



# Proposal to increase Hatchery Production to Benefit Southern Resident Killer Whales

Washington Department of Fish and Wildlife  
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Washington  
Department of  
**FISH** and  
**WILDLIFE**

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## **SOUTHERN RESIDENTS AND THE SALISH SEA**

Southern Resident Killer Whales (SRKWs), also known as orcas, are a native to Washington’s waters and have adapted to prey upon salmon. They travel in pods, ranging from Alaska to central California but spend most of the year in the Salish Sea and Washington’s outer coast. SRKWs are an icon of the Pacific Northwest, holding significant cultural value to native tribes and contributing up to \$60 million a year to Washington’s tourism industry.

Between 1995 and 2003 the population of Southern Resident Killer Whales declined by 16 percent, prompting their classification as endangered under the U.S. Endangered Species Act (ESA) in 2005 and in Canada under the Species at Risk Act in 2003. Over the past year, the population has experienced further declines, dropping to just 74 whales. Washington state classified orcas as endangered in 2004. Recent pregnancy failures, deaths of calves and adults, and the overall poor health of the remaining SRKW population has generated serious concern among policy-makers and the public.

## **GOVERNOR INSLEE’S EXECUTIVE ORDER**

On March 14, 2018, Gov. Jay Inslee signed Executive Order 18-02. The Executive Order directed state agencies to take immediate actions to benefit SRKWs and established the Southern Resident Killer Whale Task Force to develop a prioritized action plan to advance recovery efforts. The Executive Order identified lack of prey, toxic contaminants and vessel noise as major threats to SRKWs, and so workgroups were established as a part of the Taskforce process to focus in on those areas for recovery.

## **LACK OF PREY**

Lack of prey is one of the key limiting factors for recovery of SRKWs. Chinook salmon is the primary prey base for SRKWs, making up 80-90 percent of their diet. Chum and coho salmon also make up a portion of SRKW’s diet at some times of the year. A specific directive of the Executive Order was to “identify the highest priority areas and watersheds for Southern Resident prey in order to focus or adjust, as needed, restoration, protection, incentives, hatcheries, harvest levels, and passage policies and program.” The Washington Department of Fish and Wildlife (WDFW) was tasked with co-chairing the Prey Working Group and identifying the salmon stocks most critical to Southern Residents in order to focus recovery actions such as increased hatchery production.

## LEGISLATIVE DIRECTION

In concert with the Governor's Executive Order, the Legislature appropriated \$825,000 in the 2018 Capital Budget to WDFW with the following conditions:

"(1)Up to \$130,000 of the appropriation is provided to review state hatcheries to identify opportunities to increase salmon production with a focus on the needs of the southern resident killer whale. The review must include a survey of existing hatcheries and cost estimates to increase salmon and steelhead production within existing capacity, and to identify where hatcheries could be expanded to increase production...The review must be provided to the governor's office, the office of financial management, and the fiscal committees of the legislature by October 1, 2018.

(2)Up to \$30,000 is provided for the installation of 15 new fish screens to support the southern resident orca recovery.

(3) Up to \$665,000 is provided for hatchery improvements to increase chinook production to support the southern resident orca recovery.

The Legislature also provided the following guidance in the operating budget:

(15) \$837,000 of the general fund-state appropriation for fiscal year 2019 is appropriated for the department to increase hatchery production of key prey species fish throughout the Puget Sound, coast, and Columbia river. The department shall work with the governor, federal partners, tribal co-managers, the hatchery scientific review group, and other interested parties to develop a biennial hatchery production plan by December 31, 2018, that will: (a) Identify, within hatchery standards and endangered species act constraints, hatchery programs and specific facilities to contribute to the dietary needs of orca whales; (b) consider prey species preferences and migratory patterns of orca whales; and (c) include adaptive management provisions to ensure the conservation and enhancement of wild stocks. The final plan will be reviewed by the hatchery scientific review group and submitted to the appropriate committees of the legislature by December 31, 2018.

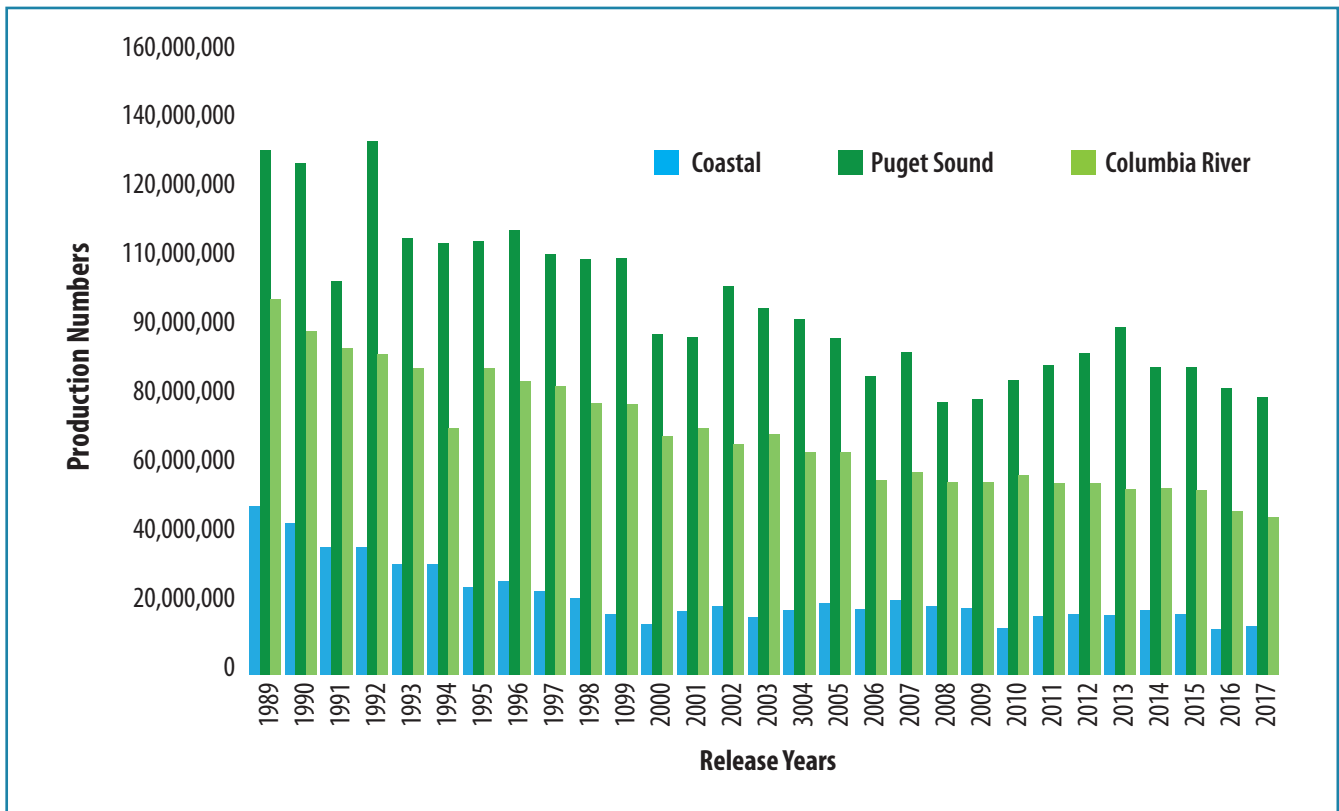


Chart 1: Hatchery production by region, 1989-2017

## HATCHERY PRODUCTION IN WASHINGTON STATE

Washington State has seen significant declines in both hatchery and wild Chinook in recent decades. Hatchery production has declined due to funding reductions and new hatchery reform policies at both the federal and state level. The chart below shows the decline in hatchery production of all salmon stocks from 1989–2017.

## HATCHERY PRODUCTION INCREASES ACCOMPLISHED IN 2018

In conjunction with Governor Inslee’s Executive Order, and utilizing funding provided by the Legislature, WDFW identified current facilities where salmon production could be increased to provide immediate relief to SRKWs. Table 1 on page 6 lists hatcheries by facility name, operator, and both the species and number of fish produced at those facilities. The table also shows the increase in production identified by WDFW at those facilities to benefit SRKW, and the percentage that increase represents compared to the current program.

The production in Table 1 represents the actual eggs taken and fish reared in the facilities for release in 2019. This production represents a 47 percent increase over current levels with 7.7 million more fish propagated in 2018 for release in 2019.

WDFW identified the facilities in Table 1 based on existing facility capacity, tribal co-manager agreement, and concurrence from the National Marine Fisheries Service (NOAA/NMFS). These facilities and the associated production were presented to the SRKW Prey Working Group and shared with the Hatchery Scientific Review Group, established by Congress in 1999 to review regional hatchery reform efforts.

The facilities also align closely with the report “Southern Resident Killer Whale Priority Chinook Stocks” (Appendix 6), produced by WDFW in partnership with NOAA. This report uses a Chinook stock spatial-temporal overlay and SRKW distribution, as well as other factors, to create a model to prioritize chinook stocks.

## Table 1. 2018 Hatchery Production Increases for Current Facilities

FACILITY NAME	OPERATOR	SPECIES	CURRENT PROGRAM	PRODUCTION INCREASE FOR SRKW	% INCREASE
Skookum Cr.	Lummi Nation	Late Spring Chinook	0	500,000	100%
Skookum Cr.	Lummi Nation	Late Spring Chinook	1,000,000	500,000	50%
Kendall	WDFW	Spring Chinook	200,000	500,000	250%
Whatcom Cr.	WDFW/ Bellingham Tech College	Fall Chinook	0	500,000	100%
Samish	WDFW	Fall Chinook	4,000,000	1,000,000	25%
Wallace River	WDFW	Summer Chinook	1,000,000	100,000	10%
Wallace River	WDFW	Summer Chinook	500,000	100,000	20%
Soos/ Palmer	WDFW	Fall Chinook	4,200,000	2,000,000	48%
Marblemount	WDFW	Spring Chinook	787,500	400,000	51%
Marblemount	WDFW	Coho	500,000	250,000	50%
Marblemount (South Sound Net Pens)	WDFW /Squaxin	Coho	1,100,000	300,000	27%
Lewis River	WDFW	Spring Chinook	1,350,000	900,000	67%
Forks Creek	WDFW	Spring Chinook	0	550,000	100%
Dungeness	WDFW	Coho	500,000	300,000	60%
Sol Duc	WDFW/ Quileute Tribe	Summer Chinook	70,000	530,000	757%
Sol Duc	WDFW/ Quileute Tribe	Summer Chinook	250,000	50,000	20%
Bear Springs	Quileute Tribe	Summer Chinook	60,000	75,000	125%
<b>Total Production</b>			<b>16,217,500</b>	<b>8,055,000</b>	<b>47%</b>



# HATCHERY PRODUCTION INCREASES PROPOSED FOR 2019 AND BEYOND

Throughout the Southern Resident Killer Whale Task Force process in 2018, both the Prey Working Group and the Task Force itself discussed hatchery increases to provide more prey for the orcas in the near term (within 3-10 years). Early on, WDFW led discussions with the Working Group on the principles and methods for how facilities should be selected for production increases. The Working Group, which included several scientists and experts familiar with salmon recovery efforts, stressed that increased production should be:

- Accomplished in conjunction with increased habitat protection and restoration so that hatchery and wild fish can be successful,
- Implemented carefully to have minimal effects on natural salmon stocks, and
- Monitored closely to better understand and adapt production as necessary.

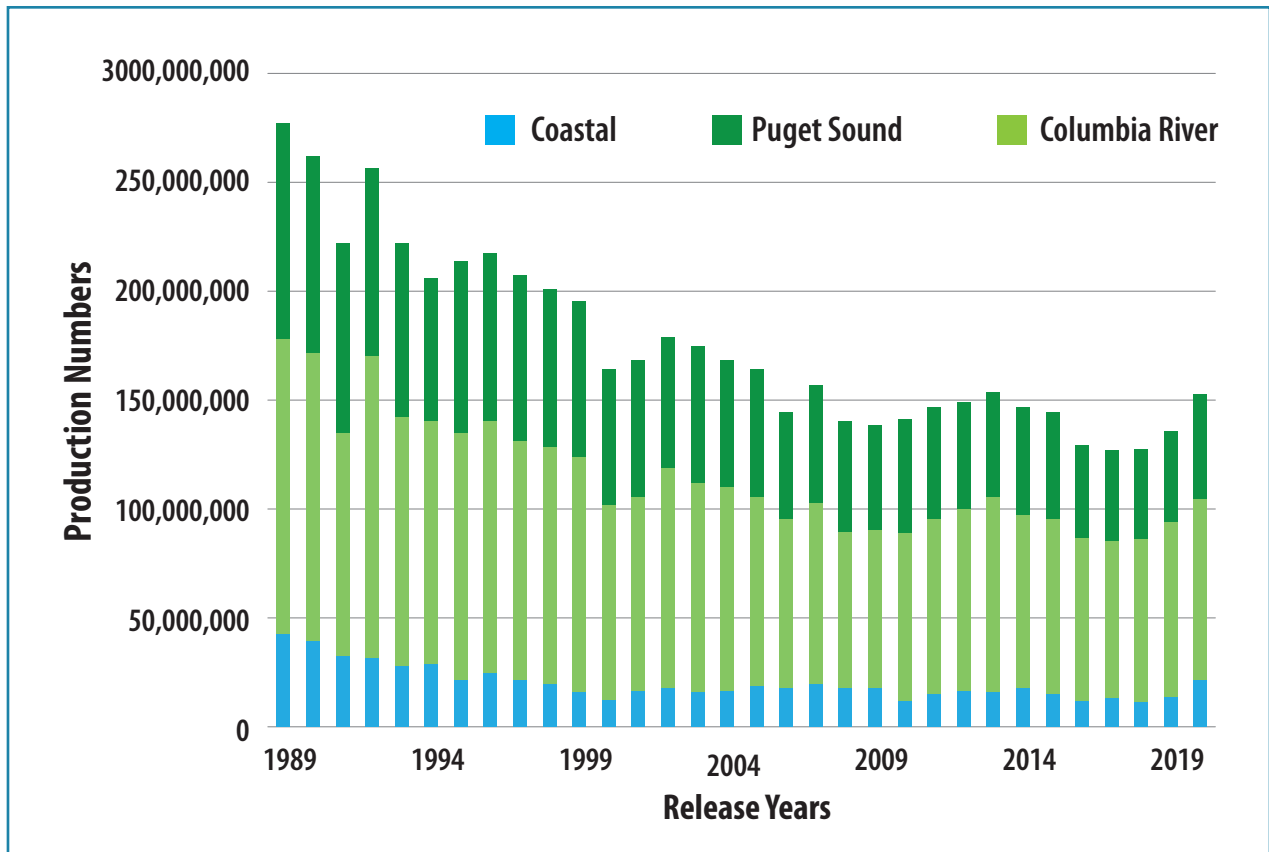
The Task Force sent its final Year 1 report to Governor Inslee on November 16, 2018, including Recommendation #6 regarding hatchery production (Appendix 1).

While the Southern Resident Killer Whale Task Force developed its recommendations for hatchery production, the Washington Fish and Wildlife Commission released a policy statement to provide guidance for the WDFW Director. On September 7, 2018, the Commission adopted general policy intent and guidance, proposing enhanced Chinook salmon abundance to benefit SRKW recovery while acknowledging secondary benefits for fisheries. The Commission proposed an increase of 50 million smolts beyond 2018 levels, along with additional hatchery enhancement proposals. (Appendix 3)

The Department has been working with our co-managers and federal partners in recent months to determine which salmon stocks and facilities are best suited for additional production increases to benefit SRKWs in the coming biennium. Key steps in this process include:

- Identifying Chinook salmon as the top priority for increased production since Chinook make up 80-90% of the SRKW's diet. Some smaller production increases are proposed for chum and coho salmon.
- Finding places where production could be increased with the least impact to natural salmon stocks and within the scope of existing ESA permits.
- Reinitiating consultation with our co-managers and NOAA to gain support for increased production of priority stocks where increased production was not included in existing ESA permits. WDFW is updating information necessary for ESA consultation.
- Initiating discussions with co-managers, U.S. Fish and Wildlife Service (USFWS), and NOAA to scope expansion opportunities at hatchery facilities that would allow for future increased production.
- Incorporating hatchery reform measures into the evaluation of production proposals, especially with regard to monitoring the proportion of hatchery-origin spawners on the spawning grounds.
- Adopting adaptive management measures to allow for course adjustments should significant increases in hatchery fish on spawning grounds be observed.

In recent years, WDFW has significantly reduced annual salmon production due to lack of funding and hatchery reform. This has contributed to a lack of salmon available for SRKW consumption. The chart below shows the historic declines in hatchery production, by region, from a high in 1989 of approximately 275 million salmon to a low in 2017 of approximately 145 million. The chart also shows future production for 2018-2021, demonstrating WDFW's commitment to reverse the previous trend and provide more salmon for SRKWs.



**Chart 2: Total hatchery production by region, 1989 - 2020**

The below table, “Table 2. 2019-21 Production Plan,” shows planned salmon production by region, facility, species, and the increase in the number of fish produced in the years ahead. The total increase in the number of salmon produced across all facilities and species is 24,175,000. This increase will begin in 2019, with further increases in out years, dependent upon continued funding and adaptive management reviews. The dollar figures in Table 2 represent the Department’s hatchery production funding request for the 2019-21 biennium. The Governor funded \$6.35 million to support increases to hatchery production in his proposed 2019-21 operating budget along with \$70 million in hatchery renovations and \$1 million for a hatchery infrastructure master plan in his proposed 2019-21 capital budget. The legislature provided \$837,000 in the 2018 supplemental operating budget proviso to produce 7,055,000 chinook in North Sound and the Washington Coast. This production is included in Table 2.



## Table 2. 2019-21 Hatchery Production Plan

LOCATION	FACILITIES	SPECIES/PRODUCTION NUMBERS			FUNDING REQUEST
		Chinook	Coho	Chum	
North Sound	Wallace Kendall Marblemount Whatcom Samish Soos/Palmer	4,900,000	600,000	1,500,000	\$678,270
South Sound/Hood Canal/ Straits	Minter/Hupp South Sound Net Pens Hood Canal Dungeness	900,000	600,000	3,000,000	\$ 903,134
Washington Coast	Forks Creek Humptulips Naselle Bingham Nemah Sol Duc	7,800,000	1,100,000	1,000,000	\$2,583,610
Columbia River	Beaver Creek Lyons Ferry Kalama Ringold Lewis River	2,100,000	675,000	-	\$1,497,174
SRKW Production Coordinator					\$306,152
Hatchery Pilot Studies					\$381,660
Species Totals		15,700,000	2,975,000	5,500,000	
Total Production			24,175,000		\$ 6,350,000

\*Table does not include salmon production at facilities managed by tribal co-managers, Oregon Department of Fish and Wildlife, or the US Fish and Wildlife Service. That production can be found in Appendices 4 and 5.

## ADAPTIVE MANAGEMENT

A key objective advanced by the Southern Resident Orca Task Force was to “maximize production of Chinook for the benefit of Southern Resident orcas while minimizing competition with wild stocks.” To achieve this goal, the task force recommends that WDFW adopt a variety of adaptive management efforts to test and refine production measures, using emerging science, knowledge and experience to guide those decisions.

WDFW will be using these strategies outlined in Recommendation #6 of the task force report to meet the objective of providing more salmon for orcas without compromising wild stocks. Monitoring and evaluation should occur annually to ensure adequate data is collected to make scientifically sound decisions while allowing for nimble adjustments in management strategies when warranted.

WDFW will monitor and evaluate the following to meet the objective:

- Proportions of hatchery origin fish in natural spawning areas. Adaptive management solutions may include:
  - Installing weirs and/or traps if feasible.
  - Increasing fishing in terminal areas to directly target hatchery fish.
  - Adjusting production levels.
- Coded-wire tag fish at rates that allow for effective monitoring of survival rates, stray rates, contributions to SRKWs and fisheries, and impacts to ESA listed species. If WDFW finds that survival rates are decreasing due to increased hatchery production, the Department may look into the following possible remedies:
  - Evaluate ocean conditions.
  - Utilize pilot studies results to adjust release timing, size of fish at release, or other variables that may reduce impacts on natural stocks or increase survival of smolts.
  - Adjust production levels
  - Maintain the highest standard of fish health standards, monitoring, and treatment.

## CONCLUSION

The Washington Department of Fish and Wildlife strongly supports this multi-dimensional initiative to recover our state’s SRKWs population, and we are pleased to play a role in that effort. Increased hatchery production, paired with investments in habitat protection and restoration to support hatchery and wild salmon, is the state’s best opportunity to increase the prey of Southern Resident Killer Whales in the near term. This report does not include all hatchery facilities run by the tribes or public utilities, which may also have space and availability within current permits to produce more prey for orca.

# Appendix 1

Hatchery Production Recommendation from the Southern Resident Killer Whale Task Force:

**Recommendation 6: Significantly increase hatchery production and programs to benefit Southern Resident orcas consistent with sustainable fisheries and stock management, available habitat, recovery plans and the Endangered Species Act. Hatchery increases need to be done in concert with significantly increased habitat protection and restoration measures.**

- Authorize/provide funding for Washington Department of Fish and Wildlife and co-managers to significantly increase hatchery production at facilities in Puget Sound, on the Washington Coast and in the Columbia River basin in a manner consistent with sustainable fisheries and stock management and the ESA. Decisions on hatchery production are made by WDFW and tribal co-managers, with Endangered Species Act consultation from the National Oceanic and Atmospheric Administration and the U.S. Fish and Wildlife Service where appropriate. The Washington Fish and Wildlife Commission adopted a policy statement in 2018 indicating support for hatchery increases of approximately 50 million smolts beyond 2018 levels to produce more Southern Resident orca prey and fisheries benefits; the task force supports significant increases in hatchery production and habitat protection and restoration.
- In 2019, undertake hatchery pilots to test and refine methods and practices (location, timing of release, age, size) that maximize production of Chinook for the benefit of Southern Resident orcas while minimizing competition with wild stocks.
- Manage the increase in hatchery production consistent with available and improved habitat to enable survival of both hatchery and wild fish stocks.
- Provide increased funding to cover the operational, infrastructure, management and monitoring costs associated with increased hatchery production.
- Conduct ongoing adaptive management, five-year comprehensive reviews and the science needed to support a sustained increase in hatchery production.

## Implementation details:

To supplement 2019 hatchery production increases, fund WDFW and co-managers in fiscal year 2020 and into the future to increase hatchery production for the benefit of Southern Resident orcas at facilities in Puget Sound, on the Washington Coast and in the Columbia River basin, in a manner consistent with sustainable fisheries and stock management, state and federally adopted recovery plans and the ESA. Increased production can be assessed at appropriate state, tribal, federal or private facilities that most benefit orcas. The governor should also ask that other funders – such as NOAA, USFWS, Bonneville Power Administration and the Oregon Department of Fish and Wildlife – of hatchery programs for Chinook stocks that are a priority for Southern Resident orcas maintain or increase production levels for those stocks, so that additional hatchery investments result in an overall increase in prey abundance. Increasing hatchery production will require funding for the following activities:

- Adaptive management and five-year comprehensive reviews. To continue ongoing hatchery production with funding at the increased levels, WDFW must conduct annual adaptive management and five-year comprehensive reviews and adjust production and practices accordingly to limit impacts on natural salmon stocks if the reviews provide evidence of significant risk to the recovery of natural salmon stocks. These reviews should consider stray rates, productivity, juvenile rearing carrying capacity, density dependence, smolt-to-adult ratios, genetic fitness and other appropriate metrics to determine if action is needed to ensure the health or recovery of natural stocks. In coordination with this effort, annual and five-year reviews will evaluate the effectiveness of increased hatchery production to increase salmon available to Southern Resident orcas at times and locations determined critical to successful feeding, and to ensure effective support of fisheries management plans related to the Pacific Salmon Treaty, tribal treaty right fisheries and other plans

and adjust hatchery production and practices to also maximize benefits to orcas and fisheries. Accomplishing this review will require additional state funding for WDFW and co-managers in future years (such as in years when hatchery-produced fish return to Washington waters).

- Production at the 2019 level. Although the Legislature provided funding in fiscal year 2019 to increase hatchery production with existing infrastructure, continued funding is needed to continue these production increases.
- Additional science and infrastructure to support increased production for orcas. Additional funding is needed to expand production beyond the 2019 level driven by the Southern Residents' needs. Expanding production significantly will require additional hatchery facility capacity upgrades and should use the best available science on hatchery production to adaptively manage the program to consider the factors listed above.
- Collaboration among WDFW and co-managers on hatchery production decisions.

The governor and Legislature should also provide funding to WDFW and co-managers to coordinate with NOAA and Long Live the Kings and begin testing pilot actions in hatcheries in 2019. These pilots should aim to: (1) increase marine survival of Chinook, (2) adjust return timing and locations to align with orcas' needs, (3) assess the feasibility and develop a plan to potentially increase size and age of returns and (4) reduce potential competition with wild fish. This work should build from and test findings of the Salish Sea Marine Survival Project, NOAA's salmon ocean program and other relevant efforts that are working to determine what is driving the survival of Chinook as they migrate downstream and through the marine environment. Hatchery pilots may require additional production to ensure that existing production levels are not affected by these trials, which have uncertain outcomes in terms of fish survival. Pilot hatchery actions should be used to gather science to adaptively manage hatchery production levels and practices, including guiding the continued increases of hatchery production over time to provide more adult Chinook for Southern Residents, while ensuring that increases are done in a manner that complies with ESA guidelines and that does not impact Chinook recovery.



## Appendix 3

### 2018 Washington Fish and Wildlife Commission Policy Statement on Hatchery Production Increases

1. At a high policy level, the Commission proposes a significant enhancement in chinook salmon abundance, via increases in releases from hatchery programs, approximating 50 million smolts beyond 2018 status quo releases. This is to include approximately 30 million from Puget Sound locations and approximately 20 million from Columbia River locations.
2. The Director is tasked with prioritizing what can be done in the most immediate time frame as the highest priority, with the remainder to be done as soon as possible.

[https://wdfw.wa.gov/commission/meetings/2018/09/minutes\\_sep0718.pdf](https://wdfw.wa.gov/commission/meetings/2018/09/minutes_sep0718.pdf)



# Appendix 4

2019-21 Biennial ODFW/USFWS Production Capacity

Location	Facilities	Species/Production Numbers		
		Chinook	Coho	Chum
Columbia River	Leaburg Willamette Bonneville Spring Creek	8,750,000		
<b>Total Production</b>			<b>8,750,000</b>	

# Appendix 5

## 2019-21 Biennial Tribal Co-Manager Production Plan

Location	Facilities	Species/Production Numbers		
		Chinook	Coho	Chum
North Sound	Whiter River Hatchery	200,000		
South Sound/Hood Canal/Straits	Clarks Creek	1,575,200	1,200,000	1,500,000
	South Sound Net Pens			
	Port Gamble Net Pens			
	Enetai			
Washington Coast	Quinault	570,000	-	-
	Quileute			
Columbia River		-	-	-
<b>Total by Species</b>		<b>2,345,200</b>	<b>1,200,000</b>	<b>1,500,000</b>
<b>Total Production</b>		<b>5,045,200</b>		

## Appendix 6

NMFS and WDFW (National Marine Fisheries Service and Washington Department of Fish and Wildlife). 2018. Southern Resident killer whale priority Chinook stocks. Unpublished draft report.

**SOUTHERN RESIDENT KILLER WHALE  
PRIORITY CHINOOK STOCKS REPORT**

NOAA Fisheries West Coast Region and  
Washington Department of Fish and Wildlife June 22, 2018

# SOUTHERN RESIDENT KILLER WHALE PRIORITY CHINOOK STOCKS

## Outline of Prey Prioritization Conceptual Model

NOAA Fisheries and Washington Department of Fish and Wildlife (WDFW) have developed a framework to identify Chinook salmon stocks that are important to Southern Resident killer whales (SRKW) to assist in prioritizing actions to increase critical prey for the whales. The framework currently includes three factors that contribute to the identification of priority Chinook salmon populations. Note, here “population” could mean management unit, stock, ESU, run, etc. Each of the three factors has a range of scores which affects its weight. For each Chinook population ranging from Southeastern Alaska to California, a total score is calculated by adding up the three individual factor scores. The Chinook salmon populations with the highest total scores are considered the highest priority to increase abundance to benefit the whales. Several sensitivity analyses provided initial help in understanding how the weighting/scoring affects the priority list. The conceptual model, factors, and scoring were reviewed at a workshop sponsored by the National Fish and Wildlife Foundation and modifications were made to incorporate feedback from participants. The factors, scoring and priority list can be adapted as new scientific information becomes available.

The three evaluation factors include:

### **FACTOR 1- Observed Part of SRKW Diet**

Description and data sources: Prey tissues/scales and fecal samples have been collected from 2004 – present (Hanson et al. 2010, Ford et al. 2016, Hanson et al. in prep). From the prey tissues/scales collected, Genetic Stock Identification (GSI) were run to identify the Chinook stocks in the diet. The majority of samples have been collected in the summer months in inland waters of WA and British Columbia.

#### Assumption

- Chinook populations that have been observed in the diet will have higher priority than those that have not.

**Caveat:** There is currently no spatial correction factor for sample collection (stocks originating from near the sample locations are more likely to be collected), no correction factor for abundance (more abundant stocks are more likely to be identified in the diet), and no correction factor for potential whale selectivity (older, larger fish more likely to be recovered in scale samples).

### **FACTOR 2- Consumed During Reduced Body Condition or Diversified SRKW Diet**

Description and data sources: For the second factor, “Consumed During Reduced Body Condition or Diverse Diet”, stocks consumed during times of potential reduced body condition and increased diet diversity receive additional weight.

Since 2008, NOAA’s SWFSC has used aerial photogrammetry to assess the body condition and health of SRKWs, initially in collaboration with the Center for Whale Research and, more recently, with the Vancouver Aquarium and SR<sup>3</sup>. Photogrammetry data has been collected during seven field efforts in five years, including September 2008, 2013, and 2015, and May and September 2016 and 2017 (Durban et al. 2017; Fearnbach et al. 2018). The proportion of Chinook salmon consumed in whales’ diet was estimated by season and region (inland vs coastal waters) using the data from prey tissues/scales and fecal samples (Hanson et al. 2010, Ford et al. 2016, Hanson et al. in prep).

#### Assumptions

- Reduced body condition and diverse diet occurs from Oct through May.
- Whales switch from preferred prey, Chinook salmon, to other salmonids or prey when Chinook are less available.

### **FACTOR 3- Degree of Spatial and Temporal Overlap**

Description and data sources: Recent prey mapping from Shelton et al. in press (Coded Wire Tag data) was used to assess the overlap in time and space distribution of individual fall Chinook salmon stocks and SRKWs. The distribution/timing of all Chinook salmon stocks across the whales’ range from California to Southwest Vancouver Island (and the inland waters of the Salish Sea) was divided into weighted spatial/temporal areas. Currently, Shelton et al. in press includes detailed information on fall runs. Available data for spring Chinook was included, but detailed analyses of data from spring runs are in progress and will be completed in the next two years, incorporating both recoveries in directed Chinook troll fisheries, and Chinook recovered as bycatch in fisheries not targeting Chinook.

For spring run Chinook we relied on reports from the Chinook Technical Committee of the Pacific Salmon Commission (PSC 2018a, 2018b) and published literature (e.g. Satterthwaite et al. 2013, Wahle et al. 1981, Weitkamp 2010) to assign approximate ocean distributions. For stocks with less information, we assumed that the risk to predation was low in seasons and regions that did not correspond to the return timing and origin of each stock (for example, Columbia spring Chinook are assumed to be most available to whales in winter and spring months near the mouth of the Columbia River, but because of their approximate ocean distribution, they are not available in other regions or seasons – particularly mid-summer to fall). Because of limited recoveries, we also assumed that for stocks returning to the Salish Sea (Strait of Georgia, Puget Sound), the distribution was similar in the Salish Sea to Southwest Vancouver Island distributions.

The spatial/temporal Areas currently include: 1) Southwest Vancouver Island (WCVI); 2) Salish Sea; 3) Cape Falcon, Oregon north to British Columbia border; 4) Cape Falcon, OR south to Cape Mendocino (northern California); 5) Cape Mendocino, CA to Point Sur, CA. Seasons are defined as: Spring: April-May; Summer: June-July; Fall: Aug-Oct; Winter: November-March. These areas reflect the division of Chinook run timing (approximately), correspond to periods of coded wire tag recoveries in fisheries, and correspond to predictable patterns of SRKW movement. SRKW distribution data was assessed from multiple sources (e.g. Center for Whale Research, The Whale Museum, NWFSC satellite tagging, NWFSC coastal hydrophones, coastal spring/winter NWFSC cruises, other opportunistic observations).

### Assumptions

- Chinook salmon stocks that overlap in space and time are potential prey.
- Chinook salmon stocks that have a higher degree of overlap in space and time have a higher priority than stocks that have a relatively lower degree of overlap.
- Weighted spatial/temporal areas accommodate variation in the distribution of SRKW and Chinook salmon

**Caveat-** Coded Wire Tag (CWT) model interpolates movement of stocks seasonally to account for gaps in fishing effort. Also, the hatchery releases going into the CWT model are not comprehensive, but rather model the distribution of major stock groupings. Within regions and run type (e.g. fall Puget Sound), the ocean distribution is assumed to be the same for all watersheds. Smaller release groups, such as those from the San Juan Islands (SJUA in RMIS) were not included in Shelton et al. because of the low recovery rates – though the ocean distribution of these fish is assumed to be similar to those populations originating from Puget Sound. In particular, ocean distributions of spring run stocks tend to be less well understood than fall stocks. We use the best information available but acknowledge that advances in estimates of ocean distribution of many stocks will improve with the completion of on-going research over the course of the next 1-3 years.

## **Weight and Scoring**

### FACTOR 1

If the Chinook stock was observed  $\geq 5\%$  of the whales diet in summer or fall/winter/spring, the stock receives 1 point. If it was not observed in the diet, the stock receives 0 points. This prioritizes stocks observed in the diet compared to those that have not been observed.

### FACTOR 2

Current data indicate that both reduced body condition and a diversified diet occur in non- summer months. If a stock is consumed during October through May, it receives 1 point. If it is consumed during June through September, the stock receives 0 points. This prioritizes stocks that are consumed during periods with a higher likelihood of food limitation or stress in the whales' health.

### FACTOR 3

For each space/time area described above, if more than 25% of the Chinook stock is distributed in that area, the area receives a sub-score of 2. For areas that contain between 5% and 25% of the Chinook stock, the area receives a sub-score of 1. If an area contains less than 5% of the Chinook stock, it receives a sub-score of 0. The sub-scores for each area are multiplied by an importance weight for each area. The final score for the Chinook stock/population is the sum of the products of the scores and weight for each area normalized such that the highest possible score of a given stock is equal to 3.

Here are the seven space/time combinations included in Factor 3 and their associated weights.

1. WA coast in Winter/Spring; weight = 0.5



2. WA coast in Summer/Fall; weight = 0.5
3. Salish Sea in Winter/Spring; weight = 0.5
4. Salish Sea in Summer/Fall; weight = 0.5
5. OR / N.CA coast in Winter/Spring; weight = 0.25
6. CA coast in Winter/Spring ; weight = 0.25
7. West Coast of Vancouver Island in Winter/Spring; weight = 0.5

The Salish Sea and coastal waters off WA have a 0.5 weight. The areas off British Columbia, OR/North CA and CA have a 0.25 weight. This structure means that the areas of highest SRKW use – the Salish Sea and coastal WA – are treated as twice as important as the other areas.

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## Priority Chinook Stocks Using Conceptual Model

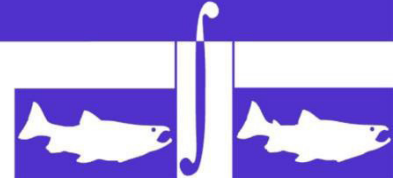
ESU / Stock Group	Run Type	Rivers or Stocks in Group	Diet Contribution Score (0,1)	Killer Whale Reduced Body Condition or Diverse Diet Score (0,1)	Spatio-Temporal Overlap Score (0 - 3)	Total Score (sum of factors)
			Avg. Factor 1 (see note)	Avg. Factor 2 (see note)	Avg. Factor 3	
Northern Puget Sound	Fall	Nooksack, Elwha, Dungeness, Skagit, Stillaguamish, Snohomish	1	1	3.00	5.00
Southern Puget Sound	Fall	Nisqually, Puyallup, Green, Duwamish, Deschutes, Hood Canal systems	1	1	3.00	5.00
Lower Columbia	Fall	Fall Tules and Fall Brights (Cowlitz, Kalama, Clackamas, Lewis, others)	1	1	2.63	4.63
Strait of Georgia	Fall	Lower Strait (Cowichan, Nanaimo), Upper Strait (Klinaklini, Wakeman, others), Fraser (Harrison)	1	1	2.63	4.63
Upper Columbia & Snake Fall	Fall	Upriver Brights	1	1	2.25	4.25
Fraser	Spring	Spring 1.3 (upper Pitt, Birkenhead; Mid & Upper Fraser; North and South Thompson) and Spring 1.2 (Lower Thompson, Louis Creek, Bessette Creek)	1	1	2.25	4.25
Lower Columbia	Spring	Lewis, Cowlitz, Kalama, Big White Salmon	1	1	2.25	4.25
Middle Columbia	Fall	Fall Brights	1	1	2.06	4.06
Snake River	Spring-Summer	Snake, Salmon, Clearwater	1	1	1.88	3.88
Northern Puget Sound	Spring	Nooksack, Elwha, Dungeness, Skagit (Stillaguamish, Snohomish)	1	1	1.88	3.88
Washington Coast	Spring	Hoh, Queets, Quillayute, Grays Harbor	1	1	1.69	3.69
Washington Coast	Fall	Hoh, Queets, Quillayute, Grays Harbor	1	1	1.69	3.69
Central Valley	Spring	Sacramento and tributaries	1	1	1.50	3.50
Middle & Upper Columbia Spring	Spring	Columbia, Yakima, Wenatchee, Methow, Okanagan	1	1	1.31	3.31
Middle & Upper Columbia Summers	Summer		1	1	1.31	3.31
Fraser	Summer	Summer 0.3 (South Thompson & lower Fraser; Shuswap, Adams, Little River, S. Thompson mainstem, Maria Slough in Lower Fraser) and Summer 1.3 (Nechako, Chilko, Quesnel; Clearwater River in North Thompson)	1	0	1.88	2.88
Central Valley	Fall and Late Fall	Sacramento, San Joaquin	1	1	0.75	2.75
Klamath River	Fall	Upper Klamath and Trinity	1	1	0.75	2.75
Klamath River	Spring	Upper Klamath and Trinity	1	1	0.75	2.75

ESU / Stock Group	Run Type	Rivers or Stocks in Group	Diet Contribution Score (0,1)	Killer Whale Reduced Body Condition or Diverse Diet Score (0,1)	Spatio-Temporal Overlap Score (0 - 3)	Total Score (sum of factors)
			Avg. Factor 1 (see note)	Avg. Factor 2 (see note)	Avg. Factor 3	
Upper Willamette	Spring	Willamette	0	0	2.25	2.25
Southern Puget Sound	Spring	Nisqually, Puyallup, Green, Duwamish, Deschutes, Hood Canal systems	0	0	1.88	1.88
Central Valley	Winter	Sacramento and tributaries	0	0	1.50	1.50
North & Central Oregon Coast	Fall	Northern (Siuslaw, Nehalem, Siletz) and Central (Coos, Elk, Coquille, Umpqua)	0	0	1.41	1.41
West Coast Vancouver Island	Fall	Roberts Creek, WCVI Wild	1	0	0.38	1.38
Southern Oregon & Northern California Coastal	Fall	Rogue, Chetco, Smith, lower Klamath	0	0	0.75	0.75
Southern Oregon & Northern California Coastal	Spring	Rogue	0	0	0.75	0.75
California Coastal	Fall	Mad, Eel, Russian	0	0	0.75	0.75
California Coastal	Spring	Mad, Eel, Russian	0	0	0.75	0.75
Southeastern Alaska	Spring	Taku, Situk, Chilkat, Chickamin, Unuk, Alsek, Stikine	0	0	0.00	0.00
Northern BC	Spring	Yakoun, Skeena, Nass	0	0	0.00	0.00
Central BC	mostly Summer	Atnarko, Dean River, Rivers Inlet	0	0	0.00	0.00

Note: Factor 1 and 2 are not literal averages. If a major component of the rivers in the ESU / Stock group had 1 then this was scored a 1. If no major component was scored a 1, this was scored a 0

# Appendix 7

Hatchery Scientific Review Group Review of WDFW Hatchery Production increases.



September 28, 2018

Mr. Kelly Susewind

Washington Department of Fish and Wildlife

P.O. Box 43200

Olympia, WA 98504-3200

Director Kelly Susewind,

Pursuant to the recent Capital budget passed by the Washington State Legislature in 2018, the Hatchery Scientific Review Group (HSRG) was asked to consult with WDFW on increasing production for Southern Resident Killer Whales using existing hatchery capacity.

As you know, the US Congress established the Hatchery Reform Project in 2000 as part of a comprehensive effort to conserve indigenous salmonid populations, assist with the recovery of naturally spawning populations, provide sustainable fisheries, and improve the quality and cost-effectiveness of hatchery programs.

**Methods:**

For this HSRG evaluation, we provide detailed comments on a single aspect of hatchery impacts; that is, the potential genetic impact of increased hatchery/natural interactions (loss of fitness in natural populations). To accomplish this, each natural salmon/steelhead population is assigned one of three designation by the Managers, based on its biological significance:

1. Primary populations- were determined to require the lowest level of hatchery influence.
2. Contributing populations- an intermediate level of hatchery influence.
3. Stabilizing populations- current level of hatchery influence deemed suitable.

In addition, it is helpful for the Managers to identify a current “Recovery Phase” for each Primary or Contributing population to identify its current status (Preservation, Re-colonization, Local Adaption or Fully Recovered). Stabilizing populations are not usually assigned a Recovery Phases as their current condition is deemed suitable.

To address the loss of fitness risks posed by hatchery fish, the HSRG adopted a set of recommendations for hatchery influence on natural populations (Table 1). These recommendations, which vary depending on the biological significance of the population, are intended to support recovery of biologically significant natural populations (Primary and Contributing) while retaining overall harvest benefits (often using Stabilizing populations). They are also designed to be simple to implement and monitor. So, each population will have a designation, as well as a recovery phase (for each Primary or Contributing population) identified. It is important to note that while pHOS and PNI levels are “not specified” for the Preservation and Recolonization phases, the HSRG encourages the use of natural-origin brood (pNOB) to the extent possible during those Phases.

**Table 1. HSRG recommendations for pHOS and PNI during each phase of recovery.**

Phase	HSRG Recommendations
Preservation	No pHOS or PNI recommendations
Recolonization	No pHOS or PNI recommendations
Local Adaptation	All recommended guidelines for pHOS and PNI apply
Full Restoration	All recommended guidelines for pHOS and PNI apply
<b>Guidelines for pHOS and PNI during the Local Adaptation and Full Restoration Phases</b>	
Primary	Integrated hatchery programs—PNI > 0.67; pHOS <30%
	Segregated hatchery programs—pHOS < 5%
Contributing	Integrated hatchery programs—PNI > 0.50; pHOS <30%
	Segregated hatchery programs—pHOS < 10%
Stabilizing	Integrated hatchery programs—current condition
	Segregated hatchery programs—current condition

<sup>1</sup> This measure is approximated by  $PNI = pNOB / (pNOB + pHOS)$  where pNOB = mean proportion of a broodstock composed on natural-origin fish each generation, pHOS = the mean (or equilibrium) proportion of naturally-spawning fish composed of hatchery-origin fish each generation, and PNI is the Proportionate Natural Influence on the population and varies from 0 to 1.0 (HSRG 2009, Paquet et al. 2011).

The HSRG has used only this basis to review the proposed increases to hatchery programs. Ten programs were provided for our review. Of those ten, the HSRG found that four should not increase the genetic risk to nearby natural populations (Minter, Soos, Lewis and Forks Creek). The remaining six were thought to need additional analysis before proceeding, and the HSRG advises caution before moving forward. Increased production from Kendall, Whatcom Creek, Samish, Wallace, Marblemount and Sol Duc risks genetic introgression (and loss of fitness) or loss of genetic integrity of naturally spawning fish of high conservation value.

In addition, all proposed increases should be reviewed using the “Additional Evaluation” as described below. Attached you will find a list of proposed projects received from WDFW (Table 1), the HSRG’s comments on each of those projects and a summary of the 6-year average surplus Chinook salmon at each of the facilities identified (Table 2).

**Additional Evaluation:**

There are many other elements of hatchery impacts that we were not able to evaluate due to the short timeline and lack of information provided. As described in the HSRG report on Columbia River hatcheries (HSRG 2009), a comprehensive analysis of the programs relative to the HSRG general principles would allow for a much more accurate assessment of the benefits and risks to endangered salmon and steelhead populations. The HSRG developed three principles and 17 recommendations to allow managers to more accurately address the risks of hatchery production on natural populations. Some examples of these, relative to the proposed hatchery increases, are described below:

**Principle 1: Develop Clear, Specific, Quantifiable Harvest and Conservation Goals for Natural and Hatchery Populations within an “All H” Context**

Recommendation 3 – Ensure goals for individual populations are coordinated and compatible with those for other populations. Goals for harvest and conservation should be clearly identified. Are the hatchery goals



changing when hatchery production increases 250-700%? We believe these changes should be documented.

## **Principle 2: Design and Operate Hatchery Programs in a Scientifically Defensible Manner**

Recommendation 5 – Explicitly state assumptions. The scientific rationale for a program must be documented. Assuming the increase in production is for Orca consumption, is there any biological justification that suggests how well this will work, how confident we might be in these assumptions, and how those biological assumptions influenced the choice of programs and sizes? This should be documented.

Recommendation 7 – Size hatchery programs based on population goals as part of an “all H” strategy. These increases in production are almost certainly going to impact harvest, either through restrictions on fisheries to give greater access to Orcas or just through sheer numbers of returning fish and all the fishery management implications that go along with that. These should be described.

Recommendation 11 – Coordinate hatchery programs to account for the effects on each natural population and hatchery programs. Hatchery fish released in each subbasin will interact with wild and hatchery fish from other sub-basins as they migrate through the downstream corridor, estuary and ocean.

Was there an attempt to evaluate/justify the impact of increased pinniped predation, either from a change in distribution or increased abundance of that population, on Puget Sound salmon and steelhead populations that will result from increasing Chinook production? This predation is a major source of recent declines for steelhead and an ESA listing factor that we do not have the management tools to counter. Steelhead have been on the verge of being upgraded to endangered in both of the last two status reviews.

## **Principle 3: Monitor, Evaluate and Adaptively Manage Hatchery Programs**

Recommendation 17 – Monitoring & discontinuing programs if risks outweigh benefits. If this is all as uncertain as it seems, then this principle has to be the most important one. This whole increase is based on the premise of trade-offs between endangered Orca, threatened Chinook, and potentially endangered steelhead. What analysis has been done to describe the monitoring that will be in place, and how it will adequately allow managers to quantify these risks to make informed decisions?

We hope you find these comments helpful.

Sincerely,



Peter Paquet, Ph.D.  
HSRG Co-Chair

Andy Appleby  
HSRG Co-Chair

cc: Eric Kinne, WDFW  
Ron Warren, WDFW

## **HSRG Review of Proposed WDFW hatchery production increases to aid in Orca Recovery**

Proposed increases are identified on the attached spreadsheet (Table 1). Comments on each program are provided below.

### **Proposed Programs that the HSRG feels need additional analysis before proceeding:**

- 1) **Kendall Creek- North Fork Nooksack Spring Chinook** – Additional analysis advised. Both the North Fork and South Fork Nooksack Spring Chinook populations have been designated as Primary populations. In addition, NOAA has designated them as Tier 1 populations and identified them as “essential for recovery” (NMFS 2010). In addition, both populations are identified as being in the “Preservation phase”. There is a long history of pHOS being very high (>80%) historically. The NF spring Chinook program was reduced to allow NORs a chance to become locally adapted. The SF Nooksack Spring Chinook population currently has a Captive brood program, indicating very low abundance. The NF Nooksack Spring Chinook are known to stray into the SF, causing concern for hybridization. The HGMP also states that “Because the hatchery program has dramatically increased hatchery-origin Chinook, but natural-origin fish are only slowly increasing, a reasonable conclusion is that the main limiting factor for this population is poor habitat.” This action could delay the benefits of local adaptation (improved fitness and reproductive success) of the North and South Fork spring Chinook natural populations.

The proposed increase at the Kendall Creek hatchery for the SRKW program is from 200,000 Spring Chinook juveniles at 80 fpp to 700,000 juveniles (a 250% increase). The May 2018 HGMP for the Kendall program indicates ponding-to-release survival for the current program averages 99.5% (HGMP Table 9.2.1.1) at juvenile rearing densities of maximum 1.9 lbs/gpm and 0.2 lbs/ft<sup>3</sup>, well below WDFW prescribed maximums for the program of 3 lbs/gpm and 0.35 lbs/ft<sup>3</sup>. This suggests that adequate rearing space is available for the 250% juvenile production increase.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) spring Chinook arriving at Kendall Creek hatchery is 1,272 fish/year (Table 2). Thus, adequate broodstock appears available for the proposed 250% increase. It is expected that any increase in production will also increase this surplus as well as strays to the SF.

- 2) **WDFW/Bellingham Tech College** – Additional analysis advised. This program does not have any broodstock, and we assume eggs will come from Samish. Fall Chinook straying into the Nooksack River (it has no natural fall Chinook population) have been identified as a problem in the past due to the potential for hybridization and competition. A non- native naturalized fall Chinook population has been established in the Nooksack from fish straying from both WDFW (Samish) and nearby Tribal (Lummi) programs. It is expected that this program will also add stray fall Chinook to the Nooksack system. Both the NF and SF Nooksack spring Chinook are identified as Tier 1 populations by NOAA and labeled as “essential for recovery” (NMFS 2010). In addition, WDFW has designated these populations as Primary. The SF program currently has a Captive brood program, indicating very low abundance. This action could delay the benefits of local adaptation (improved fitness and reproductive success) of the North and South Creek spring Chinook natural populations.

The Whatcom Creek hatchery is proposed to produce 500,000 Fall Chinook juveniles at 80 fpp for the SRKW program. This is a new program at Whatcom Creek.

- 3) **Samish** – Additional analysis advised. Fall Chinook straying into the Nooksack River (it has no natural fall Chinook population) have been identified as a problem in the past (hybridization and competition). A non-native naturalized fall Chinook population has been established in the Nooksack from fish straying from both WDFW (Samish) and nearby Tribal (Lummi) programs. Both the NF and SF Nooksack spring Chinook are identified as Tier 1 populations by NOAA and labeled as “essential for recovery” (NMFS 2010). In addition, the SF program currently has a Captive brood program, indicating very low abundance. The

Samish HGMP (2015) provisions to increase releases include 1) a self-sufficient Tribal broodstock, and 2) contribution from the Lummi Nation Lower Nooksack Fall Chinook and Samish Hatchery Chinook programs of 5% or less of the South Fork, and 5% or less of the North Fork, natural spawners within the Spring Chinook spawning time period. Have these been met? This action could delay the benefits of local adaptation (improved fitness and reproductive success) of the North and South Creek spring Chinook natural populations.

The proposed increase at the Samish hatchery for the SRKW program is from 4,000,000 to 5,000,000 Fall Chinook juveniles at 80 fpp (a 25% increase). The December 2015 HGMP for the Samish program indicates ponding-to-release survival for the current program averages 91% (HGMP Table 9.2.1). The HGMP indicates rearing densities are below WDFW prescribed maximums for the program of 3 lbs/gpm and 0.35 lbs/ft<sup>3</sup>. This suggests that adequate rearing space is available for the 25% juvenile production increase.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) fall Chinook arriving at Samish hatchery is 3,279 fish/year (Table 2). Thus, adequate broodstock appears available for the proposed 25% increase. It is expected that any increase in production will also increase this surplus as well as strays to nearby watersheds.

- 4) **Wallace River (sub-yearlings and yearlings)** – Additional analysis advised. The population has been identified as Contributing by WDFW (draft designation) and Tier 2 by NOAA (NMFS 2010). Currently the program meets HSRG broodstock recommendations for a Contributing Population (Wallace summer Chinook HGMP). NORs for brood are taken from Sunset Falls fish trap and the Wallace River trap. It is not clear if additional NORs are available for use in hatchery broodstock as there is an agreed to limit on the proportion of returning NORs that can be used for broodstock (20%) from the trap at Sunset Falls.

The proposed increase at the Wallace River hatchery for the SRKW program is from 1,000,000 to 1,400,000 summer Chinook juveniles at 70 fpp (a 40% increase) and from 500,000 to 600,000 at 8 fpp (a 20% increase). The February 2013 HGMP for the Wallace River program indicates ponding-to-release survival for the current 70 fpp program averages 91% and 73% for the 8 fpp program (HGMP Table 9.2.1). The HGMP indicates rearing densities are below WDFW prescribed maximums for the program of 3 lbs/gpm and 0.35 lbs/ft<sup>3</sup>. Ponding-to-release survivals are low compared to most WDFW proposed SRKW programs (especially the 8 fpp program), suggesting adding fish to either program could increase rearing mortality.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) summer Chinook arriving at Wallace hatchery is 1,995 fish/year (Table 2). Thus, adequate broodstock appears to be available for the proposed increases. However, at 42%, adult prespawning holding mortality at the Wallace River hatchery is considerably higher than for other programs proposed for the SRKW program (Table 1). It is expected that any increase in production will both increase prespawning mortality and hatchery surplus as well as strays into the Snohomish Chinook populations.

- 5) **Marblemount Spring Chinook** – Additional Analysis advised. The current segregated program has difficulty meeting HSRG recommendations for pHOS in the Cascade River. The 9-year weighted average pHOS is 5.3%, but varies significantly annually with estimated census pHOS ranging from 0% to a high of 17.4% (Marblemount Spring Chinook HGMP). The Cascade population is the local population and was identified as a Tier 1 population by NOAA (NMFS 2010). The hatchery spring Chinook population used at Marblemount is not native to the Cascade River but was taken from the Suiattle/Sauk Rivers (Skagit tributary) in the 1970s and is run as a segregated program. The hatchery could be used to provide fall or summer Skagit Chinook, as there is little or no production of those stocks and they are some of the most abundant in Puget Sound.

The proposed increase at the Marblemount hatchery for the SRKW program is from 787,000 to 1,187,500 Spring Chinook juveniles at 8 fpp (a 51% increase). The May 2018 HGMP for the Marblemount program indicates ponding-to-release survival for a now discontinued sub-yearling-to smolt program averaged 88% (HGMP Table 9.2.1.1). The maximum number of yearlings produced from the now discontinued yearling

program was about 140,000 fish (HGMP Table 10.3.1). The proposed program appears a re- initiation of this program. It is unclear from the HGMP if adequate rearing space is available for the proposed 51% (400,000 fish) juvenile production increase.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) spring Chinook arriving at Marblemount hatchery is 1,299 fish/year (Table 2). Thus, adequate broodstock appears available for the proposed increase. It is expected that any increase in production will also increase this surplus as well as strays into the Cascade River.

- 6) **Sol Duc Summer Chinook** – Additional analysis recommended. This has been identified by WDFW as a Primary population (draft designation). The current integrated program was recently modeled using the AHA/ISIT tool (WDFW training, 2017) and did indicate an available increase in production due to a currently low pHOS, that available increase should be quantified.

The proposed increase at the Sol Duc hatchery for the SRKW program is from 70,000 to 500,000 Summer Chinook juveniles at 50 fpp (a 714% increase) and 250,000 to 325,000 juveniles at 8 fpp (a 30% increase). No HGMP is available for Sol Duc Summer Chinook program.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) summer Chinook arriving at Sol Duc hatchery is 856 fish/year. It does appear there are enough excess broodstock for the proposed program.

### **Proposed programs that the HSRG does not believe will to increase risk to natural Chinook populations:**

- 1) **Soos/Palmer** – Green River Fall Chinook has historical significance and was used to support many other hatchery programs in Puget Sound. Currently it has been designated as a Stabilizing population in the Re-colonization phase by WDFW. However, it has been designated as a Tier 2 population by NOAA (NMFS 2010). The program does meet HSRG recommendations for a Stabilizing population.

The proposed increase at the Soos/Palmer hatchery for the SRKW program is from 4,200,000 to 6,200,000 Fall Chinook juveniles at 80 fpp (a 48% increase). The April 2013 HGMP for the Soos/Palmer program indicates ponding-to-release survival for the current program averages 92.9% at Soos and 95.7% at Palmer (HGMP Table 9.2.1.1). The HGMP indicates rearing densities are below WDFW prescribed maximums for the program of 3 lbs/gpm and 0.35 lbs/ft<sup>3</sup>. It is unclear from the HGMP if adequate rearing space is available for the proposed 48% juvenile production increase.

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) fall Chinook arriving at Soos Creek hatchery is 5,665 fish/year (Table 2). Thus, adequate broodstock appears available for the proposed 48% increase. It is expected that any increase in production will also increase this surplus.

- 2) **Lewis River Spring Chinook** – Assuming this will be run as a segregated program, the HSRG sees no issues with this program (similar to Cowlitz). While the Lewis River Spring Chinook are designated as Primary by the Lower Columbia River Salmon Recovery Plan, all the historical spring Chinook spawning habitat is above existing dams. We understand that a Plan is in place to recolonize the upper watershed (above dams) and having additional adult returns will benefit that program.

The proposed increase at the Lewis River hatchery for the SRKW program is from 1,350,000 to 1,750,000 Spring Chinook juveniles at 80 fpp (a 30% increase). The April 2015 HGMP for the Lewis program indicates ponding-to-release survival averages 94.6% (HGMP Table 9.1.1.1).

A recent analysis by the HSRG using data supplied from the WDFW website indicates that the recent 6-year average number of surplus (excess to broodstock needs) spring Chinook arriving at Lewis River hatchery is

161 fish/year (Table 2). It does not appear there are enough excess broodstock currently for the proposed program. The HSRG strongly advises against importing Spring Chinook from another population to support this program.

- 3) **Forks Creek Spring Chinook** – The HSRG has supported this action for some time. It is assumed that broodstock is available (there are no spring Chinook populations in Willapa Bay) and concerns with the Co-Managers’ Fish Health Disease policy are addressed.

The Forks Creek hatchery is proposed to produce 1,000,000 Spring Chinook juveniles at 80 fpp for the SRKW program. This is a new program at Forks Creek.

- 4) **Minter/Hupp Spring Chinook** – The HSRG has supported this action for some time. We recommend that any spring Chinook released from Minter/Hupp be ad clipped, with an appropriate number coded-wire tagged.

The proposed increase at the Minter/Hupp hatchery for the SRKW program is from 400,000 to 500,000 Spring Chinook juveniles at 80 fpp (a 25% increase). The March 2018 HGMP for the Minter/Hupp program indicates ponding-to-release survival for the current sub-yearling-to smolt program averaged 97.8% (HGMP Table 9.2.1.1).

The HGMP (9.2.2) indicates that at 4.5 lbs/gpm, rearing density is currently 1.5 times the WDFW prescribed maximum 3 lbs/gpm. It is unclear from the HGMP if adequate rearing space is available for the proposed 25% juvenile production increase.

A recent analysis by the HSRG using data supplied by WDFW indicates that the recent 6- year average number of surplus (excess to broodstock needs) spring Chinook arriving at Minter/Hupp hatchery is 446 fish/year. Thus, adequate broodstock appears available for the proposed increase.

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**Table 1.** Draft Proposal for SRKW Increases of Chinook Production.

Facility Name	Operator	Species	Current Program	Max Production	FPP	Brood source	Rearing Facility	Release Facility	Production Increase for SRKW	% Increase	Population Designation
Kendall	WDFW	Spring Chinook	200,000	700,000	80	Kendall	Kendall	Kendall	500,000	250%	Population affected - Nooksack - Primary
Whatcom Cr.	WDFW/ Bellingham Tech College	Fall Chinook	0	500,000	80	Samish	Whatcom Cr.	Whatcom Cr.	500,000	100%	Population affected - Nooksack - Primary
Samish	WDFW	Fall Chinook	4,000,000	5,000,000	80	Samish	Samish	Samish	1,000,000	25%	Population affected - Nooksack - Primary
Wallace River	WDFW	Summer Chinook	1,000,000	1,400,000	70	Wallace River	Wallace River	Wallace River	400,000	40%	Contributing
Wallace River	WDFW	Summer Chinook	500,000	600,000	8	Wallace River	Wallace River	Wallace River	100,000	20%	Contributing
Soos/Palmer	WDFW	Fall Chinook	4,200,000	6,200,000	80	Green River	Palmer	Palmer	2,000,000	48%	Stabilizing
Marblemount	WDFW	Spring Chinook	787,500	2,000,000	8	Marblemount	Marblemount	Marblemount	400,000	51%	Primary
Lewis River	WDFW	Spring Chinook	1,350,000	1,750,000	80	Lewis River	Speelyia	Lewis River	400,000	30%	Primary
Forks Creek	WDFW	Spring Chinook	0	1,000,000	80	Kalama	Forks Creek	Forks Creek	1,000,000	100%	No Spring Chinook Population
Minter/Hupp	WDFW	Spring Chinook	400,000	500,000	80	Minter	Hupp	Hupp	100,000	25%	No Spring Chinook Population
Sol Duc	WDFW	Summer Chinook	70,000	1,320,000	50	Sol Duc	Sol Duc/Bear Springs	Sol Duc	500,000	714%	Primary
Sol Duc	WDFW	Summer Chinook	250,000	325,000	8	Sol Duc	Sol Duc/Bear Springs	Sol Duc	75,000	30%	Primary
<b>Chinook Total</b>			<b>12,757,500</b>	<b>21,295,000</b>					<b>6,975,000</b>		



**Table 2.** Six-year number of adults spawned, holding mortality, and surplus adults disposed for current hatcheries proposed for SRKW increases.

Facility Name	Operator	Species	Current program size (# fish released)	6 yr ave spawned	6 yr ave mortality	6 yr ave surplus
Kendall	WDFW	Spring Chinook	200,000	380	255	1,272
Whatcom Cr.	WDFW/Bellingham Tech College	Fall Chinook	0	--	--	--
Samish	WDFW	Fall Chinook	4,000,000	2,947	1,083	3,279
Wallace River	WDFW	Summer Chinook	1,000,000	1,912	1,712	1,995
Wallace River	WDFW	Summer Chinook	500,000			
Soos/Palmer	WDFW	Fall Chinook	4,200,000	3,015	806	5,665
Marblemount	WDFW	Spring Chinook	787,500	468	79	1,299
Lewis River*	WDFW	Spring Chinook	1,350,000	781	213	161
Forks Creek	WDFW	Spring Chinook	0	--	--	--
Minter/Hupp	WDFW	Spring Chinook	400,000	284	120	446
Sol Duc	WDFW	Summer Chinook	70,000	260	608	865
Sol Duc	WDFW	Summer Chinook	250,000			
<b>Chinook Total</b>			<b>12,757,500</b>	<b>10,047</b>	<b>4,876</b>	<b>14,982</b>

Source: WDFW website: <https://wdfw.wa.gov/hatcheries/escapement/>

\* Includes Speelyia

## Attachment 2: Draft Proposal for Increased Production to Enhance Fisheries and Benefit Southern Resident Killer Whales

December, 2018

### WDFW Production - Enhance Fish Production

Location - Puget Sound/ Columbia Basin/ Coastal WA	Facility Name	Species	Capacity	Current Program	Increased Proposal	Brood source	Rearing Facility	Release Facility	Population Designation	Recovery Phase	ESA Listing	HSRG Supports or Doesn't Support (Yes/No)
Coastal WA	Forks Creek	Spring Ch	3,000,000	0	1,000,000	Kalama	Forks Creek	Forks Creek	No natural population	NA	Not Listed	Yes No local sp. Chinook population to impact
Columbia Basin	Lewis	Spring Ch	1,750,000	1,350,000	400,000	Lewis	Lewis	Speelyai	Primary	Recolonization	Threatened	Yes
Columbia Basin	Ringold	Spring Ch	350,000	0	350,000	Little White	Ringold	Ringold	No natural population	NA	Threatened	Yes No local sp. Chinook population to impact
Columbia Basin	Beaver Creek	coho	1,000,000	0	225,000	Grays River	Beaver Creek	Beaver Creek	Primary	Preservation	Threatened	Yes Homing of coho back to Elochoman may reduce catch in Deep River SAFE fishery.
Columbia Basin	Ringold	coho	250,000	0	250,000	Kalama	Kalama/ Ringold	Ringold	No natural population	NA	NA	Yes No local Coho population to impact
Columbia Basin	Lyons Ferry	coho	0	0	200,000	Kalama	Lyons Ferry	Lyons Ferry	No natural population	NA	NA	Yes Capitol project to be implemented to expand production capacity, so there will be capacity in the future.
Puget Sound	Marblemount	coho	2,500,000	1,900,000	300,000	Marblemount	Wallace	SSNP	Contributing for Minter	Local Adaptation	Not Listed	Yes The use of out of basin stock is normally discouraged by the HSRG, however, data shows non-local stocks performing better at this location.
Coastal WA	Bingham	coho	600,000	300,000	300,000	Bingham	Bingham	Bingham	Contributing for Satsop	Full Recovery	Not Listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Contributing population. Additional production will only make this worse.
Coastal WA	Humtulsips	coho	1,000,000	500,000	500,000	Humtulsips	Humtulsips	Humtulsips	Contributing	Full Recovery	Not Listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Contributing population. Additional production will only make this worse.
Coastal WA	Forks Creek	coho	600,000	300,000	300,000	Forks Creek	Forks Creek	Forks Creek	Primary for Willapa	Full Recovery	Not Listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Primary population. Additional production will only make this worse.
		<b>Total</b>	<b>11,050,000</b>	<b>4,350,000</b>	<b>3,825,000</b>							

Location - Puget Sound/Columbia Basin/Coastal WA	Facility Name	Species	Capacity	Current Program	Increased Proposal	Brood source	Rearing Facility	Release Facility	Population Designation	Recovery Phase	ESA Listing	HSRG Supports or Doesn't Support (Yes/No)
Columbia Basin	Lyons Ferry	Spring Ch	250,000	0	250,000	Tucannon	Lyons Ferry	Asotin Creek	Tucannon Spring Chinook-Primary Asotin Spring Chinook -Stabilizing	Recolonization	Threatened	Yes Only if and when broodstock is available
Columbia Basin	Lyons Ferry	Spring Ch	100,000	0	100,000	Grand Ronde	Lyons Ferry	Grand Ronde			Threatened	Yes Only if and when broodstock is available
Columbia Basin	Kalama	Fall Ch	7,000,000	2,600,000	4,400,000	Kalama	Kalama/Fallert	Kalama/Fallert	Contributing	Preservation	Threatened	No Strays from this program have been shown to impact NF Lewis River Fall Chinook (A primary population)
Columbia Basin	Beaver Creek	Fall Ch	1,000,000	0	1,000,000	Elochoman	Beaver Creek	Beaver Creek	Contributing	Preservation	Threatened	Yes
Puget Sound	Hupp	Spring Ch	500,000	Fall Chinook	100,000	Minter	Hupp	Hupp	No Spring Chinook Population	Recolonization (White)	Threatened	Yes HSRG supports assuming releases are marked with 100% ad clip
Coastal WA	Humtultips	Fall Ch	1,725,000	500,000	1,250,000	Humtultips	Humtultips	Humtultips	Contributing	Full Recovery	Not listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Contributing population. Additional production will only make this worse.
Coastal WA	Bingham	Fall Ch	700,000	200,000	500,000	Satsop River	Bingham	Bingham	Contributing	Full Recovery	Not listed	Yes
Puget Sound	Minter	Fall Ch	1,650,000	1,250,000	400,000	Minter	Minter	Minter	No natural population	NA	Threatened	Yes No local fall chinook population to impact.
Coastal WA	Naselle	Fall Ch	5,000,000	2,500,000	2,500,000	Naselle	Naselle	Naselle	Contributing	Local Adaptation	Not listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Contributing population. Additional production will only make this worse.
Coastal WA	Forks Creek	Fall Ch	2,500,000	350,000	1,900,000	Forks Creek	Forks Creek	Forks Creek	Primary	Local Adaptation	Not listed	No Data provided by WDFW indicates the current program is not meeting minimum PNI levels for a Primary population. Additional production will only make this worse.
		<b>Totals</b>	<b>20,425,000</b>	<b>7,400,000</b>	<b>12,400,000</b>							

Location - Puget Sound/Columbia Basin/Coastal WA	Facility Name	Species	Capacity	Current Program	Increased Proposal	Brood source	Rearing Facility	Release Facility	Population Designation	Recovery Phase	ESA Listing	HSRG Supports or Doesn't Support (Yes/No)
Puget Sound	Wallace	coho	300,000	150,000	150,000	Wallace	Wallace	Wallace	Primary	Recolonization	Not listed	Yes
Puget Sound	Kendall	coho	200,000	0	200,000	Kendall	Kendall	Kendall	Primary (Upper Nooksack)	Not provided	Not listed	Yes
Puget Sound	Marble-mount	coho	500,000	250,000	250,000	Marble-mount	Marble-mount	Marble-mount	Primary	Not provided	Not listed	Yes
Puget Sound	Dungeness	coho	800,000	500,000	300,000	Dungeness	Dungeness	Dungeness	Stabilizing	Local Adaptation	Not listed	Yes
		<b>Totals</b>	<b>1,800,000</b>	<b>900,000</b>	<b>900,000</b>							
Puget Sound	Wallace River	Chum	1,000,000	-	1,000,000	Skykomish	Wallace	Wallace	Not provided	Not provided	Not listed	Yes
Puget Sound	Kendall	Chum	1,500,000	1,000,000	500,000	Kendall	Kendall	Kendall	Primary	Not provided	Not listed	Yes
Puget Sound	Hood Canal	Chum	28,000,000	25,000,000	3,000,000	Hood Canal	Hood Canal	Hood Canal	Lower Skokomish-Contributing	Skokomish-Full Recovery	Not listed	Yes
Coastal WA	Nemah	Chum	1,500,000	500,000	1,000,000	Nemah	Nemah	Nemah	Not provided	Not provided	Not Listed	Yes
		<b>Totals</b>	<b>32,000,000</b>	<b>26,500,000</b>	<b>5,500,000</b>							

Location - Puget Sound/Columbia Basin/Coastal WA	Facility Name	Species	Capacity	Current Program	Increased Proposal	Brood source	Rearing Facility	Release Facility	Population Designation	Recovery Phase	ESA Listing	HSRG Supports or Doesn't Support (Yes/No)	
<b>Long Live The Kings</b>													
Puget Sound	Glenwood Springs	Fall Chinook	925,000	725,000	200,000	Glenwood/Samish	Glenwood	Glenwood	Population effected - Nooksack - P	Preservation	Threatened	Yes	Strays from this program are unlikely to enter Nooksack Riv.

**Programs not reviewed**

**USFWS**

Columbia Basin	Spring Creek	Fall Chinook	12,500,000	10,500,000	2,000,000	Spring Creek	Spring Creek	Spring Creek	Contributing	NA			
<b>Totals</b>			<b>12,500,000</b>	<b>10,500,000</b>	<b>2,000,000</b>								

**ODFW**

Willamette Basin	Leaburg	coho	1,000,000	-	1,000,000		Leaburg	Leaburg	Primary (Upper Willamette)	Unknown	Unknown		
Willamette Basin	Leaburg	coho or Sp Chinook	1,500,000	-	1,500,000		Leaburg	Leaburg	Primary (Upper Willamette/McKenzie)	Unknown	Unknown		
Willamette Basin	Leaburg	Fall Chinook	4,000,000	-	4,000,000		Leaburg	Leaburg	Stabilizing (Introduced population unclear)	Unknown	Unknown		
		combination	5,500,000	-	5,500,000		Leaburg	Leaburg		Unknown	Unknown		
Willamette Basin	Willamette	Sp Chinook	2,000,000	1,500,000	500,000	Willamette	Willamette	Willamette	Contributing (MF Willamette)	Unknown	Threatened		
Columbia Basin	Bonneville	Fall Chinook	3,250,000	2,500,000	750,000	Bonneville	Bonneville	Bonneville	Contributing	Unknown	Threatened		
<b>Totals</b>			<b>10,750,000</b>	<b>4,000,000</b>	<b>6,750,000</b>								

## Appendix 8

Letter of support for hatchery production to benefit SRKWs from National Oceanic and Atmospheric Administration: National Marine Fisheries Service, contingent upon further analysis and review of WDFW hatchery production increases.