



ROGER TABOR

Chapter 4: Current Population Status and Recovery Goals

Recovery goals provide a framework from which to evaluate both plan implementation and overall progress towards Chinook recovery. Tracking population metrics and habitat conditions provides important data used to evaluate current population status and overall habitat conditions. This information serves as a key input for informing ongoing adaptive management.

Viable Salmon Population Criteria – Current Status and Goals

The Viable Salmon Population¹ (VSP) concept – as defined by National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) – provides the foundation for all established recovery goals for Chinook salmon within the Green/Duwamish and Central Puget Sound Watershed. NMFS defines a viable salmon population as a population that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year timeframe (McElhany et al. 2000). The VSP goals outlined in this section remain unchanged from the 2005 Plan and are presented in Table 1. They

are based on recovery planning targets developed by a team of scientists (Puget Sound Technical Recovery Team) appointed by NOAA to support the original 2007 Recovery Plan for Puget Sound Chinook.

Four parameters are used to assess the viability of salmon populations: abundance, productivity, spatial structure and diversity. These parameters are reasonable predictors of extinction risk, reflect general processes important to all salmon populations, and measurable over time.

Abundance

Abundance is the number of individuals in the population at a given life stage or time. The number of natural origin Green River Chinook spawners is the primary abundance indicator. Chinook abundance indicates an overall decline since before the first plan was adopted in 2005 (Figure 6 and Table 1). In 2009, the number of Natural Origin Spawners (NOS) was the lowest ever recorded, with less than 200 fish. For five of the past 10 years (2010–2019), the number of NOS has been below the planning target range (1,000–4,200 NOS) for WRIA 9.

¹ NOAA technical Memorandum NMFS-NWSSC-42: Viable salmonid populations and the recovery of evolutionarily significant units.

Table 1. Viable Salmon Population (VSP) Goals

VSP Parameter	Indicator	2006-2010 (average)	2011-2015 (average)	2016-2019 (average)	10-Year Goal	50-100 Year Goal
Abundance	Natural Origin Spawners	1975 (average)	963 (average)	2041 (average)	1000-4200 ²	27,000
Productivity	Egg-to-Migrant Survival	2.9%	8.7%	5.3% ^a	>8%	>8%
Diversity	Percent Hatchery Origin	56.4%	60.6%	68.2%	Decreasing	<30%
	Proportion 5-6 yr-old Spawners	19.2	9.6%	N/A	Increasing	>15%
	Relative Abundance of Parr	46%	30.6%	32.8% ^a	No Target ³	No Target
Spatial Diversity	Spawning Distribution	Spawning in Green River mainstem (below Howard Hanson Dam), Newaukum Creek and Soos Creek			Spawning above Howard Hanson Dam	Maintain spawning distribution

Data Source: WDFW Salmonid Stock Inventory and NOAA Salmon Population Summary Database

^a2016-2018

2 A range is used because the productivity of each year's run varies depending on a variety of factors. If fish are experiencing high productivity, fewer adults are needed to reach future targets than if they are experiencing low productivity, which would require more fish returning to reach future targets.

3 No target established because it is not considered a reliable metric of diversity. However, relative abundance of fry and parr does provide important information for projecting future abundance.

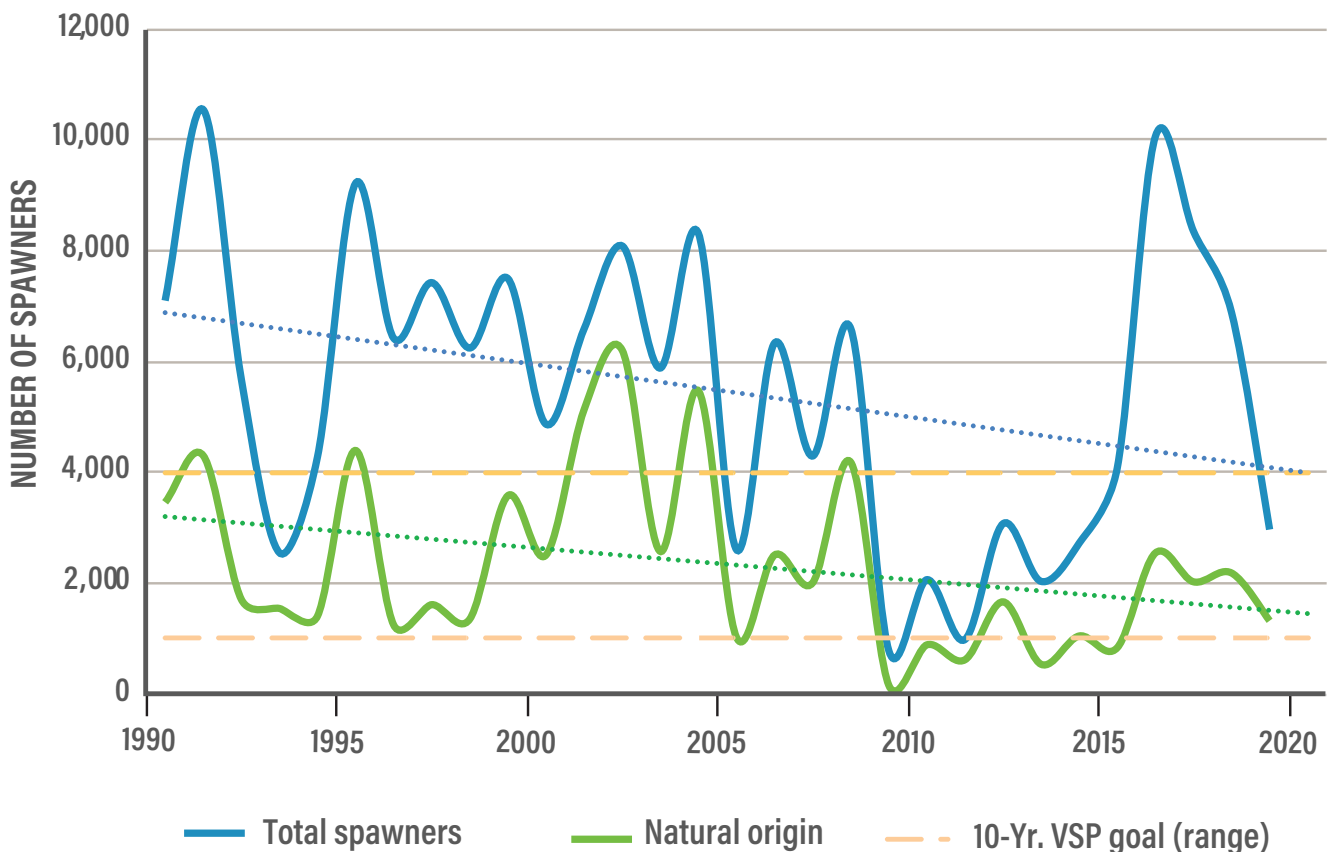
Productivity

Productivity or population growth rate is the ratio of abundance in the next generation as compared to current abundance. The WRIA uses WDFW data to track egg-to-migrant survival rates as a primary means of evaluating productivity (WRIA 9 ITC 2012). Egg-to-migrant survival rate is defined as the proportion of fertilized eggs that survive to migrate as fry or parr into the Lower Green, as quantified by the Washington Department of Fish and Wildlife (WDFW) smolt trap at river mile 34. Although, the average rate for wild Chinook populations is 10.4 percent (Quinn 2005), the WRIA set a target of 8 percent because the elevated proportion of hatchery fish on the spawning grounds is assumed to reduce reproductive fitness (see VSP diversity metric below). Between 2006 and 2018, the survival rate has ranged from 0.09 percent to 11 percent, with an average of 5.7 percent (Table 1). While the long-term average is below the target, the egg-to-migrant survival rate has exceeded the 8 percent target in five of the last 10 years of data.

VSP-Spatial Structure

The WRIA has not directly tracked a specific indicator or metric for spatial structure. However, natural origin adults predominantly spawn in Newaukum Creek and the mainstem Green River. Recent changes to hatchery operations will maintain the area in Soos Creek above the weir as a natural production emphasis area with only natural-origin adults passed above the weir. Adult Chinook will not be passed upstream of Howard Hanson Dam (HHD) in order to access the upper watershed until downstream fish passage is provided at HHD. A 2019 Biological Opinion (BiOp) issued by the National Oceanic and Atmospheric Administration (NOAA) found that the construction of a downstream fish passage facility at HHD was necessary for the recovery of Chinook salmon, steelhead, and Southern resident orcas. It sets a 2030 deadline for construction and operation of a downstream fish passage facility. For the spatial structure of the population to improve, natural origin spawners are needed within both of these areas that were part of their historic range.

Figure 6. Green River Chinook salmon escapement.



Data Source: WDFW Salmonid Stock Inventory and NOAA Salmon Population Summary Database.

VSP-Diversity

Diversity is the variety of life histories, sizes, and other characteristics expressed by individuals within a population. WRIA 9 has used three metrics to measure diversity:

- Percentage of hatchery origin spawners. The target is for fewer than 30 percent hatchery origin Chinook spawners (HSRG 2004). The target has not been met since 2002, and since plan adoption in 2005, the proportion of hatchery fish on the spawning grounds has ranged from 35 percent to 75 percent and has appeared to be increasing (Table 1);
- Percentage of juvenile Chinook that outmigrate as parr. Based on recent analyses, this indicator is influenced by basic habitat capacity, the number of natural origin spawners, and the streamflows experienced during rearing (Anderson and Topping 2018). As such, tracking the percentage of parr is no longer recommended as a reliable metric for evaluating diversity of the population. However, the metric does continue to provide important population-level information related to productivity; and
- Proportion of natural origin adults that return as five- and six-year old fish, with a simple target of an increasing percentage of older fish returning over time. Since 2005, there have been no six-year old fish, thus monitoring data reflect only five-year old Chinook. Excluding 2009, which was an outlier year with the lowest return of adults on record, the proportion of five-year olds has ranged from a high of 17 percent to a low of 1 percent (Table 1). The average percent return from 2006 to 2015, 14.4 percent, is similar to the average over the last 46 years of 15.4 percent.

Habitat Goals – Implementation Targets

Habitat goals outline both the necessary future ecological conditions to support a viable salmon population and shorter term implementation targets designed to assess plan implementation progress. WRIA 9 developed goals for key ecological indicators that reflect priority habitat needs and environmental stressors that span all life stages of Chinook salmon – adult migration, spawning, incubation and emergence, stream rearing, downstream migration, estuary rearing, and nearshore foraging. The indicators and associated goals presented in Table 2 are organized by subwatershed. This Plan Update does not outline specific goals related to marine migration outside of WRIA 9 boundaries.

WRIA 9 developed long-term goals – or necessary future conditions – during the development of the 2005 plan using scientific guidance developed by the Puget Sound Technical Recovery Team. The 2004 WRIA 9 Strategic Assessment and 2005 Salmon Habitat Plan summarize the full suite of necessary future conditions to support a viable salmon population in the Green/Duwamish and Central Puget Sound Watershed. They were not amended as part of this Plan Update. The subset of necessary future conditions outlined in Table 2 represents a strategic subset that can be readily assessed related to project implementation across shorter intervals of time.

Table 2 also outlines updated short term – 10 year – habitat targets used to directly track plan implementation. The 10-year targets were developed by the WRIA 9 Implementation Technical Committee based on a review of priority stressors, limiting factors, implementation progress under the 2005 Plan, and a review of common indicators proposed for regional tracking by the Puget Sound Partnership. Specific targets are intended to be aspirational and reflect the significant level of investment needed to substantively advance recovery within the watershed. The *Monitoring and Adaptive Management* chapter summarizes recommended methodology and timelines for periodic assessments of these and other longer-term status and trends indicators (e.g., water temperature, contamination).

Table 2. Green/Duwamish and Central Puget Sound Habitat Goals.

Necessary Future Conditions and Implementation Targets				
Habitat Indicator	Necessary Future Cond. (2005 Plan)	10-year Target 2005 Plan (achieved)	Current Condition	Recommended 10-year Target (2030)
Marine Nearshore				
Shoreline Armor	65% of shoreline in natural condition	Restore 13,500 ft of shoreline (1500 ft restored – net gain of 70 ft of armor).	36%/33 mi of shoreline in natural condition	Remove 3,000 ft of hard armor and achieve a net reduction in hard armor.
Marine Riparian Vegetation	65% of marine shoreline characterized by riparian tree cover	No target developed	40%/36 mi of shoreline has riparian tree cover	Revegetate 60 ac and/or 3.25 mi (~3.5% gain) of shoreline.
Shoreline Conservation	Not applicable	Protect 5 mi of shoreline. (4 mi protected).	9.5 mi of adjacent upland protected as natural lands	Acquire 2 mi of shoreline for permanent protection, prioritizing beaches and feeder bluffs.
Duwamish				
Shallow Water Habitat	173 ac of shallow water habitat in the transition zone (RM 1-10) (30% of historic)	Restore 26.5 ac of shallow water habitat (~6 ac restored)	Unknown	Create 40 ac of shallow water habitat between RM 1-10.
Riparian Forest	65% of each bank of the river has > 165 ft of riparian tree coverage (586 ac total)	No target was developed	69 ac/12% of 165 ft buffer contains tree cover	Revegetate 170 ac (~29% of 165-ft buffer)/9.8 mi of streambank.
Lower Green				
Off-Channel Habitat	45% of historical off-channel habitat. Restore 2.8 mi of side channels, 450 ac of floodplain wetlands, and 5,039 ac of connected 100-yr floodplain habitat (total of 8,839 ac of connected 100-yr floodplain).	Restore 16.5 ac of reconnected off-channel and riparian habitat (20.7 ac restored)	3,800 ac of connected 100-yr floodplain that is accessible to juvenile fish	<p>Restore 240 ac of floodplain habitat.</p> <p>Side Channels: 550-ft high flow/ 3,740-ft low flow</p> <p>Floodplain Tributaries: 3,080 ft</p> <p>Backwater: 75 ac</p> <p>Floodplain Wetland: 66 ac</p> <p>Other 100-yr Floodplain: 99 ac</p>
Riparian Forest	75% of each bank of the river to >165 ft wide (828 ac total)	No target was developed	222 ac/27% of 165-ft buffer contains tree cover	Revegetate 250 ac (~30% of 165-ft buffer)/ 8.52 mi of high-priority, unforested shoreline

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Table 2. Green/Duwamish and Central Puget Sound Habitat Goals. (Continued)

Necessary Future Conditions and Implementation Targets, continued				
Habitat Indicator	Necessary Future Cond. (2005 Plan)	10-year Target 2005 Plan (achieved)	Current Condition	Recommended 10-year Target (2030)
Lower Green, continued				
Large woody debris	1,705 pieces per mi (21 key pieces)	No target developed.	2004: 54 pieces/mi. 2014: 48.5 pieces/mi.	Achieve 425 pieces/mi.
Bank armor	No new, decreasing amount	No new, decreasing amount	2014: 42 mi of river bank armored (17.7-mi levees; 9.8 mi maintained revetments; 14.5 mi of semi-armored roads acting like levees and natural banks)	Set back 1 mi of levee.
Middle Green				
Floodplain connectivity/lateral channel migration	Floodplain subject to lateral channel migration represents 65% of historical conditions	Restoration of 50 ac of off-channel habitat and riparian vegetation (45 ac restored)	2017: 1,751 ac or 55% of historic floodplain connected	Reconnect 200 ac of floodplain as measured by area subject to lateral channel migration.
Riparian forest	> 65% of Channel Migration Zone (1,424 of 2,190 ac) and up to 165 ft wide where possible	No target developed	2005: 50.3% 2009: 50.5% of the Channel Migration Zone forested	Revegetate 175 ac (8% of Channel Migration Zone).
Large wood debris	10 jams/mi	No target developed	2006: 2.2 jams/mi 2015: 3.8 jams/mi	Achieve 5 jams/mi.
Bank armor	No new, decreasing amount	No new, decreasing amount (>1% reduction)	2004: 25% armored 2009: 24% armored	Set back 1 mi of revetment/levee.
Upper Green				
Fish passage	Up and downstream fish passage at Howard Hanson Dam	Fish passage provided (upstream passage provided)	Upstream passage facility complete. Downstream passage not complete.	Provide downstream passage at Howard Hanson Dam.
Bank armor	No new, decreasing amount	No new, decreasing amount	2004: 15% armored 2009: 15% armored	Remove/setback 0.5 mi of bank armoring.