

SALMON
HABITAT LIMITING FACTORS
FINAL REPORT

WATER RESOURCE INVENTORY AREA 5
STILLAGUAMISH WATERSHED

WASHINGTON STATE
CONSERVATION COMMISSION

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AGENCY AND ORGANIZATIONAL ABBREVIATIONS

ACOE	Army Corps of Engineers
EPA	United States Environmental Protection Agency
GIS	Geographic Information Systems
HPA	Hydraulic Project Approval
MBSNF	Mt. Baker-Snoqualmie National Forest
NMFS	National Marine Fisheries Service
NWIFC	Northwest Indian Fisheries Commission
PPS	People for Puget Sound
PSAT	Puget Sound Action Team
PSWQA	Puget Sound Water Quality Authority
SASSI	Washington State Salmon and Steelhead Stock Inventory
SCD	Snohomish Conservation District
SCIS	Snohomish County Information Systems
SCNWB	Snohomish County Noxious Weed Board
SIRC	Stllaguamish Implementation Review Committee
SWM	Snohomish County Surface Water Management Division
TAG	Technical Advisory Group
URS	URS Consulting
USFS	United States Forest Service, Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCC	Washington Conservation Commission
WDOE	Washington Department of Ecology
WDF	Washington Department of Fisheries (superceded by WDFW)
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOH	Washington Department of Health
WRIA	Water Resource Inventory Area
WSDA	Washington State Department of Agriculture
WSDOT	Washington State Department of Transportation
WWTIT	Western Washington Treaty Indian Tribes

UNITS OF MEASUREMENT AND OTHER ABBREVIATIONS

°C	Degrees Celsius	m ³ /yr	Cubic meters per year
cm	Centimeter	mg/l	Milligrams per liter
DO	Dissolved oxygen	RM	River Mile
m ³ /s	Cubic meters per second	TMDL	Total Maximum Daily Load
ha	Hectare	m	Meter
km	Kilometer	km ²	Square Kilometer

EXECUTIVE SUMMARY

This report is an assessment of the habitat factors limiting the production of salmon in the Stillaguamish watershed, also known as Water Resource Inventory Area (WRIA) 5. The Stillaguamish River drains a 1,774-km² watershed on the west slope of the North Cascades, and is the fifth largest tributary to Puget Sound. Between 1956 and 1965, the Stillaguamish is estimated to have contributed about 21 % of the anadromous fish production in Puget Sound. Land cover data from 1991 show over 76 % of land use in forested lands, 17 % in rural residential, 5 % in agriculture, and 2 % in urban.

This document focuses on all Stillaguamish stocks identified in the 1992 *Washington State Salmon and Steelhead Stock Inventory* (SASSI): chinook, coho, chum, and pink salmon, steelhead, and bull trout. Searun cutthroat and sockeye salmon are also discussed. The SASSI currently lists the Stillaguamish summer and fall chinook and Stillaguamish coho as depressed stocks. The Deer Creek summer steelhead is listed as critical. In March 1999, the Puget Sound chinook stocks were designated as threatened under the federal Endangered Species Act. In June 1998, the US Fish and Wildlife Service (USFWS) proposed the federal listing of the Puget Sound bull trout as threatened.

Historic Condition and Losses

Logging of the Stillaguamish watershed began in the lower mainstem of the river in the early 1860s. The floodplain forests of most of the mainstem and riparian areas bordering much of the remaining anadromous streams in the watershed were harvested by the turn of the century. By the early 1940s, the entire anadromous channel network, with the exception of a few areas had been logged.

The historic Stillaguamish estuary was also impacted by European settlement. Between 1870 and 1968, about 85 % of the Stillaguamish tidal marsh was converted to agriculture. Two-thirds of this conversion occurred between 1870 and 1886. By 1968, only 3 km² of the original salt marsh existed. In recent decades the estuary has been increasing in size, possibly as a result of upland sediment impacts. Between 1947 and 1974, the Stillaguamish delta increased from 50.5 km² in 1947 to 64.8 km² in 1974, a 28 % change. The newly accreted areas (mostly sand and mudflats) are of less value to salmon than the original salt marsh habitat.

Beaver pond habitat within the anadromous zone of the Stillaguamish watershed has been reduced between 81 and 96 % of historic levels in the anadromous zone. The total estimated historic area of beaver ponds was between 2.37 km² to 11.84 km². It is now estimated to be 0.44 km². Beaver ponds provide important rearing habitat for coho and other juvenile salmonids. Stream systems with extensive beaver ponds and wetlands, accessible to coho, have been recorded to have significantly higher smolt yields than other systems in the basin. Seventy-eight percent of historic wetlands have been impacted or lost. The Stillaguamish watershed historically supported 11,795 ha of wetlands. The current total wetland area is estimated to be 2,537 ha. Wetlands provide several functions that directly impact salmonids.

Habitat Limiting Factors

There are several habitat limiting factors negatively affecting salmon and their ecosystems in the Stillaguamish watershed. The major factors are discussed below.

In the floodplains of the Stillaguamish, the mainstem Stillaguamish has lost more than 31 % of its side channel habitat (between 1933 and 1991), primarily from the construction of dikes and revetments. The side channels of the North and South Forks have been decreased by about one-third of historic levels. The losses are mainly due to filling, and can be attributed to the combined effects of revetments, agriculture, and railroad and road construction. Side channels provide critical rearing and refuge habitats.

The riparian forests of floodplains and upland areas are also a limiting factor. Today, only 11 % of the Stillaguamish riparian forests are in an “intact” fully functional condition. Eleven of the 27 sub-basins identified in the Stillaguamish watershed have more than 70 % degraded riparian forests. Eight of these sub-basins have more than 90 % riparian degradation. Riparian zones associated with agriculture and rural residential land use are the most severely degraded.

The loss of riparian forests has resulted in a dramatic decrease in large woody debris and associated pool habitat, both of which are key to productive salmon habitat. At best, only 41 % of the Stillaguamish riparian forests bordering anadromous streams will be fully functioning to provide large woody debris by the end of the 21st century. The average and maximum number of pieces of wood per 100 meters in agricultural stream channels is 70 % less than what is found in forested and rural residential lands.

The loss of pool area is associated with the removal and reduction of large wood debris, increases in sediment supply, and increased peak flows. Channel slope also influences the stability of the wood once it has entered the stream. Generally speaking, the spacing between pools in the Stillaguamish decreases with an increase in wood pieces and a decrease in channel slope. The mainstem has the highest average percent pool area (45 %) followed by the South Fork (35 %) and North Fork (28 %).

Sedimentation problems have been a concern to fish biologists in the Stillaguamish since at least the late 1950s. Landslides associated with human land uses are the primary source of sediment. A total of 1080 landslides have been inventoried for the period from the early 1940s to the early 1990s. Seventy-four percent of the inventoried landslides in the Stillaguamish result from logging roads (22 %) or clearcuts (52 %), while 98 % of the volume of sediment is associated with these two sources. A total of 851 landslides delivered sediment to stream channels, and of these, at least 40 % delivered sediment directly to fish-bearing waters. Sixty-one percent of the 851 slides delivering sediment to streams occurred in the North Fork drainage, 36 % in the South Fork drainage, and 3 % in the mainstem drainage.

Increases in peak streamflows exacerbate sediment problems. Streamflow measurements from the North Fork show a systematic increase in peakflows. Because this trend is not found in the

South Fork streamflow data, it suggests a relationship between land use activities more prevalent in the North Fork. Between 1928 and 1995, ten of the largest peak flows recorded by the North Fork gage occurred between 1980 and 1995. Peak flows can scour gravel beds containing salmon eggs. The scoured sediment may be re-deposited over downstream salmon redds, smothering the eggs. Peak flows can also flush out juvenile salmon from normally quiet rearing areas.

Low streamflows are problematic in the Stillaguamish from July through September. The cumulative effect of groundwater withdrawals and loss of wetlands can also contribute to low flows. Known low flow problem areas include: the lower mainstem and estuary, Church Creek, North Fork (from Oso to Whitehorse), Pilchuck Creek, Harvey/Armstrong Creek, Tributary 30. The low summer flows also permit saline waters from the Sound to move further upstream in the mainstem Stillaguamish than in historic times when summer flows were larger. Low flows can cause salmon to be stranded, limit or impede salmon migration, and contribute to a decrease in dissolved oxygen, an increase in water temperature, and an increase in the concentration of pollutants.

Nonpoint source pollution is a major cause of water quality pollution in the Stillaguamish, with agricultural practices, onsite sewage disposal, development and urban runoff, and forest practices being the major sources. Violations of water quality standards for temperature, dissolved oxygen, fecal coliform and other parameters have been measured at several locations in the Stillaguamish watershed. For salmonids, high water temperature and low dissolved oxygen are the main water quality problems. Water temperatures above 21 degrees Celsius (optimum is 12 to 14 degrees Celsius) are frequent in the estuary during the hot summer months. High temperatures can lower dissolved oxygen, impair the immune system of salmon, and give non-native warmwater species a competitive edge over native salmonids.

Nearshore and Estuary Habitats

The Stillaguamish watershed, as defined by WRIA 5 boundaries, includes 22 miles of marine shoreline. This is less than one percent of the total nearshore habitat contained within the 19 watersheds of Puget Sound. Generally speaking, the nearshore habitat associated with the Stillaguamish is in relatively good condition when compared to the urbanized nearshore areas of Puget Sound. Residential development is the primary threat. There are currently no measures in place to ensure that the nearshore areas remain intact. All species of juvenile salmon use nearshore habitats in Puget Sound at either the fry and/or smolt life stages. Returning adult salmon also use nearshore habitats.

In addition to the sedimentation and water quality problems already mentioned, the Stillaguamish estuary is experiencing an invasion of non-native cordgrasses (*Spartina*). The primary areas targeted for *Spartina* control include: Kayak Point to Warm Beach (less than 1 acre); Warm Beach (less than 2 acres); Port Susan: Hat's Slough to South Pass (100 to 150 acres); Leque Island (less than 10 acres); South Pass (less than 10 acres); Stillaguamish River (7 acres 2.5 miles upstream); West Pass and Skagit Bay (over 300 acres); and Davis Slough (5 acres). Cordgrass invasions eliminate native salt marsh vegetation, displace native plants and animals, raise the elevation of the estuary substrate, and lead to an increase in flooding. The

Stillaguamish estuary provides habitat for juvenile salmon to make a physiological transition between freshwater and saltwater environments and for adult salmon to transition between saltwater and freshwater. The blind channels found in the salt marshes provide critical rearing habitat for juvenile salmon, particularly chum, chinook, and pink.

Data Gaps

Twenty-five general data gaps are identified in this report for the purpose of guiding future inventory and research needs. The data gaps were compiled from the information sources used to prepare this document and with assistance from the Stillaguamish Technical Advisory Group. High priority items are related to estuary and nearshore inventories, basin-wide physical habitat survey, landslides and sedimentation, instream flows and water rights, peak flows, chinook studies, road network survey, diking history (for restoration purposes), and acquisition priorities. Numerous reach-specific data gaps are also compiled from the work of the Stillaguamish Implementation Review Committee.

Best Functioning Habitat

Properly functioning habitat is the most cost-effective habitat to protect. The ability to restore degraded habitat back to its proper function is limited by our technical knowledge of the complex interactions associated with the different habitat types. Within the Stillaguamish watershed, the vast majority of the habitat has been impacted, at some level, by human activities. Habitat in need of protection within the watershed are those areas that still retain a significant portion of their original habitat functions or contain a good potential for re-establishing functions. Sub-basins were ranked for protection using five habitat factors: the current condition of the riparian area, level of recent landslide activity, beaver habitat, wetland conditions, and fish production. The sub-basins that received the highest ranking for protection include Squire Creek, Harvey/Armstrong, Upper South Fork, and Lower Pilchuck.