Prioritized Habitat Actions for Skookum Creek Based on Juvenile Coho Use
Interim Year 1 of 3

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Scott Steltzner
Squaxin Island Natural Resources

Introduction:
Skookum Creek Watershed is located in Mason County, WA. The mainstem of Skookum Creek is approximately 12 miles long with a basin area (mainstem and tributaries) of 20 square miles (***Figure 1***). There are two major tributaries in the Skookum basin, Little (RM 1.3) and Hurley-Waldrip (RM 6.5) creeks.

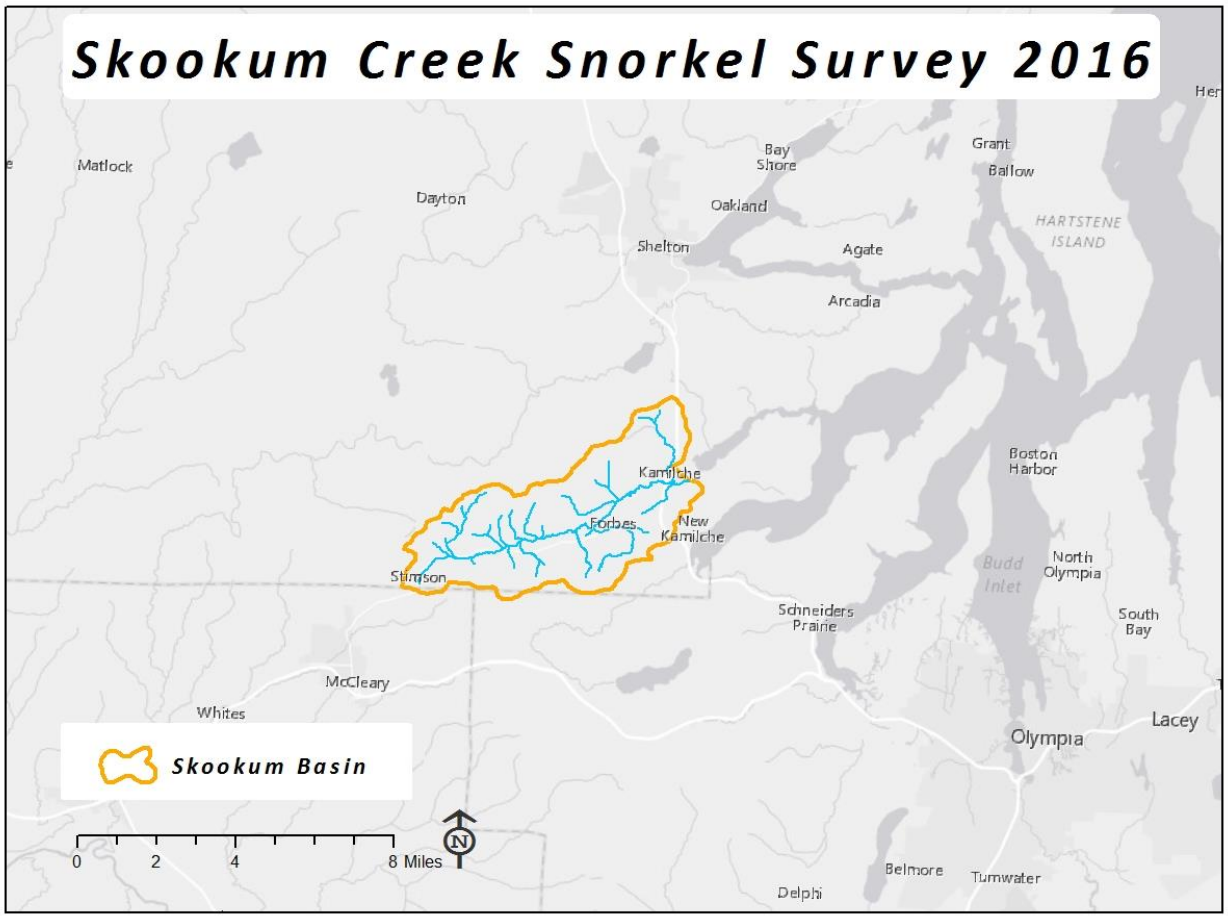

Figure 1. Skookum Creek Watershed Locator Map

Skookum creek and its tributaries begin in groundwater-fed headwaters and flow through managed timber lands, agricultural lands, the Squaxin Reservation, a small commercial/residential area in the lower watershed and exit through a Natural Preserve Area as it enters Skookum Inlet in South Puget Sound. The watershed consists of varied habitat types from complex, riffle-pool habitat with spawning gravels and good riparian cover to channelized, homogenous habitat with excess fines and areas of minimal to no riparian habitat. Skookum Creek supports several salmonid stocks including Fall Chum, Coho, small populations of steelhead, and robust populations of both searun and resident cutthroat trout.

Skookum Creek is federally listed (303d) for impaired waterbodies with elevated instream temperatures and excess fines as two primary factors for the listing. A cursory analysis of over 10 years of Spawner survey data indicates robust chum stocks that are well distributed throughout the watershed. Over 15 years of smolt trap data for Coho indicate no significant change in coho production for the Skookum Creek Watershed and overall relatively low abundance in out-migrating coho salmon.

Survey Timing, Methods and Locations:
Snorkel surveys were conducted in Skookum Creek on August 30th, September 7th and September 9th, 2016. Snorkel surveys were conducted in an effort to locate juvenile Coho within the watershed during summer base flow conditions and identify any trends in preferred habitat conditions/parameters as well as [potential] limiting factors. FLIR (Forward Looking Infrared) data, collected from flights on August 13, 2004, were used in order to identify potential cold water input areas (gaining reaches) and areas that were recorded at 16°C and colder. Snorkel Surveys were completed using the Salmonid Field Protocols Handbook (*American Fisheries Society. 2007. Salmonid Field Protocols Handbook. Johnson et al., Chapter 10*)

For the purposes of these initial surveys, there were two major factors that were assessed in order to identify stream reaches to be snorkeled, temperature and habitat. Two temperature parameters were used in order to prioritize stream reaches for on-the-ground assessment. A temperature change of 1° (C) or greater observed within the FLIR data were used as a survey parameter threshold for cold water input areas. Additionally, areas of 16° (C) and colder were selected given the known optimal temperatures for juvenile Coho. Two reaches were selected that, while outside of the optimal temperature range for juvenile Coho (temps were elevated well above optimal temperature ranges for juvenile Coho), there were intact habitat features that have been identified as preferred habitat conditions for salmonids and necessary for proper functioning conditions. Reach SK4 was identified based on intact riparian areas along both sides of the stream. Reach SK2 was a multi-year restoration site where multiple engineered log jams have been installed (***Figure 2***).

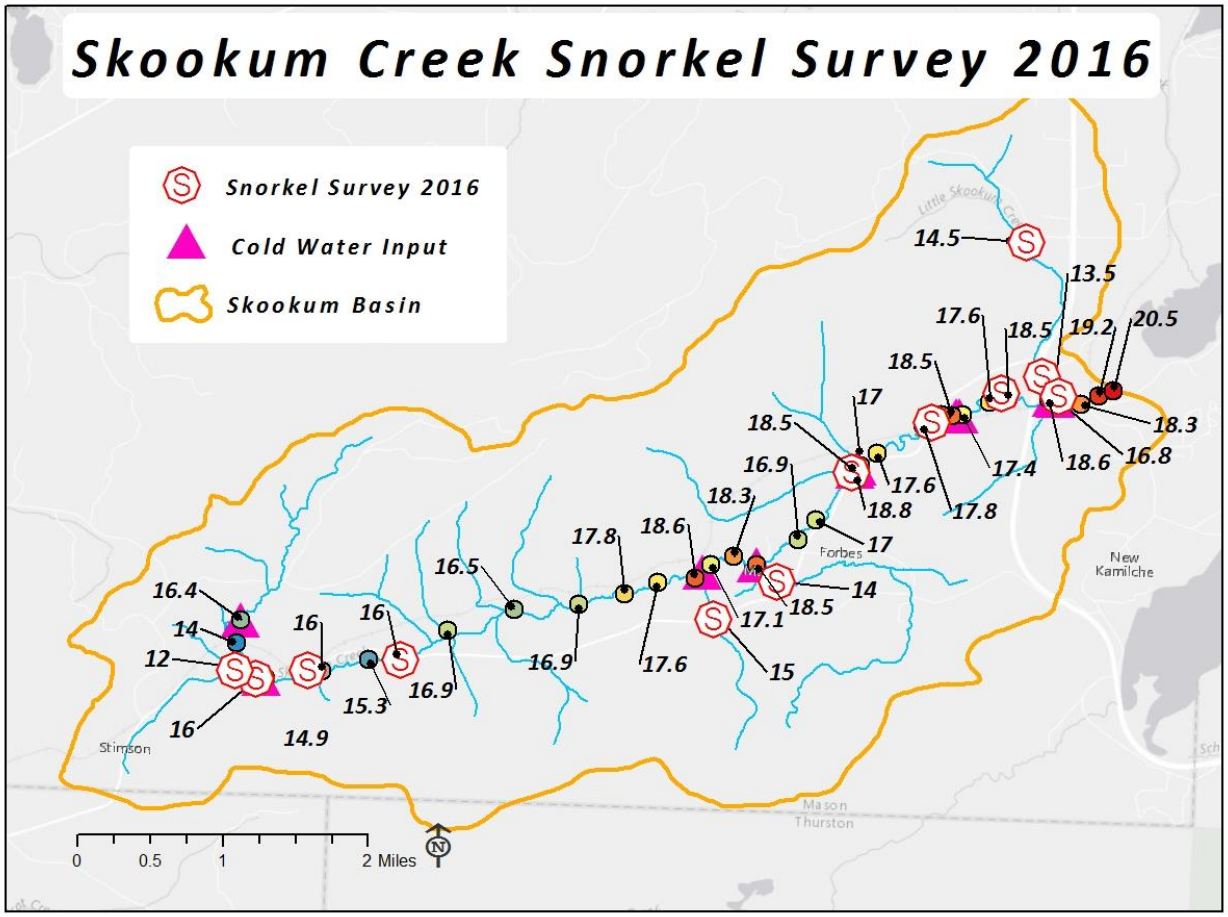

Figure 2. Snorkel Survey Sites, cold water input areas and temperature regime based on FLIR data

Observations:
Of all the reaches surveyed only those within the optimal temperature range (16° C and below) were found to have juvenile Coho occupancy (***Figure 3***).

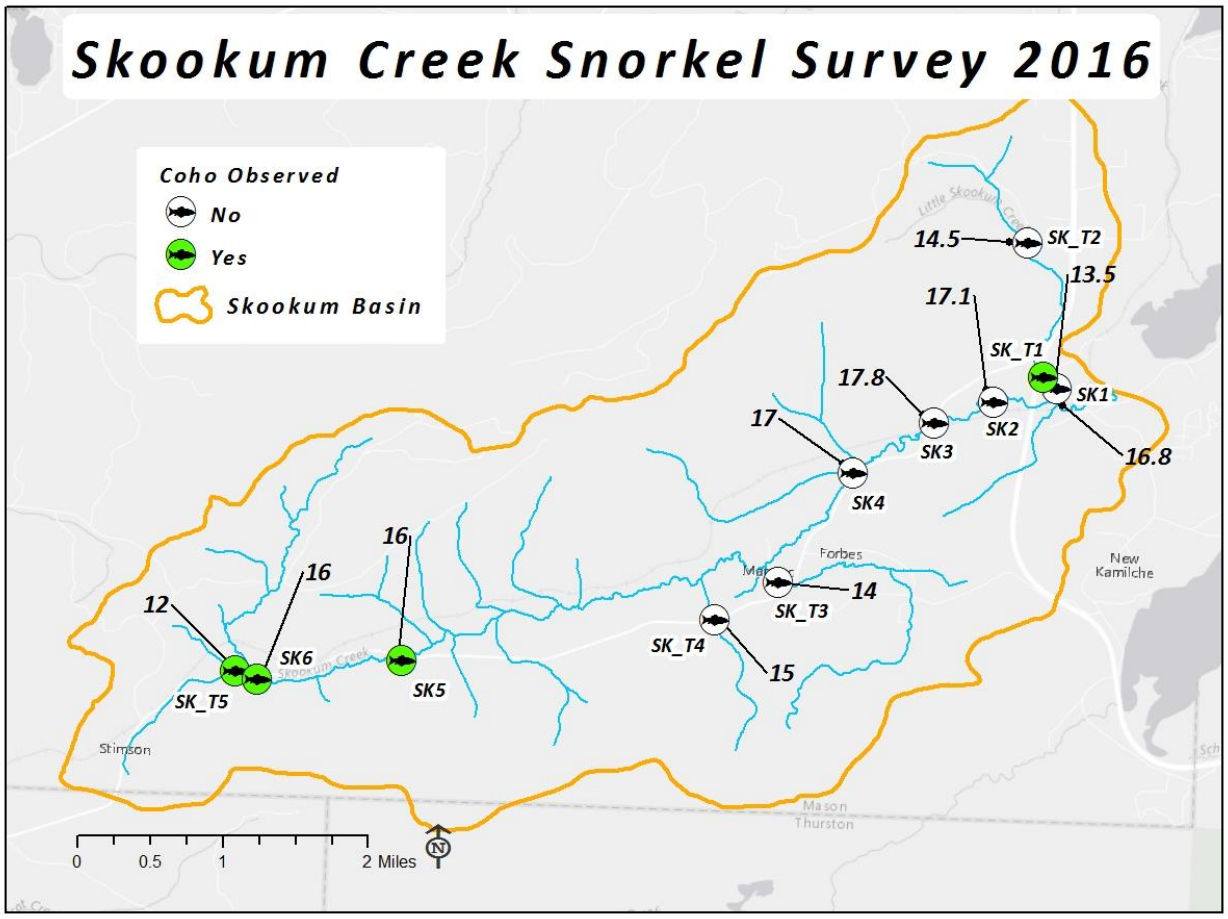

Figure 3: Observed Coho during 2016 snorkel survey

Adult Cutthroat trout were observed in most, but not all, of the other survey reaches. However, only one juvenile trout was observed in areas that had temperatures of 17 °C or higher and indications of temperature induced stress were apparent. Additionally, pool habitat was overwhelmingly the preferred instream habitat type being utilized by Coho. Cutthroat trout tended to utilize a greater variety of instream habitat types, but greater numbers were observed in pool habitat over other habitat types.

Survey results from this survey would indicate that temperature is a more significant factor for juvenile Coho use rather than intact/functioning habitat features. However, more data is needed. Additional snorkel surveys will be conducted in 2017 that will include a resurvey of the initial survey reaches from 2016 and expand to additional reaches within the watershed.

Life History Modeling

Assessment of habitat potential in Skookum Creek is based on Ecosystem Diagnosis and Treatment (EDT) (Lestelle et al. 2004). EDT is widely used in Puget Sound to assess habitat potential, identify limiting factors and to evaluate restoration alternatives. The procedure applies a set of species-habitat rules to a reach level description of the stream to estimate the capacity, productivity, equilibrium abundance and life history diversity. The assessment metrics are computed based on a Beverton-Holt production function. EDT output parameters can be related to the attributes of a Viable Salmon Population (VSP) as defined by NOAA Fisheries (McElhany et al. 2000).

Population Potential

Analysis for the entire watershed shows adult and juvenile abundances of:

- Current equilibrium adult abundance (without harvest) = 1,218
    - Historic adult abundance potential = 2,489
- Current smolt abundance (without harvest) = 10,169
    - Historic smolt abundance potential = 20,305

Analysis

According to the EDT analysis report, historical conditions were substituted in each reach to assess the restoration potential (see Appendix 1 for description and location of Reaches). Areas that showed a large increase in population performance when restored were considered priorities for restoration. Possible restoration actions were analyzed using EDT and these actions were organized into two management scenarios depicting a change at 5-year and 25-year intervals. The *5-Year Scenario* consists of restoration actions with a 5-year "lag time". I.e. the benefits from restoration activities will not be fully evident in fish populations until 5 years after the actions are implemented. The *25-Year Scenario* consists of restoration actions with a 25-year lag time.

EDT Results

If all restoration actions are completed for the 5-Year Scenario, the adult abundance of coho salmon in Skookum Creek was projected to increase approximately 36%. If all restoration actions are completed for the 25-Year Scenario the adult abundance of coho salmon in Goldsborough Creek was projected to increase approximately 54% from current conditions
(Figure 4).

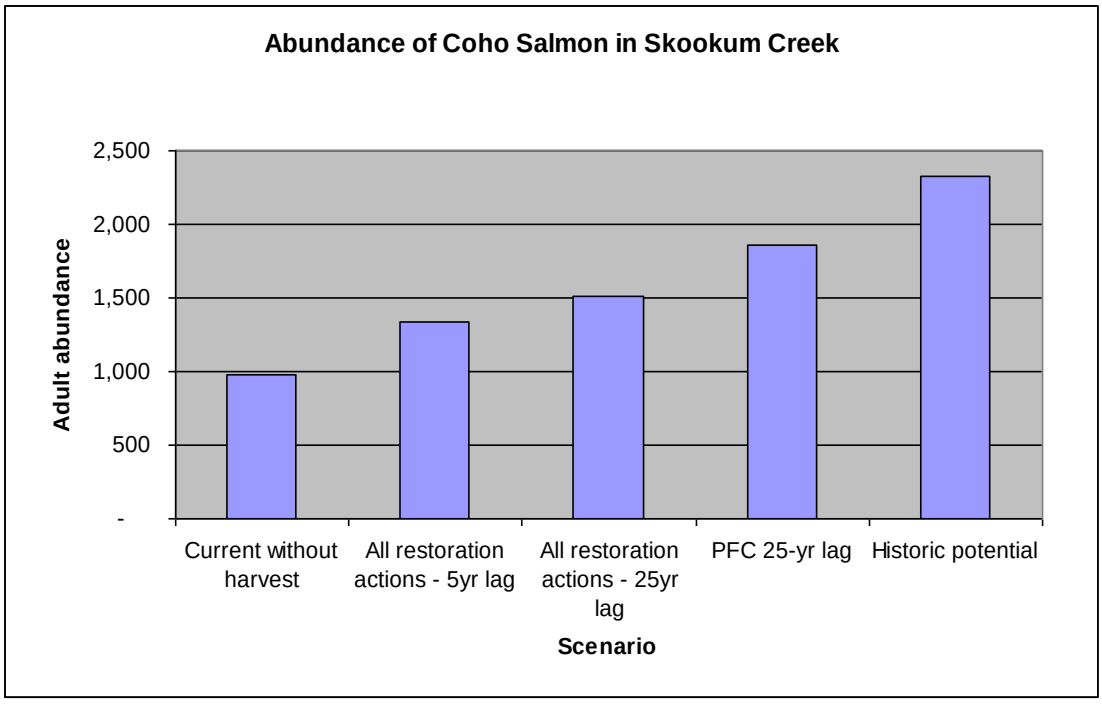

Figure 4. Abundance of coho salmon in Skookum Creek for all reaches under Current without harvest, 5-yr and 25-yr All restoration actions, Properly Functioning Conditions (PFC), and Historic potential scenarios.

Priority Areas Based on Juvenile Coho Presence

The following is a priority list of segments (and reaches within segments) identified by EDT's analysis. The priority list was based on restoration benefit to coho abundance:

1. Little Creek (SK_T1)- EDT Lit 1, Lit2
2. Upper Skookum (SK5 and SK6)- EDT SK13, SK14, SK15
3. Unnamed upper tributary (SK_T5)- EDT SFSK1

Priority Actions

Skookum Reach Name	Add large wood - 5 and 25 yr	Augment base flow - 5 and 25 yr	Remove obstructions - 5 and 25 yr	Improve passage effects - 5 and 25 yr	Restore channel migration zone - 5 and 25yr	Add gravel - 5 and 25 yr	Road maintenance - 5 and 25 yr	Decrease peak winter flows - 25yr	Restore riparian function - 25 yr
Lit 1	X						X		
Lit 2	X						X		
SK 13	X				X				X
SK 14	X			X			X		
SK 15	X			X			X		
SFSK1			X						