washington State and Tribal jurisdictions can jointly manage hatchery operations, monitoring, and evaluation activities, while meeting requirements specified under the ESA. The co-managers developed the plans jointly, and have provided the HGMPs for review and determination by NMFS as to whether they address the criteria of limit 6 of the 4(d) Rule. For the purposes of the proposed recommendation, NMFS considers the two joint HGMPs, submitted for consideration under limit 6, to be an RMP.

2 PROPOSED ACTION

The two HGMPs submitted to NMFS for consideration under limit 6 are designed to support recreational and tribal fishing and include associated monitoring and evaluation actions affecting listed Puget Sound Chinook salmon and Puget Sound steelhead within the Snohomish River

watersheds. The ESA-listed salmon Hood Canal summer-run chum salmon ESU does not encompass the Snohomish River watershed where the HGMPs would be implemented, or include any populations of the species within the watershed (Sands et al. 2009). The Snohomish River basin action area is far-removed geographically from areas where summer-run chum salmon are present, and no effects on listed summer chum salmon associated with implementation of the EWS programs are likely or expected (NMFS 2002). Applications for ESA authorizations under the section 4(d) Rule, limit 6, must provide the necessary information described in 50 CFR part 222.308. The HGMPs were reviewed upon their final submittal in updated form, and NMFS determined that they were sufficient for NMFS to proceed in its evaluation of effects of the plans on ESA-listed Puget Sound Chinook salmon and Puget Sound steelhead (Jones 2014).

The hatchery programs, as described in the HGMPs, mitigate for impacts on tribal and recreational fishing caused by past and on-going human developmental activities in the Snohomish River watershed, and from climate change. They provide hatchery fish to: (1) meet regional recreational fisheries objectives for the citizens of Washington State, and (2) meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in *United States v. Washington* (1974). The two proposed hatchery programs would use only hatchery fish for broodstock. These fish are "early winter" (Chambers Creek hatchery-lineage) steelhead (WDFW 2014a; 2014b) (Table 1) that are not included as part of the ESA-listed Puget Sound steelhead Distinct Population Segment (DPS) (71 FR 20802, April 14, 2014; Jones 2015).

The proposed programs would also include monitoring of program performance and effects in the Snohomish River watershed, while applying measures that would minimize risks of adverse genetic, demographic, or ecological effects on ESA-listed fish and other natural populations. If determined to be in compliance with limit 6 of the 4(d) Rule, the early winter steelhead (hereafter, "EWS") hatchery programs would operate in conjunction with on-going habitat restoration and harvest management actions, implemented consistent with the objectives of the recovery plans for Puget Sound and the individual watersheds (SSPS 2005; SSPS 2007; NMFS 2015b) until healthy, natural-origin salmonid populations, that would sustain fisheries, are restored.

Table 1. Proposed hatchery programs for Snohomish River basin hatchery early winter steelhead.

Hatchery Program	Operator
Snohomish/Skykomish River Winter Steelhead Hatchery Program (Segregated) (WDFW 2014a) 1	WDFW
Tokul Creek Winter Steelhead Hatchery Program (Segregated) (WDFW 2014b)	WDFW

All EWS hatchery program actions and associated monitoring and evaluation activities proposed by the co-managers for the Snohomish River watershed are included in the HGMPs. Actions proposed in the HGMPs, including descriptions of the facilities where the majority of actions occur, are summarized below.

1 The comanagers subsequently modified this plan as an outcome of consultation discussions with NMFS by reducing the annual smolt release number from the level proposed in the 2014 HGMP (Unsworth 2016).

2.1 Snohomish/Skykomish River Winter Steelhead Hatchery Programs

Actions and effects for the Snohomish/Skykomish River Winter Steelhead Hatchery program would occur in the Skykomish River and its tributaries, extending from the upper-most reaches accessible to migrating steelhead and salmon in the watershed, downstream to the river mouth, and including the Snohomish River estuary. This area includes Wallace River Hatchery, Reiter Ponds Hatchery, Wallace River, Austin Creek, the portions of the Skykomish River and the Snohomish River through which steelhead smolts produced by the programs would emigrate seaward after release and return as adults, and the estuary through which emigrating hatchery smolts would exit freshwater or enter the Snohomish River basin as adults. The affected area includes all freshwater and estuary areas used by the extant populations of ESA-listed Chinook salmon and steelhead originating from the Snohomish River basin.

The proposed Snohomish/Skykomish River Winter Steelhead Hatchery Program would operate from Reiter Ponds Hatchery, located on Austin Creek, a tributary to the mainstem Skykomish River at river mile (RM) 46.0 (continues as the Snohomish River at RM 20.5); and Wallace River Hatchery, located at RM 4.0 on the Wallace River, tributary to the Skykomish River at RM 35.7 (continues as the Snohomish River at RM 20.5) (Figure 1) (WDFW 2014a). Adult broodstock collection and spawning, and juvenile fish rearing and smolt release would occur at Reiter Ponds Hatchery and Wallace River Hatchery. Up to 300 EWS adults would be collected each year to sustain production of up to 167,600 smolts at the two hatcheries (Unsworth 2016). Up to 140,000 EWS smolts would be released at Reiter Ponds, and up to 27,600 smolts would be released from Wallace River Hatchery (E. Kinne, WDFW, pers. comm., February 1, 2016) no earlier than April 15th each year into the Skykomish River and Wallace River, respectively.

Surface water is withdrawn for use at Wallace River Hatchery from the Wallace River and an adjacent tributary (May Creek). Austin and Hogarty Creeks supply surface water for the Reiter Ponds program. Hatchery effluent produced by the two facilities is released into the Wallace River, and the mainstem Skykomish River, respectively. Effects on downstream aquatic life from effluent discharge are regulated and monitored through Federal National Pollutant Discharge Elimination System (NPDES) permits issued to each facility. Hatchery effluent at Wallace River Hatchery is passed through a pollution abatement pond to settle out any uneaten food and fish waste before being discharged into receiving waters (WDFW 2014a).

Assessment of hatchery program performance (e.g., smolt to adult survival rate and fishery contribution level monitoring) and effects on natural-origin fish would be the primary objectives of monitoring and evaluation actions implemented through the proposed program. All hatchery-origin fish would be marked and/or tagged prior to their release into the natural environment to allow for positive identification and assessment of smolt-to-adult survival rates and to determine

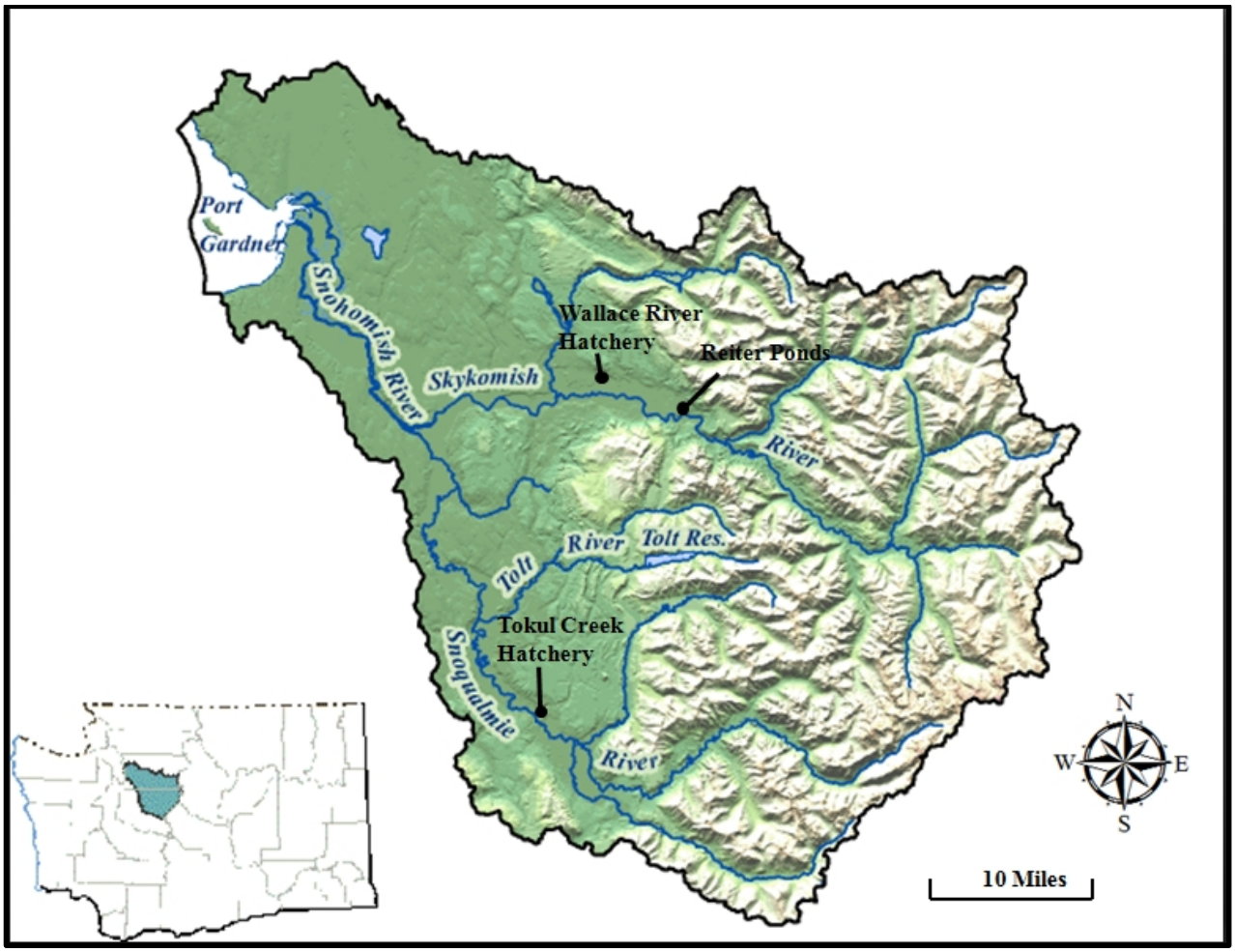

Figure 1. Action area for the proposed continued operation of Snohomish River basin EWS hatcheries for fisheries harvest augmentation purposes. Map includes locations of all WDFW EWS hatchery facilities in the basin.

Source: Modified from WDFW Score data, accessed July 17, 2015- https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA07_Snohomish.

origin of adult returns. Mass marking would also allow for differentiation of hatchery- from natural-origin adult fish escaping to the Skykomish River and its tributaries, and identification of steelhead by origin during the juvenile fish emigration periods. An adult steelhead monitoring program (spawning ground surveys) would be conducted annually to document abundance and spatial structure of steelhead escaping to natural spawning areas and the hatcheries in the action area basins (WDFW 2014a). Within the Skykomish River system, genetic (DNA) samples will be collected annually and analyzed to estimate the number of natural-origin hybrid and hatchery-ancestry fish (Anderson et al. 2014). Within the Pilchuck River system, genetic (DNA) sampling of adult fish will be conducted on a rotating basis every three years (Anderson et al. 2014). The effects of juvenile salmonid sampling occurring outside of the hatchery locations have been

previously authorized through separate ESA consultation processes (NMFS 2009, NMFS 2015a). WDFW and the Tulalip Tribes propose to monitor interactions between juvenile hatchery- and natural-origin salmonids in freshwater and marine areas within the action area to evaluate and manage the programs. Juvenile outmigrant trapping by Tulalip Tribes using a rotary screw trap on the Skykomish River would provide information on the co-occurrence, out-migration timing, relative abundances, and relative sizes of hatchery-origin fish, ESA-listed natural-origin Chinook salmon and steelhead, and non-ESA-listed natural-origin coho, chum, and pink salmon. Results from the juvenile outmigrant trapping programs described in the HGMPs (Section 11) will be reported as required in the separate NMFS authorizations for the programs (NMFS 2009; NMFS 2015a).

2.2 Tokul Creek Winter Steelhead Hatchery Program

Actions and effects for the Tokul Creek Winter Steelhead Hatchery Program would occur in the Snoqualmie River and its tributaries, extending from the upper-most reaches accessible to migrating steelhead and salmon in the watershed, downstream to the river mouth, and including the Snohomish River estuary. This area includes Tokul Creek Hatchery, Tokul Creek, the portions of the Snoqualmie River and the Snohomish River through which steelhead smolts produced by the programs would emigrate seaward after release and return as adults, and the estuary through which emigrating hatchery smolts would exit freshwater or enter the Snohomish River basin as adults. The affected area includes all freshwater and estuary areas used by the extant populations of ESA-listed Chinook salmon and steelhead originating from the Snohomish River basin.

The proposed Tokul Creek Winter Steelhead Hatchery Program is located at RM 0.5 on Tokul Creek, tributary to the Snoqualmie River at RM 39.6 (the Snoqualmie River enters the mainstem Snohomish River at RM 20.5) (Figure 1); Williams et al. 1975; WDFW 2014b). Adult broodstock collection, spawning, rearing, and release occur at Tokul Creek Hatchery. Up to 100 EWS adults would be collected each year to sustain the program. Up to 74,000 EWS smolts would be released no earlier than April 15th each year into Tokul Creek through the proposed program.

Surface water is withdrawn from Tokul Creek and an unnamed spring to rear steelhead at the facility. Tokul Creek Hatchery may also use groundwater withdrawn from a well to augment surface water sources for fish rearing in the event of an emergency. Hatchery effluent is released into Tokul Creek. Effects on downstream aquatic life from effluent discharge are regulated and monitored through a NPDES permit issued to the facility.

Assessment of hatchery program performance and effects on natural-origin fish would be the primary objectives of monitoring and evaluation actions implemented through the proposed program. All hatchery-origin fish would be marked and/or tagged prior to their release into the natural environment to allow for positive identification and assessment of smolt-to-adult survival rates and to determine origin of adult returns. Mass marking would also allow for differentiation of hatchery- from natural-origin adult fish escaping to the Snoqualmie River and its tributaries, and identification of steelhead by origin during the juvenile fish emigration periods. An adult steelhead monitoring program (spawning ground surveys) would be conducted annually to document abundance and spatial structure of steelhead escaping to natural spawning areas and the hatcheries

in the action area basins (WDFW 2014b). Within the Snoqualmie River system, genetic (DNA) samples will be collected annually and analyzed to estimate the number of natural-origin hybrid and hatchery-ancestry fish (Anderson et al. 2014). The effects of juvenile salmonid sampling occurring outside of the hatchery locations have been previously authorized through separate ESA consultation processes (NMFS 2009, NMFS 2015a). WDFW and the Tulalip Tribes propose to monitor interactions between juvenile hatchery- and natural-origin salmonids in freshwater and marine areas within the action area to evaluate and manage the programs. Juvenile outmigrant trapping by Tulalip Tribes using a rotary screw trap on the Snoqualmie River would provide information on the co-occurrence, out-migration timing, relative abundances, and relative sizes of hatchery-origin fish, ESA-listed natural-origin Chinook salmon and steelhead, and non-ESA-listed natural-origin coho, chum, and pink salmon. Results from the juvenile outmigrant trapping programs described in the HGMPs (Section 11) will be reported as required in the separate NMFS authorizations for the programs (NMFS 2009; NMFS 2015a).

3 EVALUATION

The final 4(d) Rule for salmon and steelhead states that the prohibitions of paragraph (a) of the rule (50 CFR 223.203(a)) do not apply to actions taken in compliance with a RMP jointly developed by the States of Washington, Oregon, and/or Idaho and the Tribes, provided that elements of the rule are met, including the following:

- The Secretary of Commerce (Secretary) has determined pursuant to 50 CFR 223.209(b) [the Tribal 4(d) Rule] and the government-to-government processes therein that implementing and enforcing the joint tribal/state plan will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs and DPSs.

- In making that determination for a joint plan, the Secretary has taken comment on how any HGMP addresses the criteria in §223.203(b)(5).

As per the Tribal 4(d) Rule, NMFS consulted with the Tulalip Tribes and the WDFW during the development of the two HGMPs through government-to-government and technical work group meetings. These occasions presented the opportunity to provide technical assistance, to exchange information and discuss what would be needed to conserve the ESA-listed species, and to be consistent with legally enforceable tribal rights and with the Secretary's trust responsibilities to the treaty tribes.

The following discussion evaluates whether the submitted plans address the criteria in section 223.203(b)(5) of the 4(d) Rule for salmon and steelhead.

3.1 Limit 5 Criteria and RMP Evaluation

3.1.1 5(i)(A) The HGMP has clearly stated goals, performance objectives, and performance indicators that indicate the purpose of the program, its intended results, and measurements of its performance in meeting those results.

Goals, performance objectives (standards), and performance indicators for the three hatchery winter steelhead programs are clearly described in sections 1.7, 1.9, and 1.10, respectively of each HGMP (WDFW 2014a; 2014b).

The goals of the programs are: (1) meeting regional non-Indian recreational fisheries objectives, and (2) supporting values associated with Treaty-reserved fishing rights to meet Tulalip tribal commercial, ceremonial, and subsistence needs. The programs would mitigate for lost natural-origin fish production by producing hatchery-origin winter steelhead to provide commercial, ceremonial and subsistence fisheries by the Tulalip Tribes, and recreational harvest for Washington state citizens.

The HGMPs were designed to be consistent with salmon recovery, harvest management, and habitat management strategies and actions specified in the watershed recovery plans and the salmon recovery strategies for the basins (SSPS 2005).

As indicated in section 3.0 of each HGMP, the plans the HGMPs would be implemented to comply with: general Washington State harvest goals to provide fishing opportunities consistent with WDFW's agency mandate for restoration and recovery of natural origin indigenous salmonid runs; the Pacific Salmon Treaty, the Puget Sound Salmon Management Plan, WDFW's Statewide Steelhead Management Plan (WDFW 2008); annual fisheries management plans; the annual equilibrium broodstock documents agreed through *United States v. Washington* (WDFW 2015), and other state, federal, and international legal obligations.

WDFW's Statewide Steelhead Management Plan (WDFW 2008) sets forth comprehensive approaches for each region, including Puget Sound, for preserving and restoring natural steelhead populations, and minimizing risks, including those associated with hatcheries. Among the measures included in the plan are designation of wild steelhead management zones where no hatchery production of the species would occur, and creation of gene-banking programs where hatchery, harvest and habitat management measures would be implemented to preserve and restore unique steelhead populations and habitats. Specifically, as part of the plan's policies, steelhead hatchery programs would be implemented to: "promote achievement of the plan's natural steelhead production policy and provide fishery-related benefits by implementing artificial production programs as a component of a comprehensive habitat, hydro, harvest, and hatchery strategy, and by assuring artificial production programs meet the following characteristics:

- Conservation Programs. Artificial programs implemented with a conservation objective shall have a net aggregate benefit to the diversity, spatial structure, productivity, and abundance of the target wild stock.

- Harvest Programs. Artificial production programs implemented to enhance harvest opportunities shall provide fishery benefits while allowing watershed-specific goals for the diversity, spatial structure, productivity, and abundance of wild stocks to be met (WDFW 2008)."

Program-specific performance standards derived from the Northwest Power Planning Council (NPPC) Artificial Production Review (APR) (NPPC 2001), and performance indicators that would be used to gauge compliance with each of the standards, are described in sections 1.9 and 1.10 of each HGMP (WDFW 2014a; 2014b). The standards and indicators included in the HGMPs address potential benefits and risks specifically relating to EWS steelhead production in Puget Sound, and in the watersheds where fish from the two programs would be released. Responsive monitoring and evaluation actions that would be implemented to collect information relevant to each indicator are also described in that section. Separate performance standards, indicators, and monitoring and evaluation actions are presented to track achievement of hatchery program performance relative to objectives, and monitor program effects on affected fish populations. Actions included in the HGMPs are designed to determine: program consistency with proposed hatchery actions and intended results (e.g. juvenile fish release and adult return levels); measurement of the program's success or failure in attaining results; and, effects of the program on natural-origin fish populations in the Snohomish River basin.

3.1.2 5(i)(B) The HGMP utilizes the concepts of viable and critical salmonid population thresholds, consistent with the concepts contained in the technical document entitled "Viable Salmonid Populations."

HGMPs proposed for consideration under the 4(d) Rule must use the concepts of viable and critical thresholds as defined in the NMFS Viable Salmonid Population (VSP) document (McElhany et al. 2000). Application of these VSP concepts is needed to assess the take of listed salmonids and to avoid jeopardizing any ESA-listed ESU or DPS.

The two HGMPs adequately address this criterion. The HGMPs establish that in the course of mitigating for losses to tribal and non-tribal fishers, the hatchery programs take ESA-listed salmon and steelhead within the watersheds where they occur. The term "take" means to harass, harm, pursue, hunt, shoot, would, kill, trap, capture, or collect, or to attempt to engage in any such conduct (ESA section 3(C)(18). So that take is verified and adequately limited, such that the hatchery programs do not jeopardize any ESA-listed ESU or DPS, a series of very specific standards and indicators are included in each HGMP (Table 1.8.1 and Section 1.10, List of "Performance Indicators", designated by "benefits" and "risks").

Compliance with performance standards and monitoring of indicators related to effects of the programs on ESA-listed salmon and steelhead within each basin would gauge achievement of these goals during the on-station operation of the programs and throughout the juvenile emigration and adult return timeframes. See section 3.1.1, 5(i)(D) below, for specific information on the proposed measures and protocols to be implemented to minimize effects on listed natural-origin salmon and steelhead.

The HGMPs also provide information related to the status of ESA-listed salmon and steelhead populations in the Snohomish River basin. The plans describe the viability goals (where developed) for the individual populations, as well as the recovery goals for each of the listed ESUs or DPSs that encompass the affected populations.

Puget Sound ESA-listed anadromous salmonid ESUs and DPSs in the action area:

Puget Sound Chinook (*Oncorhynchus tshawytscha*): Listed as *Threatened* on March 24, 1999 (64 FR 14308); *Threatened* status reaffirmed on June 28, 2005 (70 FR 37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76 FR 50448). The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan de Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (Ford 2011). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant, as well as fish propagated by twenty-seven artificial propagation programs (NMFS 2013 78 FR 38270). The Puget Sound Chinook salmon populations are aggregated into five biogeographic regions based on shared genetic, environmental, and life history characteristics - Strait of Juan de Fuca; Hood Canal; Central/South Sound; Whidbey Basin; and Georgia Strait (Ruckelshaus et al. 2006). Of the 10 independent Chinook salmon populations identified within the Whidbey Basin biogeographic region, the Snohomish River basin action area supports two populations—Skykomish and Snoqualmie.

Puget Sound steelhead *(Oncorhynchus mykis*s): Listed as *Threatened* under the ESA on May 11, 2007 (72 FR 26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76 FR 50448). The DPS includes all naturally-spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington. This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) (Ford et al. 2011). The Puget Sound steelhead populations are aggregated into three extant major population groups (MPGs)—North Cascades, Central and South Sound, and Hood Canal and Strait of Juan de Fuca—containing a total of 32 "Demographically Independent Populations" (DIPs) based on shared genetic, environmental, and life history characteristics (Myers et al. 2015). DIPs can include summer steelhead only, winter steelhead only, or a combination of summer and winter run timing (i.e., summer/winter). The listed DPS also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery program (NMFS 2013 78 FR 38270). Within the North Cascades MPG encompassing the action area, there are five steelhead DIPs: Snohomish/Skykomish River Winter-Run Steelhead; Pilchuck River Winter-Run Steelhead; North Fork Skykomish River Summer-Run Steelhead; Snoqualmie River Winter-Run Steelhead; and Tolt River Summer-Run Steelhead.

Below is a summary of the current information relating to viability for each of the listed salmon and steelhead populations that would be affected by the continued operation of the two EWS hatchery programs.

3.1.2.1 Snohomish River Basin Chinook salmon

Section 2.2.2 of each EWS HGMP describes the status of the two listed Chinook salmon populations present in the action area relative to "critical" and "viable" population thresholds.

The two EWS HGMPs were designed in consideration of the best available scientific information for viability goals. Goals for the viability of the Snohomish River watershed salmon and steelhead natural populations were established by the state and tribal co-managers and incorporated in planning and guiding the proposed implementation of the watersheds EWS hatchery programs (WDFW 2014a). The viability goals for steelhead will be updated upon the availability of an ESA Recovery Plan for the Puget Sound Steelhead DPS. For the interim period, the viability goals available to us will be used as reference points for monitoring the status of salmon and steelhead natural populations during implementation of the hatchery programs. The goals will also be used as reference points to gauge achievement of program performance and risk reduction objectives specified in the HGMPs, and for determining the need for adjustment of the hatchery actions. General descriptions of how the proposed hatchery programs for EWS would be implemented, so as not to reduce the viability status of the listed Chinook salmon populations, are provided in Section 3.1.4 and 3.1.5 of this document.

The Skykomish and Snoqualmie Chinook salmon populations are two of 22 populations of Chinook salmon in the region delineated by NMFS as part of the Puget Sound Chinook salmon ESU (Ruckelshaus et al. 2006). The two populations in the Snohomish River basin are grouped with eight other populations within the Whidbey Basin biogeographic region for Puget Sound Chinook salmon ESU recovery planning purposes (SSPS 2005; NMFS 2007). Under NMFS recovery and delisting criteria for the listed Chinook salmon ESU, two or more populations within the biogeographic region need to be recovered to a low extinction risk status for the ESU to be considered recovered and delisted (NMFS 2007). Hatchery-origin Chinook salmon produced through the Wallace River Hatchery and Tulalip Hatchery programs are included with the natural-origin component of the Skykomish Chinook salmon population as part of the ESA-listed ESU (64 FR 14308, March 24, 1999; 70 FR 37160, June 28, 2005; 71 FR 20802, April 14, 2014). Hatchery fish with a level of genetic divergence relative to the local natural population(s) that is no more than what occurs within the ESU are considered part of the ESU. The Snoqualmie Chinook population has no associated hatchery-origin component.

Both Snohomish River basin populations are ocean-type Chinook salmon with juveniles emigrating seaward in March through June. A significant proportion of adult Chinook salmon in each Chinook population in the Snohomish basin, averaging 24% and 22% for the Skykomish and Snoqualmie populations, respectively from 1996-2011(Mike Crewson and Pete Verhey, Tulalip Tribes and WDFW unpublished escapement data 2014), is comprised of a yearling fresh water life history type ("stream type"). Adults return primarily as four-year-old fish, although both populations exhibit a relatively strong age-5 component. For the period 2005 through 2013, age-5

Chinook salmon made up 20- and 17-percent of the natural-origin spawners in the Skykomish and Snoqualmie populations, respectively (Rawson and Crewson 2014).

Adult summer Chinook salmon return to the Skykomish River watershed beginning in May and extending through July (PSIT and WDFW 2010a). The Skykomish population has a late-summer/early-fall spawn timing with Chinook salmon spawning in the Snohomish River mainstem, the mainstem of the Skykomish, Pilchuck, Wallace, and Sultan rivers; Woods, Elwell, Olney, Proctor, and Bridal Veil creeks; and the North and South Forks of the Skykomish River (WDFW spawning ground database). The Snoqualmie Chinook population is considered a fall-run stock, migrating into the Snohomish River basin from August through October. Spawning occurs later than in the Skykomish (PSIT and WDFW 2010a), generally in the fall months (mid/late-September through early-November) (WDFW spawning ground database). Snoqualmie Chinook salmon spawn in the Snoqualmie River and its larger tributaries, including the Tolt and Raging rivers, and Tokul Creek (PSIT and WDFW 2010a).

For recovery planning purposes, goals for the four viability parameters—abundance, diversity, spatial structure, and productivity—were developed for each natural Chinook salmon population in Puget Sound, including Skykomish and Snoqualmie (Table 2) (SSPS 2005; WDFW 2014a).

Table 2. Minimum viability spawning abundance, abundance at equilibrium or replacement, and spawning abundance and productivity at maximum sustainable yield for a recovered state for the Skykomish and Snoqualmie Chinook populations and for the entire Puget Sound Chinook salmon ESU.

Population - Region	**TRT Minimum Viability Abundance** [c]	**Status Under Properly Functioning Conditions (PFC)**			**NMFS Escapement Thresholds**	
		Equilibrium Abundance [d]	Spawners at MSY	Productivity at MSY	Critical [a]	Rebuilding [b]
Skykomish	17,000	39,000	8,700	3.4	1,650	3,500
Snoqualmie	17,000	25,000	5,500	3.6	400	1,250
ESU	261,300	307,500	70,948	3.2	261,300	261,300

Source: (Ford et al. 2011; WDFW 2014a).

[a] Critical natural-origin escapement thresholds under current habitat and environmental conditions (McElhany et al. 2000; NMFS 2000).

[b] Rebuilding natural-origin escapement thresholds under current habitat and environmental conditions (McElhany et al. 2000; NMFS 2000).

[c] The TRT minimum viability abundance was the equilibrium abundance or 17,000, whichever was less.

[d] "Historic equilibrium abundance" is the estimated maximum (upper level) number of naturally spawning Chinook salmon under properly functioning habitat conditions.

Snohomish River Basin Chinook Salmon Abundance - Abundance of Snohomish River basin Chinook salmon is a fraction of historical levels (SSPS 2005). The historical equilibrium abundance levels for the Skykomish and Snoqualmie populations are 39,000 fish and 25,000 fish, respectively (Ruckelshaus et al. 2002). The most recent estimates of escapement and percent

hatchery contribution for the Snohomish Basin populations are summarized in Table 3. The 1997-2013 average escapement of natural-origin Chinook salmon for the Skykomish population is 2,183 fish, or 6-percent of the estimated historical abundance for the population. The average natural-origin fish escapement for the same period for the Snoqualmie population is 1,400 fish, which is 6- percent of the population's estimated historical abundance. Naturally-produced Chinook salmon comprise a majority of natural spawners, averaging 77.6 percent for the basin in recent years (2006-2013). The 1997-2013 average hatchery-origin fraction of the naturally spawning Skykomish Chinook population is 34.9%, and 18.9% for the Snoqualmie population. The average contribution of hatchery-origin fish to Skykomish Chinook natural spawning in the last eight recent years (2006-2013; 25.5%) has decreased by nearly half from the level 15 years ago (1997-2001 avg. = 49.9%). The hatchery-origin fraction of the naturally spawning Snoqualmie Chinook salmon population has largely remained consistent over the last 17 years. A moderate increase was observed in recent years (20.8 percent from 2005-2013) relative to the 1997-2001 average of 15.6 percent (Tulalip 2012; Tulalip Tribes, unpublished data 2014).

Table 3. Summary of Skykomish and Snoqualmie populations natural escapement, natural-origin escapement, and percent of natural escapement composed of hatchery-origin spawners (pHOS) for return years 1997-2013 (where estimates are available).

Return Year	Skykomish Natural Escapement	Skykomish Natural-Origin Escapement	Skykomish Percent Hatchery-Origin	Snoqualmie Natural Escapement	Snoqualmie Natural-Origin Escapement	Snoqualmie Percent Hatchery-Origin
1997	2,161	1,540	28.7%	1,917	1,796	6.3%
1998	4,415	1,495	66.1%	1,891	1,361	28.0%
1999	3,446	1,401	59.3%	1,345	1,040	22.7%
2000	4,668	1,775	62.0%	1,427	1,248	12.5%
2001	4,577	3,054	33.3%	3,589	3,284	8.5%
2002	4,327	NA	NA	2,896	NA	NA
2003	3,472	NA	NA	1,975	NA	NA
2004	7,614	NA	NA	2,988	NA	NA
2005	3,201	NA	NA	1,279	968	24.3%
2006	5,573	4,642	16.7%	2,615	2,161	17.4%
2007	2,648	1,510	43.0%	1,334	1,174	12.0%
2008	5,813	4,780	17.8%	2,560	2,190	14.5%
2009	1,414	1,146	19.0%	895	649	27.5%
2010	2,511	1,836	26.9%	1,788	1,585	11.3%
2011	1,176	876	25.5%	702	479	31.8%
2012	3,738	2,462	34.1%	1,379	898	34.9%
2013	2,355	1,860	21.0%	889	770	13.4%
Average	**3,712**	**2,183**	**34.9%**	**1,851**	**1,400**	**18.9%**
1997-2001 pHOS			49.9%			15.6%
2006-2013 pHOS			25.5%			20.2%

Source Tulalip 2012; Mike Crewson and Pete Verhey, Tulalip Tribes and WDFW unpublished escapement data 2014).

Snohomish River Basin Chinook Salmon Productivity - Productivity trends for the Skykomish and Snoqualmie populations, as measured by recruit per spawner and spawner to spawner rates are declining (Table 4). Productivity for the two Chinook salmon populations, as gauged by estimated recruit per spawner levels by brood year, have decreased relative to observed since 1999, when the Puget Sound Chinook ESU was listed. Positive trends in productivity were observed for both populations during the early 2000s, as measured by recruit per spawner rates derived using annual age distributions and annual average age distributions (Table 4). The recent brood year (2000-2006) average recruit per spawner estimates are above the replacement level for the Skykomish and Snoqualmie populations. However, spawner return rates for both populations are well below replacement levels for the most recent brood year for which data are available.

Table 4. Recent productivity estimates for Skykomish and Snoqualmie Chinook salmon populations (source: Rawson and Crewson 2014).

Brood Year (BY)	Skykomish Population Recruits per Natural Spawner (based on observed annual average age distribution)	Skykomish Population Recruits per Natural Spawner (based on observed annual age distribution)	Snoqualmie Population Recruits per Natural Spawner (based on observed annual average age distribution)	Snoqualmie Population Recruits per Natural Spawner (based on observed annual age distribution)
1995	0.79	0.54	3.09	2.09
1996	0.67	0.63	2.02	2.06
1997	1.71	2.33	1.59	2.24
Missing Data				
2000	1.76	2.09	2.49	2.80
2001	1.39	0.83	0.67	0.42
2002	1.57	1.38	1.04	1.27
2003	1.29	0.70	1.16	0.66
2004	0.81	1.11	0.93	1.17
2005	0.79	0.94	1.11	1.32
2006	0.41	0.28	0.61	0.53
1995-1997 Average	**1.05**	**1.17**	**2.23**	**2.13**
2000-2006 Average	**1.15**	**1.05**	**1.14**	**1.17**

Snohomish River Basin Chinook Salmon Diversity - Indices of diversity for the Puget Sound Chinook salmon ESU have not been developed at the population level (Ford et al. 2011). Life history diversity of the Snohomish River basin Chinook salmon populations has been reduced by anthropogenic activities over the last century (Haring 2002, citing J. Houghton and M. Chamblin), and is further threatened by on-going developmental actions in the watershed. Lost and degraded estuarine habitat has impaired the fry migrant components of the Skykomish and Snoqualmie

populations, which need a properly functioning, braided lower river and brackish water environment to grow to a viable smolt size. Fry migrants represent a particularly important component of the life history diversity for both populations. The Chinook salmon populations in the Snohomish River basin have been particularly affected by habitat loss in the estuary. The quantity and quality of salmon rearing habitat available to the two populations in the estuary is a small fraction of pre-development conditions (Snohomish County 2013). Historically, the Snohomish River estuary included a rich complex of tidal channels and productive marshes. Under current conditions, only one-sixth of the historical tidal marsh area downstream of the head of Ebey Slough remains intact and accessible to salmonids (Snohomish County 2013). The current lack of critical estuarine tidal marsh habitat is considered a limiting factor for Chinook salmon recovery (SBSRP 2005). These conditions compromise prospects for restoration of natural-origin Chinook salmon population viability, because ocean-type Chinook salmon stocks are extremely dependent on a properly functioning estuary due to their predominantly fry migrant life history.

Snohomish River Basin Chinook Salmon Spatial Structure - Indices of spatial structure have not been developed at the population level (Ford et al. 2011). The spatial structure for the Skykomish and Snoqualmie populations has been adversely affected by habitat loss and degradation. Bank protection and diking of the river and major tributaries have disconnected the river channels from their floodplains, leading to loss of accessible river areas and habitat complexity for rearing and migrating Chinook salmon (Snohomish Basin Salmonid Recovery Technical Committee [SBSRTC] 1999). Lack of adequate in-channel large woody debris relative to historical conditions has decreased the amount of rearing and refuge areas for juvenile Chinook salmon (SBSRTC 1999). Chinook habitat has been further reduced by loss of wetlands through draining and land conversion for human use (SBSRTC 1999). Road construction, commercial and residential construction, and bank hardening for flood control have also impaired Chinook salmon habitat use and access and population spatial structure. Artificial barriers scattered through the Basin, including dams, tide gates, water diversions, culverts, and pumping stations) prevent juvenile Chinook from reaching rearing habitat to the further detriment of population spatial structure (SBSRF 2005). Since the 1950s, the spawning distribution of the Skykomish Chinook salmon population appears to have shifted upstream. Since that time, a much larger proportion of fish spawn higher in the drainage, between Sultan and the North and South Forks of the Skykomish River, than in previous decades (SBSRTC 1999).

3.1.2.2 Snohomish River Basin Steelhead

Section 2.2.2 of each EWS HGMP describes the status (if known) of the listed steelhead populations present in the action area relative to “critical” and “viable” population thresholds.

Puget Sound steelhead population viability goals and criteria, where available (e.g., Myers et al. 2015; Hard et al. 2015), were incorporated by WDFW and the Tulalip Tribes in planning and guiding the proposed implementation of the EWS programs (WDFW 2014a; 2014b). The viability goals would be used as reference points for identifying the status of the listed steelhead populations during implementation of the hatchery programs. The goals would be used as

reference points to gauge achievement of program performance and risk reduction objectives specified in the HGMPs, and for determining the need for adjustment of the hatchery actions. General descriptions of how the proposed hatchery programs for EWS would be implemented, so as not to reduce the viability status of the listed steelhead populations, are provided in Sections 3.1.4 and 3.1.5 of this document.

The Snohomish River basin includes five steelhead DIPs: Snohomish/Skykomish River winter-run; Pilchuck River winter-run; Snoqualmie River winter-run; Tolt River summer-run; and North Fork Skykomish River summer-run (Myers et al. 2015). The DPS viability criteria developed by NMFS (Hard et al. 2015), require at least 40 percent of steelhead populations within each MPG achieve viability (restored to a low extinction risk), as well as at least 40 percent of each major life history type (e.g., summer-run and winter-run) historically present within each MPG achieve viability. There are no hatchery-origin steelhead produced in basin hatcheries that are included as part of the listed DPS (71 FR 20802, April 14, 2014). The TRT-derived interim DIP abundance goals for viable populations for the three winter-run populations are 10,695 for the Snohomish/Skykomish River population, 2,597 for the Pilchuck River winter-run population, and 8,370 for the Snoqualmie River winter-run. The TRT viable abundance goals for the two summer populations are 250 fish for the Tolt River population and 331 fish for the North Fork Skykomish River population (Table 5).

Table 5. Interim DIP abundance goals for steelhead in Puget Sound, based on a four-year average. Abundance goals for summer-run fish *(italics*) are still under review. QET, quasi extinction threshold; SAS, smolt to adult survival. Minimum abundance = 100 (Low Abundance), 250 (Viable).

Population Basin				**Quasi Extinction Threshold**	**Low Abundance**	**Viable**	**Capacity**
Population	**Area Km^2**	**Mean Elevation (m)**	**Total Stream Length (m)**		**1% SAS**	**5% SAS**	**20% SAS**
Snohomish/ Skykomish River	1,595	420	1,021,690	73	2,139	10,695	42,779
Pilchuck River	356	253	242,383	34	519	8,370	10,386
Snoqualmie River	1,615	620	1,134,038	58	1,674	2,597	33,479
Tolt River	182	784	117,732	*25*	*100 (32)*	*250*	*1,325*
NF Skykomish River	156	1,195	117,602	*25*	*100 (66)*	*331*	*641*
Puget DPS Total				**1,462**	**30,449**	**153,194**	**613,662**

Source: Hard et al. 2015 (as cited in WDFW 2014b).

Winter-run steelhead in the Snohomish River basin enter freshwater as adults between mid-October and May (PSIT and WDFW 2010b; Myers et al. 2015). Spawning occurs from mid-March through mid-June, with peak spawning in April. Most winter-run steelhead return to spawn as four year-old (57%), and five year-old fish (42%) (Myers et al. 2015 citing WDFW and WWTIT 1994). Juvenile out-migrant trapping data indicate that natural-origin Snohomish River basin steelhead juveniles emigrate seaward in April and May as smolts predominantly as two-year-old fish (84%) (Myers et al. 2015 citing WDFW and WWTIT 1994). Three-year-old smolts are a lesser seaward emigration component for the species (15% of the total smolt production).

Adult summer steelhead return to the watershed between late-May and mid-October (PSIT and WDFW 2010b; Myers et al. 2015), and predominantly as four-year-olds. Myers et al. (2015) (this and following) reported that summer-run steelhead in the Tolt River spawn from January through May, with two peak spawning periods; one in February and the other in mid-April. Non-native stock (Skamania) hatchery-origin, summer-run steelhead produced by WDFW's Reiter Ponds program spawn from late -December through April. The spawn timing of Skamania lineage hatchery stock is believed to overlap with naturally-spawning native summer-run steelhead in the region, but the overlap may be diminished because of current broodstock collection procedures that have retained the earliest returning fish for spawning. However, recent genetic analyses conducted by WDFW indicate that introgression by Skamania-linage steelhead is substantial in at least two putative steelhead populations in the watershed (K. Warheit, WDFW, pers. comm., February, 2014). Summer-run steelhead are thought to exhibit the same predominantly 2-year smolt emigration life history strategy as natural-origin winter-run steelhead.

Snohomish Steelhead Abundance - Available data since 2000 indicate that steelhead population abundance in the basin is stable at low levels for three natural populations, declining for one (Snoqualmie/Skykomish River), and largely unknown for another (North Fork Skykomish River) (Table 6). All populations are well below abundance levels that the watershed could support, assuming properly functioning habitat conditions. Intrinsic potential (IP) production estimates based on basin size indicate the Snohomish River basin could support a total winter-run steelhead abundance for the three DIPs of approximately 31,775 fish (Myers et al. 2015). Myers et al. (2015) estimated IP-based adult productivity capacity ranges from 2,139 to 42,779 adults for the Snohomish/Skykomish River winter-run steelhead DIP; 519 to 10,386 adults for the Pilchuck River DIP; and 1,674 to 33,479 adults for the Snoqualmie River DIP (Table 6). By comparison, the recent year (2000-2013) combined geometric mean escapement for the three winter-run populations in the Snohomish River basin is 3,148 fish (WDFW escapement database), or 9.9% of the combined IP production capacity for the basin. Winter-run steelhead escapements have declined significantly since the mid-1990s (Scott and Gill 2008; Ford 2011; Hard et al. 2015).

Snohomish Steelhead Productivity - Productivity of the Snohomish River basin DIPs, measured as mean growth rate, is declining for all populations except for Tolt River, which has a very low abundance. For the four DIPs for which data are available, the PSSTRT found that two populations are at high risk of extinction and two are at low risk (Table 7).

Table 6. Snohomish River basin natural steelhead annual escapement estimates for three winter-run DIPS and two summer-run DIPs.

Year	Winter Steelhead			Summer Steelhead	
	Snoqualmie River	Pilchuck River	Snohomish/ Skykomish River	Tolt River	N.F. Skykomish
	674	590	1,588	185	
2001	1,395	462	1,265	167	NA
2002	789	279	1,166	115	NA
2003	988	696	1,915	198	NA
2004	1,510	1,518	3,116	42	NA
2005	1,060	604	2,746	68	NA
2006	1,832	580	2,854	112	NA
2007	964	976	NA	50	NA
2008	404	646	NA	52	NA
2009	428	342	NA	86	NA
2010	662	294	732	116	82
2011	664	552	1,150	68	14
2012	792	848	876	122	22
2013	614	1,036	1,008	126	NA
2014	**822**	**676**	**1,188**	**124**	**NA**
2015	**966**	**1008**	**940**	**53**	**72**
Average	**910**	**694**	**1,578**	**105**	**NA**

Source: Mike Crewson and Pete Verhey, Tulalip Tribes and WDFW unpublished escapement data 2015. 2015 data are preliminary estimates.

Table 7. Abundance and trend information for DIPs within the Snohomish River basin for which information is available. Populations within the action area are bolded.

Population (Run Timing)	2000 to 2011 Geometric mean Escapement (Spawners)[1]	1985-2009 Mean Growth Rate in Abundance	Extinction Risk (probability of reaching QET within 100 yrs)[3]
Snohomish/Skykomish (winter)	1,684	0.9762[2]	Low (40%)
Tolt (summer)	92	0.961	High (80%)
Pilchuck (winter)	535	[4]	Low (40%)
Snoqualmie (winter)	995	[4]	High (70%)

[1] Source: WDFW escapement database for Snohomish/Skykomish, Tolt, Pilchuck, and Snoqualmie DIPs (no data available for N.F. Skykomish).
[2] Source: (Ford et al. 2011).
[3] Source: (Hard et al. 2015)
[4] The growth rate presented for the Snohomish/Skykomish DIP is the overall estimate for Snohomish basin winter-run steelhead including the Skykomish/Snohomish, Pilchuck, and Snoqualmie DIPs.

Snohomish Steelhead Diversity - Data are not available to evaluate changes in the diversity of steelhead in the Snohomish River basin. However, given it is likely that the degradation and loss of habitat in the watershed, and past harvest practices that disproportionately affected earliest returning fish, have reduced the diversity of the species relative to historical levels. Genetic diversity for the native winter-run populations may have been adversely affected by releases of non-native Chambers Creek steelhead from basin hatcheries, in watershed areas where spawn timings for natural and hatchery-origin fish have over-lapped. Although not part of the EWS programs under review, continued releases of Skamania lineage summer steelhead through a past and on-going program at WDFW's Reiter Ponds facility have likely led to interbreeding with native steelhead populations in the Snohomish River basin. There is also evidence of hatchery EWS interbreeding at low levels with natural fish from the three winter-run populations in the basin (Warheit 2014).

Snohomish Steelhead Spatial Structure - Human developmental activities in the Snohomish River basin have adversely affected steelhead population spatial structure. Scott and Gill (2008) reported that the current distribution of winter-run steelhead in the basin over 432 miles is reduced from the pre-development distribution of 433 to 562 miles of riverine habitat. Similarly, the distribution of summer-run steelhead had been reduced from an historical distribution of 570 miles to a current distribution of 431 miles.

Because the two HGMPs, considered here as an RMP, apply VSP criteria that are incorporated as standards and indicators for program effects, and into the monitoring objectives, the actions are consistent with this 4(d) rule criterion.

3.1.3 5(i)(C) Taking into account health, abundances, and trends in the donor population, broodstock collection programs reflect appropriate priorities.

Broodstock collection actions proposed for the Snoqualmie/Skykomish and Tokul Creek Hatchery EWS programs reflect appropriate priorities to safeguard ESA-listed fish populations. No natural-origin, ESA-listed fish are collected as broodstock for spawning and propagation the programs. All broodstock collected each year for spawning would be EWS, produced by the WDFW hatcheries and localized to the individual hatchery release sites. EWS in the Snohomish River basin are not listed under the ESA and are not part of the Puget Sound steelhead DPS.

The HGMPs describe measures that would be applied to safeguard the health and abundance of listed Chinook salmon and steelhead native to the Snohomish River and its tributaries that may be affected incidentally by broodstock collection activities associated with the proposed hatchery actions.

3.1.4 5(i)(D) The HGMP includes protocols to address fish health, broodstock collection, broodstock spawning, rearing and release of juveniles, deposition of hatchery adults, and catastrophic risk management.

The HGMPs for the two EWS programs include detailed descriptions of protocols and operational elements related to this criterion. This criterion is primarily focused on the adequacy of HGMPs

for programs that rear ESA-listed fish, and the need to operate such programs in a manner that adequately safeguards listed fish while under propagation. The proposed isolated hatchery EWS programs do not include spawning, rearing, or acclimation and release of ESA-listed steelhead. Additionally, because EWS are not part of the listed Puget Sound steelhead DPS, the catastrophic risk management component of this criterion, which is focused on the risk to ESA-listed fish while under propagation, is not included in the HGMPs. "Best management practice" (BMP) measures applied to safeguard non-listed EWS under propagation are included in the HGMPs. Below are the EWS hatchery effects elements identified in this criterion that are germane to listed Chinook salmon and steelhead populations, and for which the proposed HGMPs therefore identify protocols or BMPs designed to address potential incidental effects. These elements are: fish health, broodstock collection, release of juveniles, and deposition of hatchery adults.

Fish Health

BMPs addressing fish health, including fish health maintenance and hatchery sanitation procedures applied during broodstock collection, mating, fish incubation, rearing, and release, are detailed in the performance standard and indicator, adult management, and fish rearing and release sections of each HGMP. Fish health monitoring and evaluation measures are also described in those HGMP sections.

The Snohomish River basin EWS programs would be operated in compliance with "Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State" protocols (NWIFC and WDFW 2006). The co-manager policy delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish that are designed to limit the spread of fish disease pathogens between and within watersheds (NWIFC and WDFW 2006). The programs would also comply with standard fish health diagnosis, maintenance and hatchery sanitation practices referenced in the policy (as per Pacific Northwest Fish Health Protection Committee (PNFHPC) (1989) and AFS (1994) guidelines) to reduce the risks of fish disease pathogen amplification and transfer within the hatchery and to fish in the natural environment. Fish health specialists and pathologists from the WDFW Fish Health Section would provide fish health management support and diagnostic fish health services for EWS propagated through the two HGMPs (WDFW 2014a; 2014b).

BMPs for monitoring the health of fish in hatcheries specified in the co-managers' fish health policy (NWIFC and WDFW 2006) help reduce the likelihood of fish disease pathogen amplification and transmission from hatchery salmonids to naturally produced fish. When implemented, these BMPs would help contain any fish disease outbreaks in the hatcheries, minimizing the risk that diseased fish would be released from the hatcheries, reducing the risks of fish disease pathogen transfer and amplification to natural-origin fish (NMFS 2012).

Broodstock Collection

Sections 6 and 7 of the HGMPs describe BMPs for broodstock selection and collection, carrying forth steelhead production goals and objectives for the hatchery programs, and addressing adult fish capture, transport, holding, and handling practices.

Steelhead collected for use as hatchery broodstock are adult early winter-run, hatchery-origin fish returning to Wallace River Hatchery, Reiter Ponds Hatchery, and Tokul Creek Hatchery. None of the adult fish collected for use as broodstock are part of the Puget Sound Steelhead DPS. All EWS collected for broodstock are from the extant, non-listed, early winter hatchery steelhead stock propagated at each hatchery facility. The proposed WDFW hatchery programs function to produce EWS adults for harvest in tribal and recreational fisheries. All broodstock voluntarily enter hatchery traps during December through January, with peak EWS entry and spawning in January. The traps used to collect broodstock are operated until April 15 as a measure to ensure that any later-returning EWS adults are captured and removed from basin waters. Due to their earlier (July through September) return and spawn timing, Chinook salmon adults are not typically present when EWS trapping occurs at the hatcheries, and incidental captures are therefore unlikely. Natural winter-run steelhead populations in the Snohomish River watershed enter freshwater as adults between mid-October and May (Myers et al. 2015). The peak spawn timing for natural origin winter steelhead is from late-April through early May (Hoffmann 2014). Adult summer steelhead return to the watershed between late-May and mid-October (Myers et al. 2015), and predominantly as four-year-olds. Myers et al. (2015) reported that summer-run steelhead in the Tolt River spawn from January through May, with two peak spawning periods; one in February and the other in mid-April. Due to the low level of return and spawn timing overlap between EWS and natural winter-run and summer-run steelhead, the potential exists for natural steelhead to be encountered in the traps used to collect broodstock at Wallace River Hatchery and Tokul Creek Hatchery. The trapping facility at Reiter Ponds is positioned on the hatchery outlet to the Skykomish River, with little or no incentive for natural-origin fish to voluntarily enter the trap (WDFW 2004a). Therefore, Austin and Hogarty Creeks, which supply surface water for the Reiter Ponds program, are not used by natural steelhead, and incidental encounters during broodstock collection at the site are unlikely.

The Wallace River Hatchery EWS broodstock collection facilities are located on May Creek and Wallace River (WDFW 2014a). No natural origin steelhead have been observed during EWS broodstock collection at Wallace River Hatchery past 12 years (WDFW 2014a). The Tokul Creek Hatchery trap is located at the hatchery outlet, which coupled with the hatchery location on a small tributary stream, provides minimal attraction for natural-origin steelhead, with little incentive to enter the Tokul Creek Trap. (WDFW 2014b). No natural origin steelhead have been observed in the hatchery trap for the last 12 years (WDFW 2014b). Any natural origin steelhead or bull trout encountered during the EWS broodstock collection period at the two hatcheries would be immediately released unharmed back into the natural environment (WDFW 2014b).

For the above reasons, although stray natural steelhead adults may be incidentally trapped during the EWS broodstock collection period, encounters with ESA-listed Puget Sound steelhead at the broodstock collection locations are unsubstantial, and measures are applied to minimize effects of any natural steelhead encountered.

Release of Juveniles

BMPs for hatchery EWS rearing and release are described in sections 9 and 10 of the HGMPs. Rearing and release practices proposed for implementation would help ensure that juvenile fish

produced by the two programs are released as healthy seawater-ready smolts that emigrate downstream rapidly after release, leading to minimal interactions with any co-occurring natural-origin fish, and high hatchery smolt to adult return survival rates.

Potential effects of ecological interactions between newly released EWS and natural-origin salmon and steelhead in the action area are described in Section 2.0 of the HGMPs. Reducing the risk of adverse ecological effects on natural-origin salmon and steelhead from the release of juvenile EWS is an important objective, as indicated in the justification statements for both plans (Section 1.8). Post-release interactions of concern include competition between hatchery-origin EWS and natural-origin salmon and steelhead for food and space, and EWS smolt predation on natural-origin fish. Section 10.11 of the HGMPs describes the specific BMPs proposed to minimize the risk of EWS smolt competition and predation in Snohomish River basin freshwater areas downstream of the hatchery release sites and in the estuary. These BMPs also are designed to promote high juvenile hatchery fish to adult return survival rates consistent with meeting harvest augmentation objectives for the proposed programs. These measures are: (1) reductions in the number of hatchery fish that would be released at each hatchery location relative to recent past levels; (2) elimination of off-station smolts releases to reduce the number of areas that may be affected by hatchery EWS smolt interactions with natural juveniles; (3) elimination of fry and sub-yearling releases, and mandatory rearing and release of only yearling smolts in migratory condition, promoting rapid out-migration that minimizes the time spent in the river, thereby minimizing or eliminating interactions with rearing and migrating natural-origin salmonids; (4) use of volitional release practices to foster rapid seaward migration and limit residualism and freshwater interactions with listed Chinook and steelhead juveniles, bull trout and other naturally-produced salmonids; (5) mass-marking all EWS smolt release groups to allow monitoring of hatchery and natural fish interactions and selective removal of EWS upon return as adults; (6) release of steelhead smolts no earlier than April 15th, to allow listed juvenile Chinook salmon and steelhead to emigrate out of the system, and/or provide time for additional natural-origin fish growth to reduce the risk of EWS smolt predation; and, (7) continuation of monitoring, research and reporting of EWS smolt migration performance behavior, and interactions with natural origin fish to assess and adjust, if necessary, hatchery production and release strategies to further minimize effects on natural origin fish.

Disposition of Hatchery Adults

Protocols for the disposition of adult hatchery EWS are described in section 7.5 of the HGMPs. Weirs and traps at the hatcheries would remain open for the entire EWS adult migration and spawning period (November through March). This measure would be implemented to maximize removal of EWS, and thus minimize the number of hatchery-origin fish that escape to spawn naturally. Fish collected above broodstock needs (surplus) would be removed from the system (culled), and there would no longer be any recycling of adult EWS trapped at the hatcheries back into the natural environment. Recycling of escaping EWS from the hatcheries that were surplus to broodstock collection needs back into the rivers was applied in the past to make the fish available for harvest in recreational fisheries. If available, food-grade surplus fish may be donated to charitable organizations and local tribes for ceremonial and subsistence purposes.

Non-food-grade carcasses would be distributed in local streams for nutrient enhancement purposes, if approved by WDFW Fish Health Program staff.

3.1.5 5(i)(E) The HGMP evaluates, minimizes, and accounts for the propagation programs' genetic and ecological effects on natural populations, including disease transfer, competition, predation, and genetic introgression caused by straying of hatchery fish.

The two Snohomish River basin EWS HGMPs provide evaluations of genetic and ecological effects on listed steelhead and Chinook salmon in section 2.0. Additionally, each HGMP includes risk minimization measures that would be applied for each specific program action (in Sections 6-10) to reduce the likelihood for substantial adverse effects on listed fish species from disease transfer, competition, predation, and interbreeding. Following is a summary of potential Snohomish River basin EWS hatchery program genetic and ecological effects on listed natural fish populations evaluated and accounted for in the plans, as well as risk minimization measures proposed in the HGMPs to address any effects.

Genetic Effects

Because, due to species differences, steelhead cannot interbreed with Chinook salmon, there would be no genetic effects on listed Chinook salmon populations in the Snohomish River basin associated with EWS HGMP implementation. However, adult EWS returning to the hatchery release sites in the Skykomish and Snoqualmie river watersheds, unless harvested or removed by some other means, may spawn naturally with native Snohomish River basin steelhead populations or in areas used by the natural populations, and thus contribute genetically to the next generation of natural-origin fish. The genetic diversity status of ESA-listed steelhead populations in the Snohomish River basin may therefore be adversely affected through EWS straying into natural spawning areas and interbreeding. The magnitude of any effects would be dependent on the level of gene flow between hatchery and natural-origin fish, and on the risk level given the affected natural population's viability status, in particular diversity, productivity, and abundance. Potential genetic risks to listed steelhead populations which may be associated with Snohomish/Skykomish and Tokul Creek Hatchery EWS HGMP implementation are: loss of within-population diversity, outbreeding effects, and hatchery-influenced selection ("domestication") (NMFS 2012).

Loss of Within-Population Diversity

Loss of within-population genetic diversity (variability) is defined as the reduction in quantity, variety and combinations of alleles in a population (Busack and Currens 1995). Quantity is defined as the proportion of an allele in the population and variety is the number of different kinds of alleles in the population. Genetic diversity within a population can change from random genetic drift and from inbreeding. Random genetic drift occurs because the progeny of one generation represents a sample of the quantity and variety of alleles in the parent population. Since the next generation is not an exact copy of the parent generation, rare alleles can be lost, especially in small populations where a rare allele is less likely to be represented in the next generation (Busack and Currens 1995).

The hatchery programs under consideration produce steelhead that are not included as part of the ESA-listed Puget Sound steelhead DPS (Jones 2011). Adult fish produced are not intended to spawn naturally nor contribute to the viability of any Puget Sound steelhead population as part of an integrated recovery effort. Only EWS adults produced by the programs (identified by early return timing and early spawn timing, and presence of an adipose fin clip mark) will be used as broodstock, and no natural-origin steelhead will be collected and spawned.

Within-population diversity of the natural steelhead populations in the Snohomish River basin may be affected by hatchery-origin EWS adult spawning with natural-origin steelhead, but in general the effects are expected to be minimal. Within-population diversity is generally a concern only when the relative abundance of hatchery-origin fish on the spawning grounds far exceeds that of natural-origin fish, and when spawning between the two groups is expected to be extensive, neither of which is the case for the two proposed EWS programs. A specific diversity-related concern that has been raised with respect to EWS is loss of the reproductive output of natural-origin fish through mating with wild fish. For these proposed programs, we expect that mating of EWS with natural-origin steelhead would result in a noncumulative loss in wild fish reproductive output of less than 2%, which is likely to have an undetectable effect on within-population diversity.

Outbreeding Effects and Hatchery-Influenced Selection

Gene flow from EWS hatchery fish could impact natural steelhead populations through outbreeding effects and hatchery-influenced selection. Although the relative contribution of the two types of effects cannot be cleanly determined, the potential effect is the same reduction in fitness of natural populations. The measures applied to reduce both types of risk are also the same, all aimed at minimizing gene flow opportunities.

Outbreeding effects are a concern whenever the hatchery-origin and natural-origin fish are from different populations. This is the case with the proposed EWS and the natural steelhead populations in the basins of operation. The EWS are considered so diverged genetically from natural steelhead that they are not considered part of any steelhead DPS (NMFS 2003). The basis of this is the fact that they have been subjected to many years of intense artificial selection for early smolting, which has resulted not only in smolting predominantly at one year of age, but also earlier spawning time (Crawford 1979).

Hatchery-influenced selection (commonly called “domestication”) results in fitness loss and phenotypic change caused by differences between the hatchery and natural environments (includes intentional selection and relaxation of selection), and sampling “errors” during fish culture (includes advertent or inadvertent selection of traits for fish under propagation). Hatchery-induced selection may lead to changes in quantity, variety, and the combination of alleles between a hatchery population and its source population that are the result of selection in the hatchery environment (Busack and Currens 1995). This hazard is also defined as the selection for traits that favor survival in a hatchery environment and that reduce survival in natural environments NMFS

(2012). The concern is that hatchery-induced selection effects will decrease the performance of hatchery fish and their descendants when exposed to natural selection conditions in the wild.

For both effects, risks to natural-origin steelhead populations are controlled by measures that reduce the number of naturally spawning hatchery-origin fish, in general, and, in particular, reduction in the number of those fish that would overlap spatially and temporally with natural-origin spawners. Genetic effect analyses included with the HGMPs, and cited in the body of the plans, indicate that adult EWS produced by the programs, as previously implemented, have contributed and are expected to contribute very few fish to the associated naturally spawning populations in the watersheds where the fish are released (Hoffmann 2014; Warheit 2014). Specifically, for the two proposed programs, the analysis of genetic data indicate that gene flow from EWS to native steelhead populations should be under 2% in all the natural-origin steelhead populations affected by the programs and this is supported by gene flow projections based on demographic parameters. Cumulatively, in compliance with this criterion, findings presented in the HGMPs and accompanying analyses (Hoffmann 2014; Warheit 2014) indicate the proposed EWS programs would not pose substantial hatchery-influenced selection and fitness loss risks through gene flow to listed Snohomish River basin steelhead populations to the extent that effects would impair the survival of these populations or their progress towards recovery for achieving Puget Sound Steelhead DPS viability goals.

Measures Applied to Minimize Potential Genetic Effects

The HGMPs address genetic effects posed by the continued operation of these programs in Sections 1.10.2, 2.2.3, 6.3, 7.9, and 11.1.1. The plans propose a series of general operational actions to minimize the likelihood of unharvested adult EWS escaping to stray into natural spawning areas and interacting reproductively with natural-origin listed steelhead in the Snohomish River basin. These actions include:

- A greater than 40% reduction in on-station smolt releases at Tokul Creek Hatchery relative to the recent average level (from 185,000 to 74,000 fish) to reduce the number of adults produced, and associated gene flow risks, to natural-origin steelhead in the Snoqualmie River watershed.
- Cessation of off-station smolt releases, reducing the number of smolt release locations from three to one in the Snoqualmie River watershed, and from five to two in the Skykomish River watershed. These reductions promote homing fidelity to the hatchery rearing sites, where returning adult fish can be removed, reducing the potential for EWS straying to natural steelhead spawning areas.
- Elimination of EWS adult recycling, with removal of all adult fish recruiting to the hatcheries required to prevent straying that potentially resulted from this past practice of returning adult fish to the rivers to increase recreational fishing opportunities.
- Collection of all eggs to sustain each program from broodstock returning to each of the individual hatchery facilities to promote fidelity of adult fish homing to the hatchery location where the fish were propagated.

- Collection of all eggs to sustain each program from hatchery-origin, marked EWS returning to the facilities prior to January 31st, of each year, to promote and maintain temporal separation in the spawn-timing between hatchery EWS and natural origin fish.
- Maintenance of all hatchery traps in open, operating condition through mid-April each year to provide opportunity for all adult hatchery fish to return to the hatchery for removal, thereby reducing the potential number of unharvested, returning EWS remaining in the rivers that may stray to natural steelhead spawning areas.

The HGMPs also describe proposed protocols for minimizing the number and rate of program smolts released that fail to emigrate from the system. These protocols are designed to reduce the risk that the newly released hatchery fish do not emigrate seaward, but instead "residualize" in the rivers. Hatchery steelhead that residualize present not only risks of competition and predation (addressed below, Ecological Effects), but also may pose interbreeding risks with natural listed populations of steelhead if the hatchery fish later mature to spawn as jacks in freshwater. The BMPs described in the Competition and Predation sections below are applied to reduce this risk.

Measuring and Monitoring for Genetic Effects

The HGMPs include monitoring and evaluation actions that would be implemented to account for and monitor genetic effects resulting from the proposed hatchery steelhead programs. Through these actions, the level of gene flow from the hatchery EWS population into the natural listed steelhead populations in the Skykomish and Snoqualmie River watersheds would be estimated. WDFW would estimate and report gene flow as "proportionate effective hatchery contribution" or PEHC. WDFW has proposed to manage the proposed steelhead programs for isolated harvest purposes, and thereby seek to minimize PEHC to not exceed 2% in each watershed. They propose several methods (Hoffmann 2014; Warheit 2014b) to estimate annual gene flow rates, and validate whether gene flow remains under 2%. Collection of data necessary to derive gene flow rates will be accomplished through a significant, annual sampling effort to obtain thorough and representative tissue samples for DNA analyses from either juvenile or adult wild steelhead in each of the basins (Anderson et al. 2014a).

Ecological Effects

Consistent with this criterion, ecological effects resulting from implementation of the EWS hatchery actions are also evaluated, minimized (through application of operational practices), and accounted for in the HGMPs (section 2.0 in WDFW 2014a; 2014b). Listed steelhead and Chinook salmon ecological effects that may be of concern associated with implementation of the two steelhead HGMPs are fish disease pathogen transfer, resource competition, and predation.

Disease

The HGMPs address general threats from disease transfer in section 2.0 of each plan. Fish disease transfer and amplification risk reduction measures are more specifically addressed for broodstock selection and collection actions in sections 6.0 and 7.0; incubation and rearing actions in section 9; and for fish release actions in section 10.0. Within these sections, the plans describe fish

disease pathogen issues of concern and actions that would be implemented to minimize risks of fish disease pathogen transfer and amplification. As noted in the plans, all hatchery actions would be implemented in accordance with the "Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (NWIFC and WDFW 2006). Protocols described in the policy and applied through the programs would help reduce risks of fish disease to propagated and natural fish populations through regular fish health monitoring and reporting, and application of best management practice measures to reduce fish health risks. The health of steelhead under propagation would be monitored and managed consistent with fish health policy practices. Under the fish health plan, professional fish pathologists from the WDFW Fish Health Section would visit the hatchery rearing locations monthly, or as needed to perform routine monitoring of adult and juvenile fish, advise hatchery staff on disease findings, and recommend disease treatments when appropriate. All fish monitored for fish health assessment purposes would be sampled consistent with the co-manager policy and procedures referenced in the policy, to minimize the proportion of the total rearing population exposed to handling and non-lethal and lethal sampling. In addition, all WDFW hatchery personnel are trained in standard fish propagation and fish health maintenance methods to help ensure that fish under propagation are adequately protected from catastrophic loss due to poor hatchery practices, adverse water quality conditions, or fish health issues associate with poor water quality or inadequate water quantity.

Competition

Release of hatchery–origin species into a listed species' habitat, or where they may access the habitat of listed species, may harm listed species and therefore constitutes a "take" under the ESA (NMFS 1999). Among the mechanisms of potential harm is competition (Tatara and Berejikian 2012). Competition occurs when the demand for a resource by two or more organisms exceeds the available supply. If the resource in question (e.g., food or space) is present in such abundance that it is not limiting, then competition is not occurring, even if both species are using the same resource. Adverse impacts of competition may result from direct interactions, whereby a hatchery-origin fish interferes with the accessibility to limited resources by naturally produced fish, or through indirect means, as when utilization of a limited resource by hatchery fish reduces the amount available for naturally produced fish (SIWG 1984). Specific hazards associated with adverse competitive impacts of hatchery salmonids on listed naturally produced salmonids may include food resource competition, competition for juvenile rearing sites, and, to a lesser extent, competition for spawning sites NMFS (2012). For these competition risks between fish origins or fish species to occur, substantial levels of spatial and temporal overlap, and limited resources shared by the fish must exist (Tatara and Berejikian 2012). The relative sizes of juvenile hatchery EWS and natural-origin salmon and steelhead, species and size-determined diet preference differences, and relative densities of EWS and natural-origin fish in migration reaches, would also determine competition risks in freshwater areas where the groups overlap spatially and temporally.

The co-managers have included BMPs in the proposed HGMPs designed to avoid or reduce competition in freshwater between fish from natural populations and hatchery EWS:

- All juvenile hatchery steelhead produced by the programs would be released as seawater-ready smolts as a measure to foster rapid emigration seaward. The release of seawater-ready smolts only is expected to reduce the duration of interaction with any co-occurring natural-origin steelhead and salmon that are at a life stage vulnerable to competition for food or space.
- All smolt release groups will meet the minimum size criteria of 5 to 6 fish per pound (fpp), or 198 to 210 mm fork length (fl) established by Tipping (2001) (as cited in (WDFW 2014a; 2014b)) to ensure the fish are at size that will promote downstream migration. The hatchery EWS smolt populations would be released at a uniform size closely adhering to the 5 to 6 fpp minimum to reduce the risk of residualism.
- Hatchery- and natural-origin juvenile steelhead and salmon emigration timing and abundance would be monitored each year through operation of tribal juvenile outmigrant trapping programs to evaluate hatchery fish emigration rates, co-occurrence levels with natural-origin fish, and the potential for harmful ecological interactions. Information collected would be used to develop as needed, alternate hatchery EWS release timings or other mitigation measures that would help avoid or limit the risk of interactions that may lead to competition.
- All hatchery-origin steelhead smolts produced by Wallace River Hatchery, Reiter Ponds Hatchery, and Tokul Creek Hatchery would be volitionally released from hatchery rearing ponds to minimize residualization, and associated competition risks to natural fish. The plans provide sufficient information, some of which is based on 30 years of hatchery program implementation and monitoring, supporting the efficacy of volitional release for meeting actively migrating smolt release and residual minimization objectives. As indicated in the HGMPs, WDFW is conducting research on the effects of volitional release practices in Upper Columbia River region. Preliminary results suggest faster downstream migration for volitionally released smolts, and substantially reduced rates of residualism relative to force-released steelhead (Snow et al. 2013). Volitional releases would begin when steelhead display cues of outward physical signs and behaviors reflecting a state of active smoltification, including loss of parr marks, banding of the caudal fin, and increased attraction of the population to pond edges, inflow, and outflow areas. When these conditions were observed after May 1st, rearing pond end-screens would be removed to provide the opportunity for migration-ready steelhead smolts ready to exit downstream. Any EWS smolts that do not exit rearing ponds volitionally would be removed (culled) and planted into landlocked lakes to enhance recreational fishing opportunities.

Predation

Risks to naturally produced salmon and steelhead attributable to direct predation (direct consumption) or indirect predation (increases in predation by other predator species due to enhanced attraction) can result from hatchery salmonid releases (NMFS (2012). Hatchery-origin fish may prey upon juvenile naturally produced salmonids at several stages of their life history. Newly released hatchery EWS smolts have the potential to consume naturally produced fry and fingerlings that are encountered in freshwater during downstream migration. Hatchery smolts that do not emigrate and instead take up stream residence near the point of release (residuals) have the potential to prey on rearing natural-origin juvenile fish over a more prolonged period. In general, naturally produced salmonid populations will be most vulnerable to predation when naturally

produced populations are at low abundance and predator abundance is high, in small streams, where migration distances are long, and when environmental conditions favor high visibility (NMFS (2012).

The level of risk for EWS smolt predation on natural-origin juvenile fish is dependent upon three factors: (1) the hatchery fish and their potential natural-origin prey must overlap temporally; (2) the hatchery fish and their prey must overlap spatially; and, (3) the prey should be less than 1/3 the length of the predatory fish (NMFS (2012).

The proposed EWS hatchery programs would reduce temporal and spatial overlap and the potential for predation on listed juvenile salmon and steelhead through application of the following measures:

- All juvenile hatchery steelhead produced by the programs would be released as seawater-ready smolts as a measure to foster rapid emigration seaward. The release of seawater-ready smolts only is expected to reduce the duration of interaction with any co-occurring natural-origin steelhead and salmon that are at life stages and sizes vulnerable to predation by EWS smolts of an average individual size of 5 to 6 fpp, or 198 to 210 mm fl.
- All smolt release groups will meet the minimum size criteria of 5 to 6 fpp (198 to 210 mm fl) established by Tipping (2001) (as cited in (WDFW 2014a; 2014b) to ensure the fish are at size that will promote downstream migration. The hatchery EWS smolt populations would be released at a uniform size closely adhering to the 5 to 6 fpp minimum to reduce the risk of residualism.
- Hatchery- and natural-origin juvenile steelhead and salmon emigration timing and abundance would be monitored each year through operation of tribal juvenile outmigrant trapping programs to evaluate hatchery fish emigration rates, co-occurrence levels with natural-origin fish, and the potential for harmful ecological interactions. Information collected would be used to develop as needed, alternate hatchery EWS release timings or other mitigation measures that would help avoid or limit the risk of interactions that may lead to predation.
- All hatchery-origin steelhead smolts produced by Wallace River Hatchery, Reiter Ponds Hatchery, and Tokul Creek Hatchery would be volitionally released from hatchery rearing ponds to minimize residualization, and associated predation risks to natural fish. The plans provide sufficient information, some of which is based on 30 years of hatchery program implementation and monitoring, supporting the efficacy of volitional release for meeting actively migrating smolt release and residual minimization objectives. As indicated in the HGMPs, WDFW is conducting research on the effects of volitional release practices in Upper Columbia River region. Preliminary results suggest faster downstream migration for volitionally released smolts, and substantially reduced rates of residualism relative to force-released steelhead (Snow et al. 2013). Volitional releases would begin when steelhead display cues of outward physical signs and behaviors reflecting a state of active smoltification, including loss of parr marks, banding of the caudal fin, and increased attraction of the population to pond edges, inflow, and outflow areas. When these conditions were observed after May 1st, rearing pond end-screens would be removed to provide the opportunity for migration-ready steelhead smolts ready to exit downstream. Any EWS smolts that do not exit

rearing ponds volitionally would be removed (culled) and planted into landlocked lakes to enhance recreational fishing opportunities.

3.1.6 5(i)(F) The HGMP describes interrelationships and interdependencies with fisheries management.

The HGMPs describe the relationship of the proposed actions with fisheries management in section 3.0 of each plan. The HGMPs indicate that all co-manager anadromous salmonid hatchery programs in the Puget Sound region, including the two proposed EWS programs, would operate consistent with the *United States* v. *Washington* (1974) fisheries management framework. This legal framework sets forth required measures for coordinating State and tribal implementation of agreed hatchery programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (PSSMP 1985). This fisheries resource co-management process requires that both the State of Washington and the Puget Sound Tribes develop salmon hatchery program goals and objectives, and reach agreement on the function, purpose, and fish production strategies for all Puget Sound hatchery programs.

The NMFS evaluation and authorization for 'take' of ESA-listed steelhead associated with all fisheries in the Snohomish River basin action area are described in NMFS (2015b).

3.1.7 5(i)(G) Adequate artificial propagation facilities exist to properly rear progeny of naturally spawned broodstock, to maintain population health and diversity, and to avoid hatchery-influenced selection and domestication.

This 4(d) Rule, limit 5 criterion was intended to address programs that propagate ESA-listed fish, to ensure that hatchery facilities and practices used for the programs provide adequate safeguards to protect the listed fish while in the hatchery. The two hatchery programs rear steelhead that are not included in the ESA-listed Puget Sound steelhead DPS (71 FR 20802, April 14, 2014; Jones 2015). This criterion therefore does not apply to the proposed hatchery programs.

3.1.8 5(i)(H) Adequate monitoring and evaluation exist to detect and evaluate the success of the hatchery program and any risks potentially impairing the recovery of the listed ESU.

Adequate monitoring and evaluation actions are proposed in the two HGMPs to evaluate program performance in meeting hatchery plan implementation requirements and objectives, including verification of effects on ESA-listed species (Anderson et al. 2014a). These actions are summarized in Section 1.10, and are further described in Section 11.0 of each HGMP ("Monitoring and Evaluation of Performance Indicators"). Included in HGMP section 1.10 are descriptions of monitoring and evaluation measures that would be implemented to assess hatchery program performance indicators. The Anderson et al. (2014a) report included in the co-manager submittal of the HGMPs for NMFS review describes monitoring and evaluation actions that will be applied to determine gene flow effects of each program on associated natural steelhead populations.

In addition to monitoring and evaluation actions proposed within the HGMPs, the WDFW and Puget Sound Tribal staffs engage in annual monitoring activities (approved through separate ESA authorizations) to assess the status of listed steelhead and Chinook salmon populations in the Snohomish River basin action area. These activities, authorized for listed fish takes through other consultations (NMFS 2009; NMFS 2015a) include:

- Annual surveys to census steelhead spawning abundance, count redds, and sample carcasses to identify fish origin in natural spawning areas, and adult fish abundance and distribution.
- Annual scale sampling of returning adult fish and fish carcasses for age composition analysis.
- Annual operation of a downstream juvenile outmigrant traps in the mainstem Skykomish and Snoqualmie Rivers that would provide estimates of natural-origin juvenile salmon production levels and sizes for assessment of the natural population survival and productivity. The outmigrant trapping programs would also be used to indicate natural and hatchery-origin salmon and steelhead juvenile emigration timings, rates, and co-occurrence levels.
- Collection of adult steelhead return abundance, timing, sex ratio, mark status, disposition, holding mortality, and fish health condition data at all hatchery facilities to monitor the effects of the programs.
- Implementation of juvenile outmigrant trapping programs and carcass sampling in natural spawning areas that would provide sources of tissue samples for DNA analyses to determine gene flow levels between EWS and associated natural-origin steelhead populations. In the Skykomish River watershed, genetic samples would be collected from smolts trapped at the mainstem trap, and analyzed to determine the number of wild, hybrid, and hatchery-ancestry fish. Genetic samples would be collected from adults in the Pilchuck River subbasin on a rotating basis every three years for the same purpose. Genetic sampling of smolts and adults collected from the mainstem Snoqualmie River smolts trap, and through hook and line sampling, respectively, would be used to assess gene flow levels for EWS spawning in the Snoqualmie River watershed.

The proposed monitoring and evaluation of hatchery implementation requirements (e.g., annual EWS smolt release levels, individual fish sizes, and release timing), hatchery performance, and the verification of hatchery effects on ESA-listed species, along with annual, natural population status and trends monitoring, will enable the co-managers to detect and evaluate the success of the two EWS programs as well as any deleterious effects on the listed species.

3.1.9 5(i)(I) The HGMP provides for evaluating monitoring data and making any revisions of assumptions, management strategies, or objectives that data show are needed.

Consistent with this criterions, the HGMPs provide for regular monitoring and reporting, and responsive adaptive management. As key provisions of the HGMPs, required are implementation of BMPs, monitoring and evaluation of program performance, and adjustment of the hatchery programs accordingly. Each of the proposed HGMPs identify objectives and actions needed to

determine hatchery program performance in meeting stated EWS production objectives, and effects on non-target natural-origin fish populations in the Snohomish River basin (HGMP Section 1.10). In compliance with this 4(d) Rule criterion, the HGMPs include the intent to apply adaptive management and risk management approaches in their implementation of the EWS hatchery programs.

Under the HGMPs, annual data collected relating to hatchery program performance and effects would be evaluated by WDFW and the Tulalip Tribes to determine whether the two steelhead programs were meeting their respective objectives. As identified in Sections 1.10 and 11 of the HGMPs, monitoring and evaluation results would be used to determine whether performance standards addressing program benefits and risks (performance and effects) were met. The co-managers indicate in the HGMPs that funding and staff resources would be committed to monitor and evaluate the programs through review by the WDFW Fish Program and Tulalip tribal technical staffs.

The HGMPs include as proposed actions reporting of program performance and effects on listed fish to monitor compliance with plan objectives (sections 1.10.2 and 10). The comanagers proposed to report: numbers of hatchery (marked) and natural (unmarked) steelhead returning to the hatcheries, number of broodstock collected, and surplus returns; EWS smolt release information consistent with Equilibrium Broodstock Document requirements (number, location, method and age class); levels of compliance with applicable fish health standards and criteria; effluent discharge water quality and water withdrawal levels compared to permit standards and allowances; and, hatchery smolt migration behavior, including EWS smolt interactions with natural origin fish. In addition to these reporting proposals included in the individual HGMPs, annual levels of gene flow between EWS and natural-origin steelhead populations in the Snohomish River Basin would be monitored to gauge whether the programs remain at levels that likely pose unsubstantial risk to the affected wild populations (Anderson et al. 2014a). DNA analyses results for juvenile and adult steelhead samples collected in the Snohomish River Basin, including the Skykomish and Snoqualmie river watersheds, would be analyzed and reported to allow for evaluations of whether gene flow limitation objectives of the HGMPs are met, and whether adjustments of the programs are necessary. As part of any ESA determination regarding the proposed HGMPs, NMFS would review all reports provided annually for compliance with stated HGMP objectives, and post the reports on the NMFS website for public information purposes.

3.1.10 5(i)(J) NMFS provides written concurrence of the HGMP which specifies the implementation and reporting requirements.

After completion of the public review and comment period for this proposed evaluation and pending determination document, NMFS will consider the comments received and determine whether implementation of the HGMPs would either appreciably reduce the likelihood of survival and recovery of the ESA-listed species, and whether the HGMPs address all of the criteria specified in limit 6 of the 4(d) Rule.

3.1.11 5(i)(K) The HGMP is consistent with plans and conditions set within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.

The Snohomish/Skykomish River Winter Steelhead Hatchery and Tokul Creek Winter Steelhead Hatchery plans were developed by WDFW and the Tulalip Tribes pursuant to the *United States v. Washington* (1974) fisheries and hatchery management framework.

There are no other plans or conditions set within Federal court proceedings with continuing jurisdiction over tribal harvest allocations, including memorandums of understanding, court orders or other management plans, that direct tribal harvest allocations with respect to operation of the proposed EWS hatchery programs in the Snohomish River basin.

4 NOTICE OF PENDING RECOMMENDATION

As required by limit 6 of the 4(d) Rule, the Secretary is seeking comment from the public on the pending determination as to whether or not the HGMPs would appreciably reduce the likelihood of survival and recovery of ESA-listed species. As required in (6)(iv) of section 223.203 of the 4(d) Rule for salmon and steelhead, the Secretary will publish notice of the determination together with a discussion of the biological analysis underlying that determination.

5 PENDING DETERMINATION

NMFS has reviewed two EWS HGMPs provided by WDFW and the Tulalip Tribes for implementation in the Snohomish River basin, pursuant to limit 6 of the 4(d) Rule, and evaluated them together against the requirements of the 4(d) Rule. Based on this review and evaluation, NMFS' pending determination, subject to information provided during public comment, is that activities implemented as described in the two plans would not appreciably reduce the likelihood of survival and recovery of ESA-listed Puget Sound steelhead or Puget Sound Chinook salmon.

6 REEVALUATION CRITERIA

NMFS will reevaluate this determination if: (1) the actions described by the HGMPs are modified in a way that causes an effect on the listed species that was not previously considered in NMFS' evaluation; (2) new information or monitoring reveals effects that may affect listed species in a way not previously considered; or (3) a new species is listed or critical habitat is designated that may affect NMFS' evaluation of the HGMPs.

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