

**EVALUATION OF THE
PUGET SOUND RECREATIONAL
FISHERY ENHANCEMENT (PSRFE)
PROGRAMS**

**Prepared by the
Hatchery Scientific Review Group**

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EXECUTIVE SUMMARY

The Puget Sound Recreational Fishery Enhancement (PSRFE) requested the Hatchery Scientific Review Group (HSRG) review the current operational status of PSRFE programs and make recommendations to increase their efficiency. Current PSRFE salmon production funding contributes to fish rearing efforts at nine Chinook Salmon and three Coho Salmon programs at eleven Washington Department of Fish and Wildlife (WDFW) supported hatcheries in Puget Sound (Glenwood Springs, Marblemount, Wallace River, Soos Creek, Icy Creek, Voight Creek, Minter Creek, Gorst Creek, Garrison Springs, Hupp Springs, and Hoodsport hatcheries).

The PSRFE sought guidance from the HSRG to review current PSRFE-funded hatchery production to determine if PSRFE production at specific facilities contributes to the Puget Sound recreational fisheries in marine catch record areas (MA) 5 through 13 and if there are better-suited production programs that would contribute at a higher rate. Additionally, this review was to determine if the operations and broodstock management of those hatcheries aligned with the Hatchery Reform guiding principles and broodstock recommendations provided by the HSRG and previously found in the WDFW Hatchery and Fishery Reform Policy.

Initially, most PSRFE efforts focused on enhancement of the “winter” blackmouth recreational fishery through delayed release of up to three million Chinook juveniles. However, in 2011 the Washington State Legislature refocused legislation and included the overall number of angler trips expended as a measure of fishing opportunity. Currently, most PSRFE supported fish production is focused in south and central Puget Sound, with limited production in North Puget Sound and Hood Canal, and includes about 8 million subyearling and 900,000 yearling Chinook (summer and fall races) and 525,000 yearling Coho.

The HSRG ranked PSRFE programs based on a number of metrics, including: 1) cost per adult harvested in Puget Sound sport fishery; 2) productivity of individual programs; and 3) ratio of PSRFE production to total production in target regions (i.e., North, Central, and South Puget Sound and Hood Canal).

For PSRFE supported programs, based strictly on cost per fish in the Puget Sound sport fishery for Chinook, the Hoodsport Hatchery yearling program ranks first (1st) in cost efficiency at \$136 per fish harvested in the summer/winter combined fishery and \$399 per fish harvested in the winter fishery. For the winter fishery alone, the Soos Creek subyearling program ranks last (13th) with a harvest efficiency of 1.66 percent and a cost of \$1,985 per fish harvested. Not enough information was available to adequately rank current PSRFE Coho programs, however, the Hupp Springs program apparently ranks last in production cost (\$148 per fish harvested), based on Minter Creek hatchery Coho data.

When all Puget Sound hatchery programs are compared to only the PSRFE programs based on the number of fish harvested per 100,000 juveniles released, the results indicate that the PSRFE has chosen to support some of the best hatchery programs in Puget Sound. Overall, for the May through September sport fishery, the PSRFE programs average over 68 fish/100,000 juveniles released, compared to about 30 fish/100,000 for non-PSRFE programs. This relationship holds true for releases of both subyearling and yearling fish.

An important consideration in ranking PSRFE programs is the scale of production of PSRFE programs compared to overall production in each evaluation area (i.e., North, Central, South Sound and Hood Canal). For instance, while the PSRFE Hoodspout Chinook program ranks high in harvest efficiency and number of adults harvested in the sport fishery, the overall production of 120,000 juveniles is only 2 percent of all hatchery Chinook production in Hood Canal while accounting for about 9 percent of the PSRFE budget for fish production. In the North Sound area, PSRFE production makes up 13 percent of Chinook production and 19 percent of Coho production while accounting for about 30 percent of the PSRFE budget for fish production. In the Central Sound, PSRFE production comprises 36 percent of Chinook production and 0 percent of Coho production while accounting for about 34 percent of the PSRFE budget for fish production. In the South Sound, PSRFE production makes up 29 percent of Chinook production and 5 percent of Coho production while accounting for about 26 percent of the PSRFE budget for fish production.

In terms of angler opportunity, the HSRG evaluated harvest data for all MAs associated with PSRFE programs (MAs 5 through 13). Overall sport salmon fishing opportunity in days per marine area in Puget Sound has been reduced since the early 1990s in terms of total days of allowable fishing, although opportunity has increased somewhat in recent years. Since the introduction of Puget Sound Sport Chinook mark-selective fisheries (MSFs) in the early 2000s, there has been a significant shift from non-selective to MSF opportunity. Overall, WDFW data indicates that neither of these increases in opportunity resulted in a significant increase in angler trips or Chinook salmon harvest. However, WDFW data suggests that allowing Coho-only sport fishing seasons (non-retention of Chinook salmon) has increased opportunity, particularly in MAs 9 and 10.

The recent six-year average (2010-2016) sport catch of Chinook and Coho salmon approaches 0.8 fish per marine angler trip in MA 5 (Sekiu-Piller Point); this is the most western MA in which the Legislature directed PSRFE to enhance fishing opportunity. Reasonable fishing success of about half a fish per angler trip is also available in the east Juan de Fuca MA 6. However, catch is greatly reduced in areas in the San Juan Islands and within the main body of Puget Sound (MAs 7 through 13). In areas around Everett and Seattle (MAs 9 and 10) sport catch is around 0.3 per marine angler trip, while it is even lower (about 0.1 or less) in MAs 11 through 13.

Although catch in MAs 11 through 13 is very low, average opportunity as measured in marine angler trips averages about 100,000 per year in these areas, suggesting considerable unmet demand for fish to catch. One potential source for fish theoretically available for sport catch is surplus fish returning to WDFW hatcheries. In the MAs close to the population centers in Puget Sound (MAs 10, 11, and 13), these surplus fish meet or exceed

catch in MAs 10 and 11 and greatly exceed catch (to over 10 times) in MAs 12 and 13. For instance, for MA 13 (South Puget Sound), the recent 10-year average Chinook and Coho sport catch was 32 percent and 6 percent of hatchery surpluses and most recently (2015-2016 season) was about 7 percent and 2 percent, respectively. MA 13 is currently open year round for salmon fishing, while the areas directly to the north (MAs 11 and 10) have numerous catch regulations and closures. Nonetheless, recent 6-year average angler trips were 2 to 2.5 times higher in MAs 10 and 11 than in MA 13, suggesting anglers might be unaware of potential surpluses and increased angler opportunities in South Puget Sound (MA 13).

Overall, HSRG recommendations include endorsement of the PSRFE plan for phasing out production at Glenwood Springs Hatchery. Additionally, the HSRG suggests either phasing out or greatly increasing production at Hoodsport Hatchery as current production is only a fraction (2 percent) of total hatchery Chinook production in MA 12. Currently, although the Hoodsport Hatchery yearling Chinook production ranks first (1st) in cost efficiency, the program is small with the overall production of 120,000 juveniles accounting for only 2 percent of all hatchery Chinook production in Hood Canal (MA 12), while costing about 9 percent of the PSRFE budget for fish production. Additionally, Chinook sport catch in Hood Canal is low (less than 1,250 fish per year) as are combined Chinook and Coho angler trips (less than 23,300 per year; about 20 percent of MA 9 to the north). Greatly increasing Hoodsport Hatchery Chinook production might increase opportunity and catch, while phasing out the program should have no effect on either.

The HSRG also suggests the PSRFE program consider increasing support for production of yearling Chinook to enhance winter fishing opportunities, especially in areas with high population density (Seattle south to Olympia).

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1.0 INTRODUCTION

In spring of 2018, the Puget Sound Recreational Fishery Enhancement (PSRFE or Program) executive board funded the Hatchery Scientific Review Group (HSRG) to review the current operational status of PSRFE programs and make recommendations to increase their efficiency. The PSRFE sought guidance from the HSRG to review current PSRFE-funded hatchery production to determine if PSRFE production at specific facilities contributes to the Puget Sound recreational fisheries in marine catch record areas (MAs) 5 through 13 (Figure 1) and if there are better suited production programs that would contribute at a higher rate. Additionally, this review was to determine if the operations and broodstock management of those hatcheries aligned with the Hatchery Reform guiding principles and broodstock recommendations provided by the HSRG and previously found in the Washington Department of Fish and Wildlife (WDFW) Hatchery and Fishery Reform Policy.

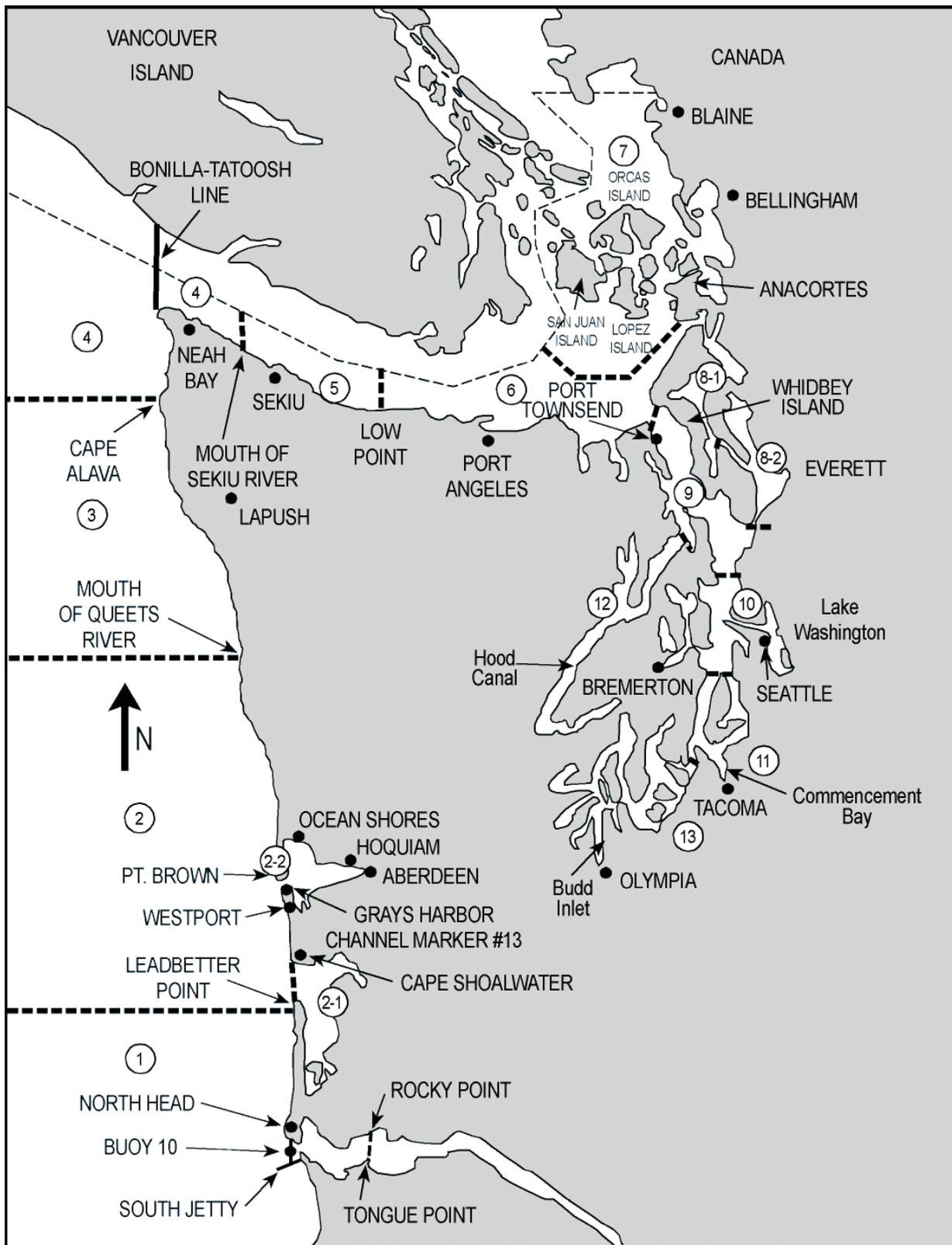


Figure 1. Marine Catch Record Areas (CRAs or Marine Areas (MAs)) in Washington state.

The following is a brief summary of the HSRG principles and management recommendations used in this evaluation of PSRFE programs. More detailed information may be found in Appendix A.

1.1 HSRG PRINCIPLES

The HSRG has identified three foundational principles for best management practices for operation of hatcheries (Mobrand et al. 2005; HSRG 2009, 2014; Paquet et al. 2011; Flagg 2015):

- **Principle 1:** Every hatchery program must have well-defined goals in terms of desired benefits and purpose (e.g., harvest, conservation, research, education).
- **Principle 2:** The goals and day-to-day operations of hatchery programs must be scientifically defensible.
- **Principle 3:** Hatchery programs must be flexible and respond adaptively to new information.

The HSRG has concluded that the biological principles used to manage hatchery populations and programs should be the same principles used to manage natural populations. This paradigm shift requires fishery and hatchery managers to focus on the biological viability of the populations propagated in, and/or influenced by, the hatchery environment, as opposed to focusing on the management of physical facilities. The HSRG has additionally emphasized that maintaining healthy habitat is critical not only for viable, self-sustaining natural populations, but also to adequately control risks of hatchery programs and to realize maximum benefits of hatcheries to recover populations and sustain healthy harvests in an increasingly populated world.

Loss of fitness is a major concern in situations where hatchery fish interact (interbreed) with wild fish (Ford 2002). The HSRG described two overall genetic management options to address potential fitness loss from hatchery fish (Mobrand et al. 2005; HSRG 2009, 2014; Paquet et al. 2011):

- *Genetically segregated broodstocks* are generally derived strictly from hatchery-origin adults returning back to the hatchery each year. Segregated hatchery programs are structured to create a genetically distinct, hatchery-adapted population. Such programs are typically designed to provide harvest benefits.
- *Genetically integrated broodstocks* include a prescribed proportion of natural-origin fish in the broodstock (pNOB¹) each year to maintain genetic integration with a natural

¹ pNOB is calculated as $NOB/(NOB+HOB)$ where NOB is the number of natural-origin broodstock and HOB is the number of hatchery-origin broodstock.

population. The intent is to minimize the genetic and reproductive fitness differences between the hatchery broodstock (fish used for spawning) and the naturally-spawning population from which they are derived.

Normally, conservation programs will be focused on integrated strategies and harvest programs on segregated strategies. However, integrated programs can, in many cases, also support harvest opportunity. Both integrated and segregated populations pose risks to natural populations. Thus, both types of programs will require methods (e.g., selective fisheries, control structures such as weirs, or limits to production levels) to limit the number of hatchery-origin fish arriving on the spawning grounds to adequately control hatchery-to-wild fish ratios.

1.2 BASIC HSRG FRAMEWORK

The HSRG has used the designations developed by the Lower Columbia River Fish Recovery Board to identify the biological significance of salmonid populations. Primary populations require the lowest level of hatchery influence, Contributing populations require an intermediate level of influence, while Stabilizing populations require no changes. To address the 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. In addition, each Primary and Contributing population will be assigned one of four “Recovery Phases” (Preservation, Re-colonization, Local Adaptation, or Fully Recovered). Stabilizing populations don’t usually have a recovery phase assigned as their current status is deemed acceptable. It is important to note that while pHOS² (proportion of hatchery-origin spawners) and PNI³ (proportionate natural influence) 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.

² pHOS is calculated as $HOS/(HOS+NOS)$ where HOS is the number of hatchery-origin spawners on the spawning grounds and NOS is the number of natural-origin spawners. Effective pHOS applies a correction factor to HOS to account for the assumed lower reproductive success of hatchery-origin returns.

³ PNI is calculated as $pNOB/(pNOB+pHOS)$.

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
Guidelines for pHOS and PNI during the <u>Local Adaptation</u> and <u>Full Restoration</u> Phases	
Primary	Integrated hatchery programs—PNI ≥ 0.67 ; pHOS $\leq 30\%$
	Segregated hatchery programs—pHOS $< 5\%$
Contributing	Integrated hatchery programs—PNI ≥ 0.50 ; pHOS $\leq 30\%$
	Segregated hatchery programs—pHOS $< 10\%$
Stabilizing	Integrated hatchery programs—current condition
	Segregated hatchery programs—current condition

2.0 OVERVIEW OF THE PSRFE PROGRAM

2.1 PROGRAM HISTORY

The PSRFE was created by the Washington State legislature in 1993 by authorizing a revised code of Washington (RCW) to improve recreational fishing opportunities [RCW 75.54]. The legislation established, consistent with available revenue, Commission policies, Tribal Co-Manager agreements, and limitations of the Endangered Species Act, that the WDFW, in consultation with the oversight committee created in the law, shall adaptively manage the Puget Sound recreational salmon and marine fish enhancement program to maximize the benefits to the Puget Sound recreational fishery.

Beginning in 1993, persons who recreationally fish for salmon or marine bottom fish in Puget Sound and Lake Washington were assessed an annual recreational surcharge of \$10, in addition to other licensing requirements. Funds from the surcharge were deposited in the enhancement account. In 1998, funding was changed from a \$10 surcharge to a percentage of each saltwater and combination fishing license sold.

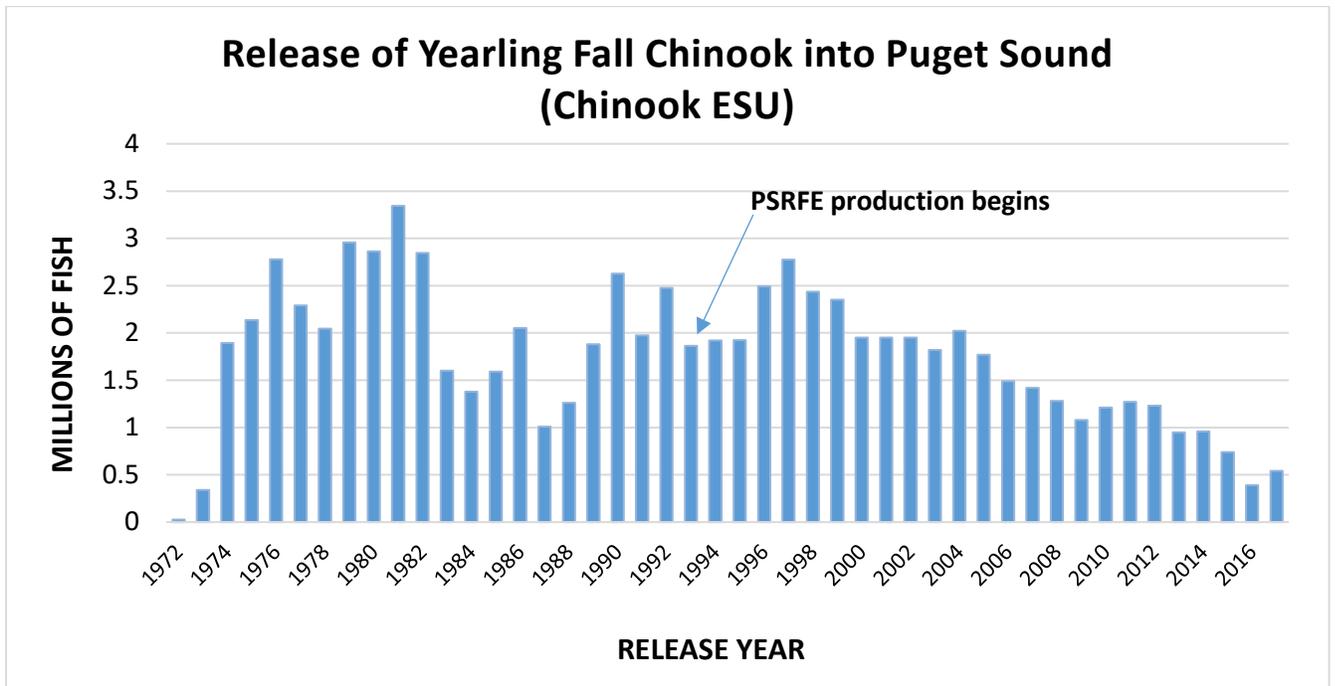
Initially, the primary objective for expenditures under the Program was focused on achieving the goal of 3 million yearling Chinook salmon (*Oncorhynchus tshawytscha*) released into Puget Sound annually, mostly to enhance the “winter” blackmouth recreational fishery. The winter blackmouth fishery has historically been thought of as the period from October through April (historically, the sport fishery in Puget Sound was open

all year). Due to a lack of available cool-water summer rearing hatchery space, much of the increase in yearling production was accomplished in saltwater net pens. The Legislation also included provisions for marine bottom fish enhancement and enhancement of Lake Washington Sockeye salmon.

The PSRFE legislation focused on delayed-release Chinook salmon because previous research at that time showed that by releasing juvenile Chinook at 15 months of age (a year after normal migration time), a higher proportion of the surviving fish would remain in Puget Sound rather than migrating to the ocean, and therefore would be available to Puget Sound recreational fishers (Haw et al. 1967; Buckley 1969; Buckley and Haw 1978). Further, the Legislature established a goal to produce fish in each of four regions: South, Central, and North Puget Sound, and Hood Canal.

The Legislature set the annual production goal at 3 million juvenile fish because it represented the number of Chinook salmon released from the mid-1970s through the early 1980s, when Puget Sound recreational fishing was at its height (Figure 2).

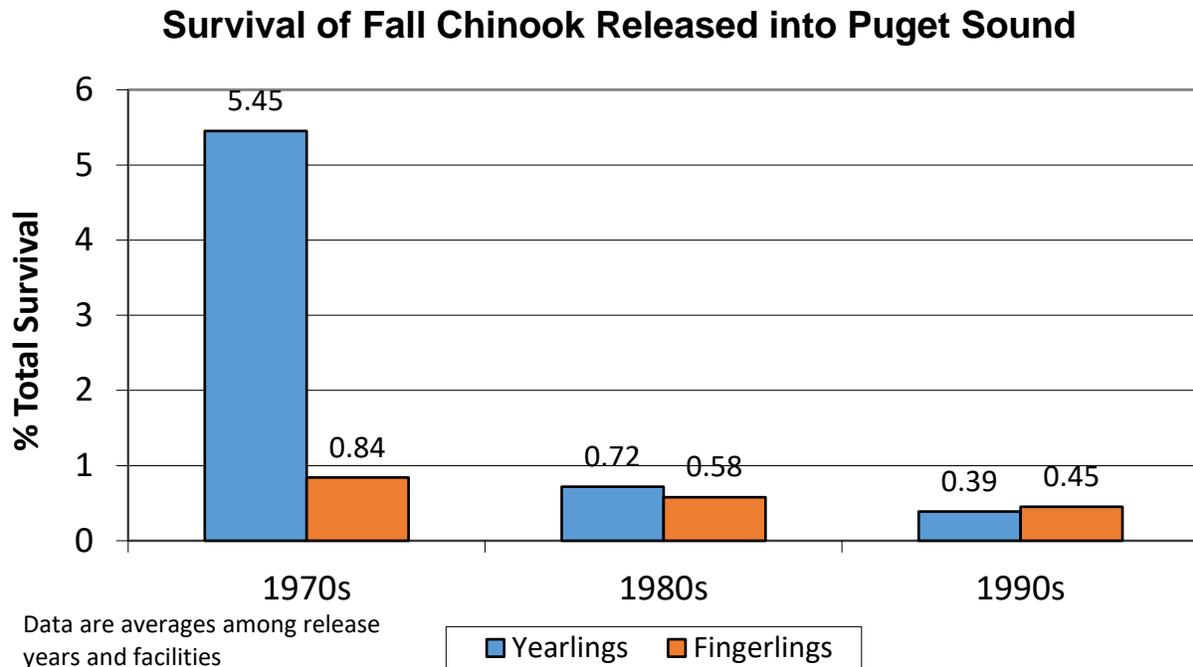
In 2010, the State Auditor’s Office conducted a performance audit of the PSRFE program. Key audit conclusions included: 1) the WDFW was not meeting its statutory goal to release 3 million delayed-release Chinook salmon annually, and 2) the statutory goal was not an effective or efficient strategy for restoring the Puget Sound Chinook salmon recreational fishery.



Source: WDFW data, as calculated by HSRG

Figure 2. Releases of yearling fall Chinook into the Puget Sound Chinook ESU, 1972-2017 (millions of fish). Includes production from all sources (state, Tribal, and federal).

According to the 2010 audit, from 1993 to 2010 the cost of each subyearling fish produced by the program and eventually caught by an angler was \$392. For yearlings, the cost of each fish caught was \$768. These figures reflected the fact that only a small number of fish produced by the program were actually caught by Puget Sound anglers (one out of every 904 yearling fish). The audit suggested that the low catch rate from 1993 to 2010 was due to fishing restrictions to protect wild salmon and a low survival rate for fish that remained in Puget Sound (Figure 3). The audit stated that the comparable cost of yearling resident Chinook caught during the 1970s was estimated at \$56 per fish.



Source: WDFW data, as calculated by HSRG.

Figure 3. Survival of fall Chinook released into Puget Sound during the 1970s, 1980s, and 1990s.

In 2011, the Legislature repealed several sections of RCW 75.54, including some, but not all, that focused on the winter blackmouth fishery (see repealed sections 040, 060, 070, 080, 090, 100, 110, 120, 130, and 900; <http://app.leg.wa.gov/rcw/default.aspx?cite=77.105>). The Legislature subsequently reauthorized the PSRFE program under RCW 77.105. Key points of the revised legislation include some notable evaluation metrics, including 77.105.005(3), in which the Legislature determined that the number of angler trips expended in these waters would be the measure of fishing opportunity; and 77.105.020(2a), in which the objectives include, but are not limited to, an increase in salmon and bottom fish angler trips.

RCW 77.105 included provisions for marine fish enhancement, and in the early-mid 2000s, a number of marine fish enhancement studies were conducted in Puget Sound for both lingcod and rockfish species (e.g., Lee et al. 2011). These studies indicated release of artificially (hatchery) produced juveniles could aid enhancement of bottomfish resources.

However, Puget Sound rockfish populations were in severe decline, with some species listed as threatened under the US Endangered Species Act (ESA), and in 2011 WDFW established a rockfish conservation plan that limited recreational opportunities (https://wdfw.wa.gov/publications/00035/apr2011_rockfish_conservation_plan.pdf). Currently, fishing for rockfish is closed in MAs 6, 7, 8-1, 8-2, 9, 10, 11, 12, and 13. Thus, no recreational opportunity currently exists for rockfish in Puget Sound (except in MA 5), and no artificial production programs are being considered.

RCW 77.105 also included provisions for enhancement of Sockeye salmon (*O. nerka*) in Lake Washington. The PSRFE contributed to the cost of counting Sockeye salmon at the Ballard Locks between 2007 and 2017. However, in recent years, adult returns have been poor and there has been no recreational fishery opportunity. The current management of the Lake Washington Sockeye hatchery is governed by the 2006 Adaptive Management Plan (AMP). A lack of fry-to-smolt survival in Lake Washington is believed to be the cause of poor adult returns, however, no clear cause of this poor survival has been identified. The AMP places limits on the ability of the hatchery to increase the abundance of Sockeye fry in Lake Washington. The PSRFE no longer supports (financially) the Ballard Lock counts for Sockeye salmon. Funding was eliminated in 2017 due to the continued lack of a fishery and limited ability of the hatchery to increase Sockeye returns, therefore limiting any future fishing opportunity.

2.2 EFFECTS OF ESA ON PSRFE PROGRAMS

The US ESA places constraints all hatchery production, including PSRFE, in terms of the number of hatchery fish released and release location. Most concerns about hatchery releases are based on ecological and genetic factors stemming from negative interactions between hatchery and wild juveniles and hatchery adults spawning with adults from wild populations.

In Puget Sound, all natural stocks of Chinook salmon are listed under the ESA as threatened (FR Notice 70 FR 37160; 6/28/2005). Additionally, Hood Canal summer Chum (*O. keta*; FR Notice 70 FR 37160, 6/28/2005) and Puget Sound Steelhead (*O. mykiss*; FR Notice 72 FR 26722, 5/11/2007) are also listed as threatened. In Puget Sound, no stocks of Coho salmon are listed under ESA.

RCW [77.105.160](#) provides that, consistent with available revenue, Commission policies, Tribal Co-Manager agreements, and limitations of the ESA, the WDFW, in consultation with the oversight committee created, shall adaptively manage the Puget Sound recreational salmon and marine fish enhancement program to maximize benefits to the Puget Sound recreational fishery.

More information about ESA-listed salmon populations in Puget Sound is provided in Appendix B.

2.3 PSRFE PROGRAM STATUS

The PSRFE currently receives about \$1.4 million from WDFW recreational licensing fees and distributes these funds to a combination of hatchery production and research efforts to promote recreational fishing opportunities. PSRFE individual fish production program expenditures account for about \$1 million (71 percent) of total annual PSRFE funding (Tables 2 and 3).

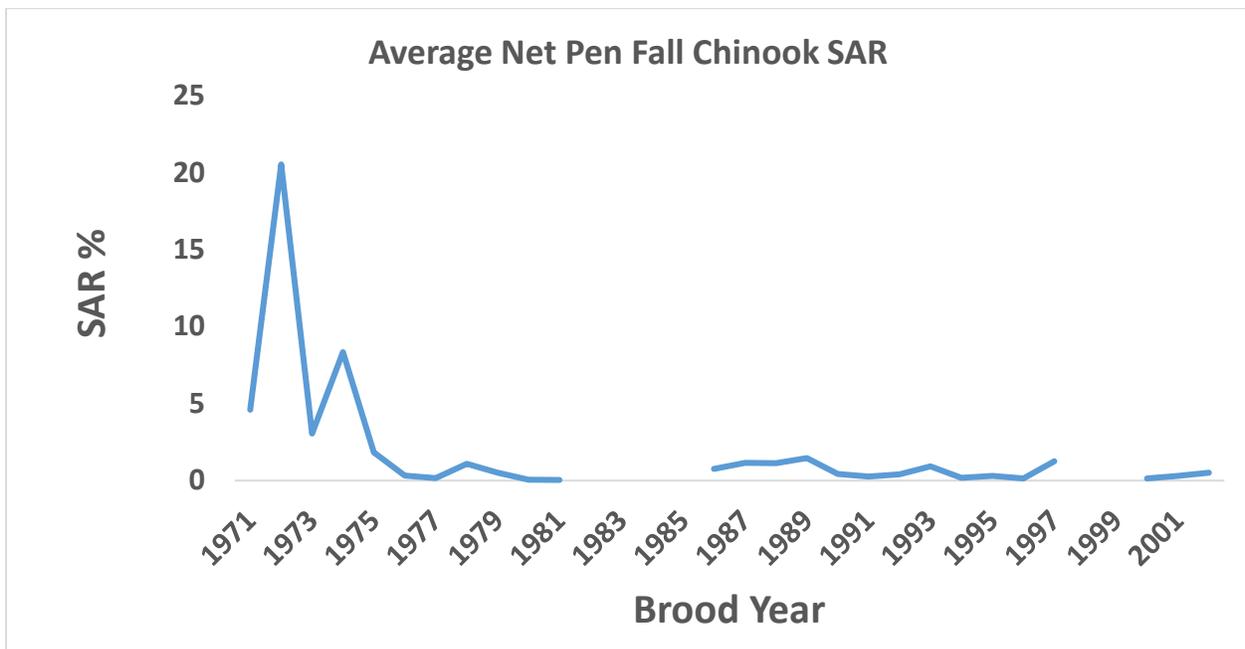
As discussed previously, much of the delayed-release program production was accomplished in saltwater net pens due to lack of available cool-water summer rearing space at hatcheries. During on-going evaluations of hatchery programs, the WDFW determined that survival of delayed-release yearling Chinook salmon had significantly declined (order of magnitude) along with the contribution to the recreational fisheries (Figure 4). Additionally, there were concerns about straying of adult Chinook salmon from the net pen programs and the domestication effect of a non-native life history (yearling vs. zero age at smolt migration) to ESA-listed natural populations. Ultimately, in the early 2000's, WDFW made a shift to support the release of Chinook salmon subyearlings directly from hatcheries using PSRFE funding, and the use of saltwater net pens for yearling releases was discontinued.

Table 2. PSRFE allotments and expenditures, 2018-2019.

Activity Description	FY 2018			FY 2019		
	Allotment	Expenditures	Variances	Allotment	Expenditures	Variances
<i>Chinook programs</i>						
Wallace (yearlings)	\$229,800	\$210,658	\$19,142	\$229,800		\$229,800
Icy Creek (subs)	\$78,200	\$84,953	(\$6,753)	\$78,200		\$78,200
Soos Creek (subs)	\$198,800	\$213,095	(\$14,295)	\$198,800		\$198,800
Garrison (subs)	\$143,339	\$147,969	(\$4,630)	\$143,400		\$143,400
Hoodspport (yearlings)	\$85,200	\$75,765	\$9,435	\$85,200		\$85,200
Garrison (jumbo subs)	\$29,100	\$23,376	\$5,724	\$29,100		\$29,100
Minter/Gorst (subs)	\$34,500	\$26,049	\$8,451	\$34,500		\$34,500
Glenwood (subs)	\$30,000	\$12,000	\$18,000	\$30,000		\$30,000
Voights (subs)	\$64,300	\$7,792	\$56,508	\$64,300		\$64,300
Minter (subs)	\$42,500	\$14,730	\$27,770	\$42,500		\$42,500
<i>Coho programs</i>						
Wallace	\$25,100	\$0	\$25,100	\$25,100		\$25,100
Hupp	\$25,000	\$28,051	(\$3,051)	\$25,000		\$25,000
Marblemount	\$6,000	\$0	\$6,000	\$6,000		\$6,000
<i>Other costs</i>						

Activity Description	FY 2018			FY 2019		
	Allotment	Expenditures	Variances	Allotment	Expenditures	Variances
Indirect	\$79,340	\$79,340	\$0	\$66,950		\$66,950
Fish Health	\$40,600	\$24,219	\$16,381	\$40,600		\$40,600
Coordinator	\$75,253	\$35,673	\$39,580	\$77,601		\$77,601
CWT Fish Marking	\$111,600	\$66,800	\$44,800	\$111,600		\$111,600
Goal Development	\$89,109	\$7,392	\$81,717	\$89,109		\$89,109
Total	\$1,387,741	\$1,057,862	\$329,879	\$1,377,760	\$0	\$1,377,760

Source: PSRFE data.



Source: WDFW data.

Figure 4. Average smolt-to-adult (SAR) for fall Chinook delayed released from net pens in Puget Sound.

Current PSRFE salmon production funding contributes to fish rearing efforts at 13 WDFW hatcheries. Most of this production is focused in south and central Puget Sound (Table 3) and includes about 8 million subyearling Chinook, 900,000 yearling Chinook (summer and fall races), and 525,000 yearling Coho salmon. The PSRFE program also has research underway to determine if transportation (barging) of hatchery fish through known high mortality zones in Southern Puget Sound can improve recreational catch.

Table 3. Chinook and Coho salmon programs funded by the PSRFE.

Puget Sound Region/MA	Hatchery Program	Production Goal and PSRFE Funding					
		Chinook subyearling	Chinook Jumbo sub-yearling	Chinook Yearling	PSRFE 2018 Funding	Coho	PSRFE 2018 Funding
North/MA7	Glenwood Springs	550,000			\$30,000		
North/MA 8	Marblemount					250,000	\$6,000
North/MA8	Wallace River			500,000	\$229,800	150,000	\$25,100
Central/MA 10	Big Soos	3,200,000			\$198,800		
Central/MA10	Icy Creek			300,000	\$78,200		
Central/MA11	Voight Creek	1,200,000			\$64,300		
South/MA13	Garrison Springs	950,000	200,000		\$172,400		
South/MA13	Minter Creek	1,400,000			\$77,000		
South/MA13	Minter/Gorst	750,000			\$34,500		
South/MA13	Hupp Springs					125,000	\$25,000
Hood Canal/MA12	Hoodsport			120,000	\$85,200		
	Total	8,050,000	200,000	920,000	\$935,700	525,000	\$56,100
	<i>Total Chinook production</i>	<i>9,170,000</i>					
	<i>Total Coho production</i>	<i>525,000</i>					
	<i>Total PSRFE costs</i>	<i>\$991,800</i>					

Source: PSRFE data.

2.4 PROGRAM EVALUATION METHODS

The HSRG reviewed all Hatchery and Genetic Management Plans (HGMPs) for fish production programs funded by PSRFE (Table 3). In addition, the HSRG requested and reviewed information from WDFW on smolt to adult survival (SAR), catch distribution, current production numbers and costs of production per fish for selected fisheries. The HSRG also searched numerous PSRFE and WDFW databases and compiled information on items such as recent sport catch statistics and hatchery production information for all Puget Sound areas (see examples of websites in Appendix C). The HSRG then ranked PSRFE propagation programs by:

- a. Cost effectiveness of PSRFE Chinook propagation programs (cost/harvested fish). In addition, Puget Sound sport harvest benefits (harvested fish/100,000 juvenile release) and harvest efficiency (percent of total adults produced by a program that were harvested in Puget Sound sport fishery) were also documented for the winter and the summer/winter (combined) fisheries.
- b. Cost effectiveness of PSRFE Coho propagation programs (cost/harvested fish). In addition, Puget Sound sport harvest benefits (harvested fish/100,000 juvenile release) and harvest efficiency (percent of total adults produced by a program that were harvested in Puget Sound sport fishery) were also documented for the summer/winter (combined) fisheries.
- c. Consistency of PSRFE propagation programs with HSRG principles and recommendations.

A summary of the variables used to evaluate each program is provided in Table 4.

Table 4. Variables used to evaluate PSRFE programs.

Variable	Definition	Relationship to PSRFE Goals
SAR	Smolt-to-adult survival of hatchery releases	Used to estimate the total number of hatchery-origin adults produced annually.
Winter Sport Catch	PS sport fishery October-April	Used to estimate cost per fish and harvest efficiency in this fishery.
Summer Sport Catch	PS sport fishery May-Sept.	Used to estimate cost per fish and harvest efficiency in this fishery.
Cost per Harvested Fish	Production costs for each fish harvested in specific fishery	Used to rank programs.
Harvest Efficiency	Number of harvested fish in specific fishery per 100K juveniles released	Used to rank programs.

3.0 INDIVIDUAL PROGRAM REVIEWS

3.1 NORTH PUGET SOUND

In this review, the HSRG defined the North Puget Sound Region as consisting of WDFW MAs 5, 6, 7, 8.1, 8.2 and 9 (Figure 1). The HSRG review further breaks the North Puget Sound Region into the Strait of Juan de Fuca and San Juan Islands (MAs 5 through 7) and the area of Admiralty Inlet east to Everett (MAs 8.1, 8.2, and 9). Sport catch in MAs 5 through 7 has averaged about 16,000 Chinook and 41,000 Coho salmon annually in the last decade, and catch numbers are much greater than in MAs 8.1 through 9, which have averaged about 6,200 Chinook and 29,000 Coho salmon (Table 5). Total hatchery production in the North

Puget Sound area from all sources (WDFW, federal, and Tribal) is about 8.3 million juvenile Chinook salmon and 2.1 million Coho salmon (Table 6). PSRFE production of Chinook and Coho salmon in the North Sound region amounts to about 1 million juveniles (Table 3), representing less than 10 percent of total hatchery production in the North Puget Sound area. The PSRFE program doesn't support any programs specifically within MAs 5 through 6, although salmon from PSRFE programs (and most other WDFW, federal, and Tribal programs) pass through these areas during migration. PSRFE funds one program in MA 7 and two in MAs 8.1 through 9.

Table 5. Chinook and Coho salmon sport catch by Marine Area from the 2007-8 through 2015-16 seasons.

Area	Chinook Sport Catch	Coho Sport Catch
North Sound Areas 5, 6, 7		
9 year total	113,569	290,497
Ave per year	16,214	40,750
North Sound Areas 8.1, 8.2, 9		
9 year total	38,414	235,700
Ave per year	6,257	29,202
Central Sound Areas 10 & 11		
9 year total	76,189	92,518
Ave per year	8,465	13,786
South Sound Area 13		
9 year total	11,930	3,406
Ave per year	1,326	378
Hood Canal Area 12		
9 year total	11,916	14,181
Ave per year	1,324	1,576
<i>Combined Total (All Areas)</i>		
9 year total	252,018	636,302
Ave per year	33,586	85,692

Source: WDFW data, as calculated by HSRG.

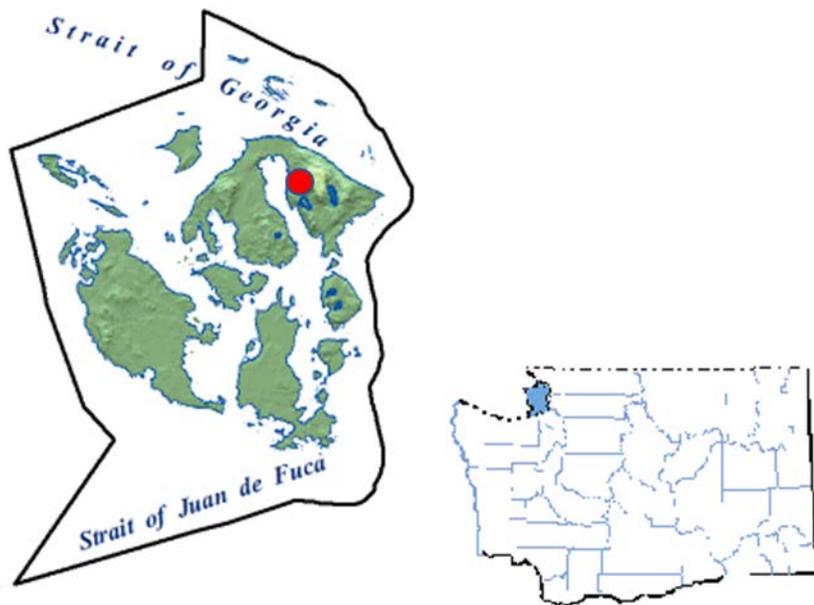
Table 6. Total juvenile releases for Chinook and Coho salmon in Puget Sound, annual average, 2006-16; rounded to nearest 10,000.

Area	Chinook Salmon	Coho Salmon
North Puget Sound		
Areas 5, 6, 7, 8.1, 8.2, 9	8,345,000	2,130,000
Central Puget Sound		
Areas 10, 11	13,200,000	2,920,000
South Puget Sound		
Area 13	11,450,000	2,420,000
Hood Canal		
Area 12	5,650,000	500,000

Source: WDFW data, as calculated by HSRG.

3.1.1 Glenwood Springs Hatchery

The only program supplied with PSRFE funds in the San Juan Islands is Glenwood Springs Hatchery in MA 7. Glenwood Springs Hatchery is located in the Eastsound area of Orcas Island (Figure 5).



Source: WDFW 2011.

Figure 5. Glenwood Springs Hatchery on Orcas Island.

The PSRFE program provides about \$30,000 in annual funding to aid in the production of about 550,000 subyearling Chinook salmon at the Glenwood Springs hatchery (about 3 percent of PSRFE funding for fish production) (Table 3). The Chinook salmon program at

Glenwood Springs is operated by the nonprofit group Long Live the Kings (LLTK). Program fish are produced from adults which have been returning to the facility since 1982. The program is operated in an area with no historical Chinook salmon populations and is operated as a “segregated” program (Table 7). Glenwood Springs Hatchery provides Chinook for commercial and sport fishing opportunities in north Puget Sound. All program fish are released with an adipose fin-clip (AD), with a portion (100,000) also coded-wire tagged (AD+CWT), and mass-marking is conducted on-site. Based on the average SAR of 0.43 percent for brood years 2002 to 2011 (RMIS coded-wire tag database 2017), and the release goal of 550,000 subyearlings, the estimated number of adults produced annually is approximately 2,400.

Out of the 2,400 adults produced annually by this program, an estimated 10.2 percent are caught in the Puget Sound sport fishery, summer and winter combined (89.8 percent of the fish that survive end up somewhere else). This is defined as the program’s “harvest efficiency” in Table 8. Recent analysis by WDFW estimates that the production costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for this program are \$2,090 and \$534, respectively, based on 2016 operating costs (Table 8).

The Glenwood Springs Hatchery program does meet HSRG recommendations for a segregated broodstock program (Table 1). Glenwood Springs does not have a natural Chinook population. The nearest Chinook population is the Nooksack spring Chinook population, which has been designated as a Primary population. A designated recovery phase of Preservation was provided by WDFW (Table 7). Most returning fish uncaptured at the hatchery or unharvested (known as strays) from this program migrate to a watershed that lacks a natural Chinook population and therefore do not cause impacts. In terms of cost per fish, this program is the most expensive and ranks 13th out of 13 Chinook programs evaluated (note that not all programs evaluated get funds from PSRFE; Table 8). PSRFE funding for this program is being phased out (D. Knutzen, pers. comm.).

Table 7. Population designations of nearest natural Chinook populations to each hatchery program.

Program	Age	Hatchery/stock	Run	Nearest Natural Chinook Population*	Hatchery in/out of basin	Population Designation*	Recovery Phase	Program type
PSRFE	Subs	Chambers/Garrison	Fall	N/A	Out	N/A	N/A	Seg
PSRFE	Subs	Glenwood Springs	Fall	Nooksack River	Out	Primary	Preservation	Seg
PSRFE	Subs	Minter Creek	Fall	N/A	Out	N/A	N/A	Seg
PSRFE	Subs	Minter/Gorst	Fall	N/A	Out	N/A	N/A	Seg
PSRFE	Subs	Soos Creek	Fall	Green River	In	Stabilizing	Recolonization	Int
PSRFE	Subs	Voights Creek	Fall	Puyallup River	In	Stabilizing	Recolonization	Int
PSRFE	Yearlings	Hoodsport	Fall	Skokomish	Out	Primary	Preservation	Seg
PSRFE	Yearlings	Icy Creek	Fall	Green River	In	Stabilizing	Recolonization	Int
PSRFE	Yearlings	Wallace	Summer	Snohomish River	In	Contributing	Recolonization	Int

Note: All Population Designations are DRAFT and represent the nearest natural Chinook population.

Source: WDFW.

Table 8. Cost per fish harvested for Chinook and Coho programs funded by PSRFE.

Hatchery Name	Species	Age at Release	Run	PS Summer/Winter Combined			PS Winter			HSRG Broodstock standards met?
				Harvest Efficiency*	Harvest per 100K releases	Rearing cost / fish harvested	Harvest Efficiency**	Harvest per 100K releases	Rearing cost / fish harvested	
Hoodsport	Chinook	Yearlings	Fall	33.2%	213	\$136	11.3%	73	\$399	Y
Wallace	Chinook	Yearlings	Summer	13.5%	151	\$323	6.9%	77	\$634	Y
Chambers/Garrison	Chinook	Jumbo subs	Fall	27.5%	170	\$152	5.8%	36	\$722	Y
Minter Creek	Chinook	Subs	Fall	17.8%	107	\$232	4.7%	28	\$878	Y
Icy Creek	Chinook	Yearlings	Fall	27.7%	15	\$328	9.0%	3	\$1,011	Y
Chambers/Garrison (program dropped due to fish health issues)	Chinook	Yearlings	Fall	46.5%	136	\$202	8.9%	27	\$1,022	Y
Voights	Chinook	Subs	Fall	12.8%	77	\$200	2.5%	15	\$1,026	Y
Hoodsport	Chinook	Subs	Fall	9.7%	44	\$218	2.0%	9	\$1,049	Y
Chambers/Garrison	Chinook	Subs	Fall	21.5%	83	\$291	4.2%	16	\$1,485	Y
Wallace***	Chinook	Subs	Summer	8.2%	25	\$810	4.2%	13	\$1,585	Y
Minter/Gorst	Chinook	Subs	Fall	11.1%	45	\$378	2.2%	9	\$1,889	Y
Soos Creek	Chinook	Subs	Fall	12.6%	56	\$250	1.6%	7	\$1,985	Y
Glenwood Springs (phasing funding out)	Chinook	Subs	Fall	10.2%	43	\$534	2.6%	11	\$2,090	Y
Wallace	Coho		Fall	7.6%	171	\$89				Y
Hupp Springs (Minter data used)	Coho		Fall	13.0%	271	\$148				Unkn
Marblemount	Coho		Fall	12.5%	722	Not Avail.				Y
Voights***	Coho		Fall	11.7%	386	\$75				Unkn
South Sound Net Pens***	Coho		Fall	12.7%	354	\$122				Y

* Percent of total fish harvested in PS summer and winter sport fishery

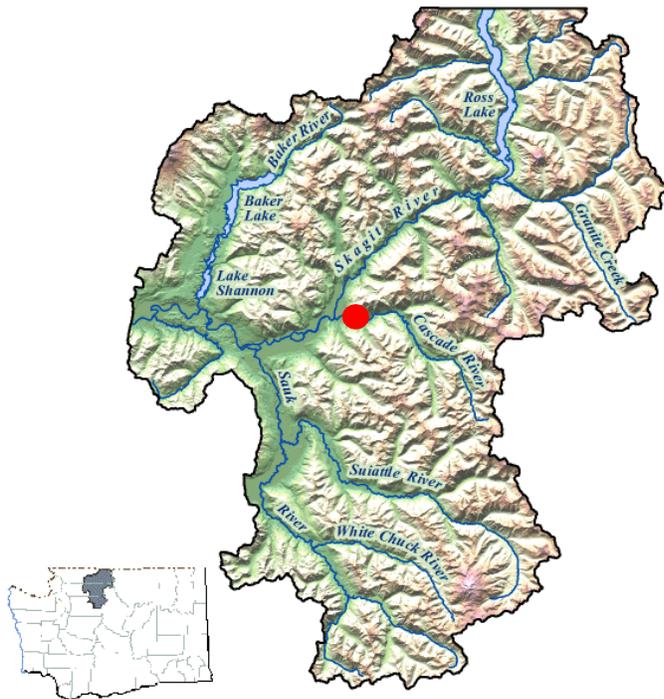
** Percent of total fish harvested in PS winter sport fishery

*** Not funded by PSRFE. Included for comparison only

Source: PSRFE.

3.1.2 Marblemount Hatchery

Marblemount Hatchery is located on the Cascade River, a tributary of the Skagit River near the town of Marblemount (Figure 6). It empties into Skagit Bay near the town of Mt. Vernon.



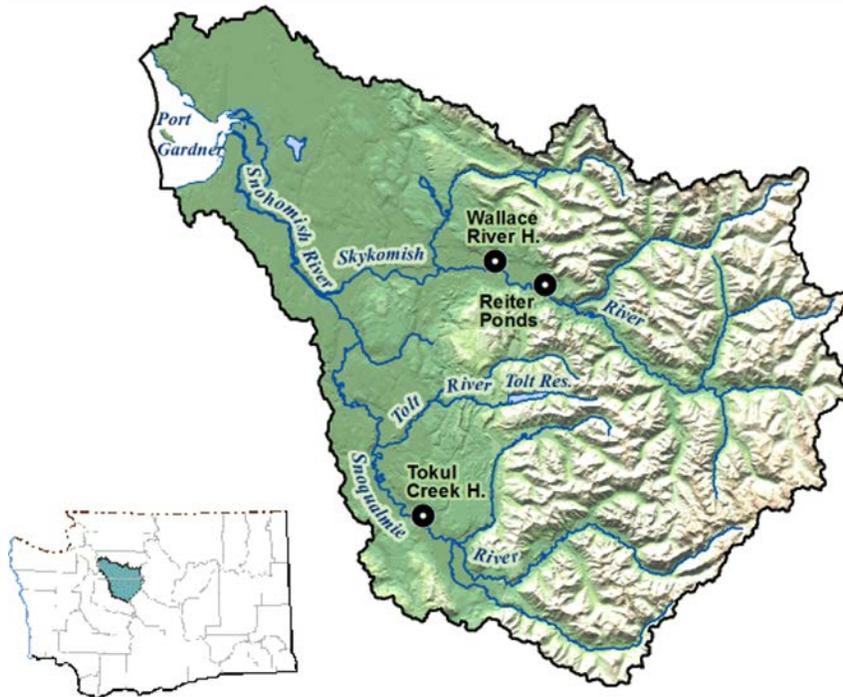
Source: WDFW 2011.

Figure 6. Marblemount Hatchery near Mt. Vernon, Washington.

Marblemount Hatchery produces approximately 250,000 yearling Coho, among other species. The PSRFE provides \$6,000 annually towards that production (about 0.6 percent of PSRFE funding for fish production; Table 3). Due to the small amount of funding, a complete analysis was not conducted. However, based on the average SAR of Marblemount Hatchery yearling Coho salmon of 5.72 percent (2000-2011 Brood year (BY)) and the program release goal of 250,000, the estimated average production would be 14,300 adults. Out of the adults produced annually by this program, an estimated 12.5 percent are caught in the Puget Sound sport fishery (Table 8). No production costs were provided to allow for the calculation of cost per adult for this program (Table 8). It is assumed that this population should be considered Primary and in the Local Adaptation phase due to generally high abundance (average 47,083 for 2007 through 2015 return years; WDFW SCoRE data base); however, no determination was provided. Based on this information and the level of natural-origin fish used in the broodstock (21 percent, from HGMP), the PNI is most certainly above 0.67, which meets or exceeds HSRG recommendations. Additional analysis for this program is provided in Appendix D.

3.1.3 Wallace River Hatchery

The WDFW Wallace River Hatchery is located on the Skykomish River, which is a tributary of the Snohomish River that enters Puget Sound at MA 9 near Everett, Washington (Figure 7).



Source: WDFW 2011.

Figure 7. Wallace River Hatchery near Gold Bar, Washington.

Chinook --The PSRFE program provides about \$230,000 in funding to aid in the production of 500,000 yearling summer Chinook salmon at the Wallace River Hatchery (about 23 percent of PSRFE funding for fish production; Table 3). The program is identified as an integrated harvest program. This population has been identified as a Contributing population in the Recolonization phase (Table 7). Based on the average SAR of Wallace Hatchery yearling Chinook salmon of 1.12 percent and the release goal of 500,000, the estimated average recruitment would be about 5,600 adults.

Out of the estimated 5,600 adults produced annually by this program, an estimated 13.5 percent are caught in the Puget Sound sport fishery. Recent analysis by WDFW estimates that the production costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for this program are \$634 and \$323, respectively (based on 2016 operating costs). This program ranks 2nd out of the 13 Chinook programs evaluated (Table 8).

The Wallace River Hatchery Chinook program does meet HSRG recommendations for integrated broodstock management programs (Table 1). Wallace River is a Contributing

population in the Recolonization phase (Table 7) and PNI has averaged above 0.5 in recent years (Appendix D).

Coho--The PSRFE program provides about \$25,000 in funding to aid in the production of 150,000 yearling Coho salmon at the Wallace River Hatchery (about 2.5 percent of PSRFE funding for fish production; Table 3). The program is identified as an integrated harvest program (Table 7). Skykomish River Coho is not ESA-listed. This population has been identified as biologically significant by the Co-Managers and has been designated as a key wild management unit status (one of five) in Puget Sound (Co-Managers Comprehensive Coho Management Plan, 1998). The HSRG assumes this equates to a “Primary” population. Based on the average SAR of Wallace Hatchery yearling Coho salmon of 6.25 percent (2001-2009 BY) and the program release goal of 150,000, the estimated average production would be 9,375 adults. Out of the adults produced annually by this program, an estimated 7.6 percent are caught in the Puget Sound sport fishery.

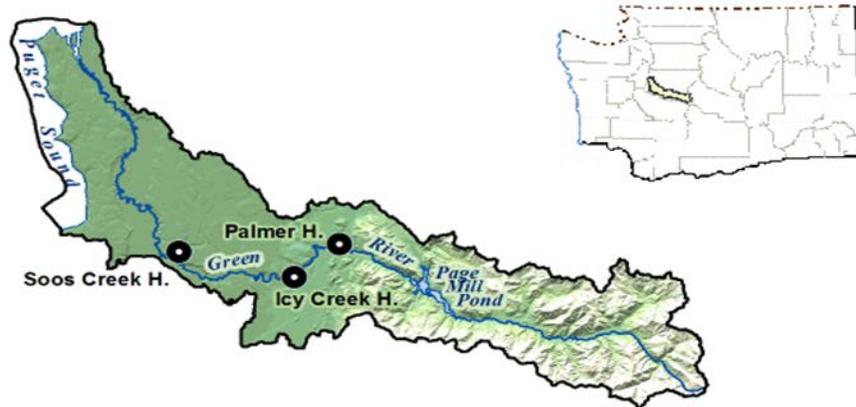
Recent analysis by WDFW estimates that the production cost per fish harvested in the Puget Sound winter and summer sport fishery combined for this program is \$89 based on 2016 operating costs (Table 8). The Wallace River Hatchery Coho program does meet HSRG recommendations for integrated broodstock management programs (Table 1). Wallace River is assumed to be a Primary population in the Local adaptation phase (Table 7) and PNI has averaged above 0.9 in recent years (Wallace Coho HGMP).

3.2 CENTRAL PUGET SOUND

The Central Puget Sound area is comprised of MAs 10 and 11 (Figure 1). Central Puget Sound provides a sport fishery averaging about 8,500 Chinook and 14,000 Coho salmon caught annually (Table 5). Total hatchery production in the Central Puget Sound region of juveniles from all sources (WDFW, federal, and Tribal) is about 13 million Chinook and 3 million Coho salmon (Table 6). The PSRFE provides funds for three Chinook salmon production programs in the Central Puget Sound. PSRFE supports production of 4.7 million juvenile Chinook salmon in the Central Sound region (representing about 36 percent of all Chinook production in the Central Sound area; Table 3).

3.2.1 Soos Creek/Icy Creek Hatchery Complex

Soos Creek Hatchery is located on the Green River, which is a tributary of the Duwamish River and enters Puget Sound in Seattle, Washington (Elliot Bay). Icy Creek Hatchery is a component of the Soos Creek hatchery complex and is located on a Green River tributary (Figure 8).



Source: WDFW 2011.

Figure 8. Soos Creek/Icy Creek Hatchery Complex.

The PSRFE provides about \$277,000 to support the rearing of 3.2 million subyearling fall Chinook salmon at Soos Creek Hatchery and 300,000 yearling fall Chinook at the Icy Creek facility (about 28 percent of PSRFE funding for fish production; Table 3). The fall Chinook salmon production at Soos Creek Hatchery is currently managed as an integrated program, which requires annual inclusion of natural-origin fish in hatchery broodstock. The Soos Creek Hatchery population is listed as Stabilizing and is in the Recolonization phase (Table 7).

Based on the average survival of Soos Creek Hatchery subyearling and Icy Creek yearling fall Chinook salmon of 0.44 percent (the average SARs are currently identical), and the programmed release goal of 3.2 million subyearlings and 300,000 yearlings, the estimated average recruitment would be about 14,000 and 1,320 adults, respectively. The program's harvest efficiency (percent of total adults produced by the programs that contribute to the Puget Sound sport fishery) is 12.6 percent for Soos Creek subyearlings and 27.7 percent for Icy Creek yearlings (Table 8).

Recent analysis by WDFW estimates that the costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for the Soos Creek subyearling program are \$1,985 and \$250, respectively (based on 2016 operating costs). This program ranks 12th out of 13 Chinook programs evaluated (Table 8). The costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for the Icy Creek yearling program are \$1,011 and \$328, respectively (based on 2016 operating costs). This program ranks 5th out of 13 Chinook programs evaluated (Table 8).

The Soos Creek Hatchery program does meet HSRG recommendations for integrated broodstock management for a Stabilizing population in the Recolonization phase (Table 1). Strays from this program occur in a watershed that has been identified by the Co-Managers as a Stabilizing population (Green River, Draft designation). Since the population is in the

Recolonization phase, HSRG standards for pHOS and PNI do not apply⁴; additional hatchery origin fish straying to the watershed benefit the population by making use of under-utilized habitat.

3.2.2 Voight Creek Hatchery

Voight Creek Hatchery is located in the Puyallup River watershed (Figure 9).



Source: WDFW 2011.

Figure 9. Voight Creek Hatchery near Puyallup, Washington.

The PSRFE provides about \$64,000 to support the rearing of 1.2 million subyearling fall Chinook salmon at this facility (about 6.5 percent of PSRFE total funding for fish production; Table 3). Based on the average smolt-to-adult survival rate of 0.60 percent and a programmed release goal of 1.2 million subyearlings, the estimated adult production level would be about 7,000 fish. Of these returning adults, 12.8 percent are harvested in the Puget Sound sport fishery (Table 8). The Puyallup River natural Chinook population is managed as a Stabilizing population in the Recolonization phase (Table 7). The goal for the hatchery program is to attain the HSRG standards for a Stabilizing population by maintaining pNOB, PNI and pHOS values at their current levels.

⁴ Recommendations for pHOS and PNI standards have not yet been developed by the HSRG for populations in the Recolonization phase; currently, the HSRG recommends that populations in this phase maintain current pHOS and PNI levels.

Recent analysis by WDFW estimates that the costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for this program are \$1,026 and \$200, respectively (based on 2016 operating costs). This program ranks 7th out of 13 Chinook programs evaluated (Table 8).

The Voight Creek Hatchery program meets HSRG recommendations for broodstock management (Table 1). Strays from this program are in a watershed that has been identified by the Co-Managers as a Stabilizing population (Puyallup River; Draft designations). Since the population is in the Recolonization phase, HSRG recommendations for pHOS and PNI do not apply; additional hatchery origin fish straying to the watershed benefit the population by making use of underutilized habitat.

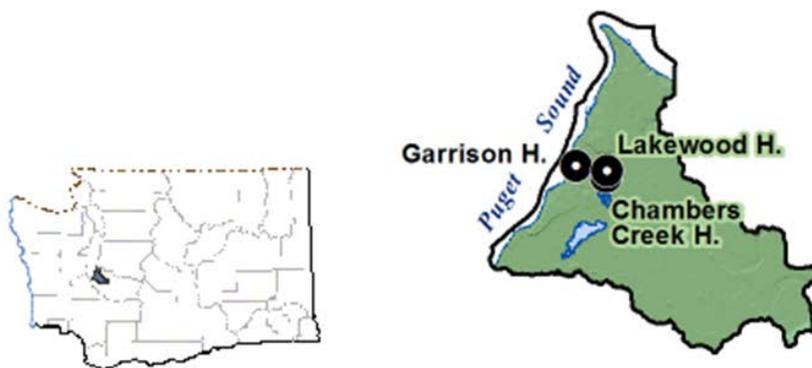
Information on Voights Creek Coho has also been provided. While not funded by PSRFE, Voights Creek has traditionally been an excellent Coho producing hatchery and information is presented in Appendix D for comparisons.

3.3 SOUTH PUGET SOUND

The South Puget Sound area is composed of MA 13 (Figure 1). South Puget Sound provides a sport fishery averaging about 1,300 Chinook and 400 Coho salmon caught annually (Table 5). Total hatchery production in the South Puget Sound region of juveniles from all sources (WDFW, federal, and Tribal) is about 11.5 million Chinook and 2.4 million Coho salmon (Table 6). The PSRFE supports two major Chinook salmon production programs in South Puget Sound which produce about 3.4 million juveniles (representing about 29 percent of total Chinook production in the South Sound) (Table 3). The Nisqually River is the only native Chinook salmon bearing river that enters South Puget Sound. Most watersheds consist of small-to-medium size stream/rivers and support natural Coho and Chum runs.

3.3.1 Garrison Springs Hatchery complex (Garrison, Chambers Ck.)

The Garrison Springs Hatchery complex is located south of Tacoma (Figure 10).



Source: WDFW 2011.

Figure 10. Garrison Springs Hatchery Complex near Tacoma, Washington.

The PSRFE provides about \$172,000 to rear 950,000 regular and 200,000 jumbo subyearling fall Chinook salmon at this facility complex (about 17 percent of PSRFE total funding for fish production; Table 3). The program is identified as a segregated harvest program (Table 7). The broodstock is derived from stock returning to south Puget Sound. Broodstock for this program are normally collected at Tumwater Falls Hatchery (located near Olympia, WA). However, broodstock may be taken from several facilities located in south Puget Sound and are aggregated for use in several hatchery programs located in this region. Based on an average SAR of 0.39 percent for subyearlings and 0.62 percent for jumbo subyearlings and the production goal of 950,000 subyearlings and 200,000 jumbo subyearlings, approximately 3,700 and 1,200 adults are produced by each program, respectively. The harvest efficiency (percent of total adults produced by these programs that contribute to the Puget Sound sport fishery) is 21.5 percent for subyearlings and 27.5 percent for jumbo subyearlings produced at these facilities (Table 8). A program for yearling fall Chinook has been dropped from this facility due to fish health issues.

Recent analysis by WDFW estimates that the costs per fish harvested in the winter Puget Sound Sport Fishery and the winter and summer sport fisheries combined for the regular subyearling program are \$1,485 and \$291, respectively (based on 2016 operating costs). The regular subyearling program ranks 9th out of 13 Chinook programs evaluated (Table 8). The costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fisheries combined for the jumbo subyearling program are \$722 and \$152, respectively (based on 2016 operating costs). The jumbo subyearling program ranks 3rd out of 13 Chinook programs evaluated (Table 8).

The Garrison Springs Hatchery complex program does meet HSRG recommendations for segregated broodstock management (Table 1). This is because strays from this program are in a watershed that lacks a natural Chinook population (Chambers Creek).

3.3.2 Minter Creek Hatchery complex (Minter and Gorst)

Minter Creek Hatchery is located on the Kitsap Peninsula (Figure 11).



Source: WDFW 2011.

Figure 11. Minter Creek Hatchery on the Kitsap Peninsula.

The PSRFE provides about \$77,000 to support rearing of 2,150,000 subyearling fall Chinook salmon at the combined Minter/Gorst complex (about 7.8 percent of PSRFE total funding for fish production; Table 3).

Minter Creek Hatchery—Minter Creek Hatchery provides broodstock collection, incubation, and initial rearing for 2,150,000 fish. About 1.4 million juveniles are released on site and the remainder shipped to the Gorst facility (see below). The Minter Creek Hatchery program is identified as a segregated harvest program (Table 7). Minter Creek Chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy. The SAR is 0.61 percent. The harvest efficiency for this program (percent of total adults produced that contribute to the Puget Sound sport fishery) is 17.8 percent (Table 8).

Recent analysis by WDFW estimates that the costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for the Minter Creek portion of this program are \$878 and \$232, respectively (based on 2016 operating costs; Table 8). This program ranks 4th out of 13 Chinook programs evaluated (Table 8).

The Minter Creek Hatchery program does meet HSRG recommendations for segregated broodstock management (Table 1). This is because the strays from this program are in a watershed that lacks a natural Chinook population (Minter Creek).

Gorst Creek Hatchery—Gorst Creek hatchery is located on the Kitsap Peninsula (Figure 12).



Source: WDFW 2011.

Figure 12. Gorst Creek Hatchery on the Kitsap Peninsula.

About 800,000 of the 1.6 million fall Chinook salmon fingerlings released at Gorst Creek are supplied by Minter Creek Hatchery (Table 3). The program is identified as a segregated harvest program (Table 7). The SAR is 0.41 percent. The harvest efficiency for this program (percent of total adults produced that contribute to the Puget Sound sport fishery) is 11.1 percent (Table 8).

Recent analysis by WDFW estimates that the costs per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fishery combined for this program are \$1,889 and \$378, respectively (based on 2016 operating costs; Table 8). This program ranks 11th out of 13 Chinook programs evaluated (Table 8).

The program does meet HSRG recommendations for segregated broodstock management (Table 1). Strays from this program are in a watershed that lacks a natural Chinook population (Gorst Creek).

Hupp Springs Hatchery - Hupp Springs hatchery is located on Minter Creek, about 5 miles upstream of that facility (Figure 11). The Coho program is new without any performance or cost data. The PSRFE is funding the release of 125,000 Coho at a cost of \$25,000. Minter Creek Coho data were used to estimate the performance of this program (Table 8).

3.4 HOOD CANAL

The Hood Canal area is composed of MA 12 (Figure 1). Hood Canal provides a sport fishery averaging about 1,300 Chinook and 1,600 Coho salmon caught annually (Table 5). Total hatchery production in the Hood Canal region of juveniles from all sources (WDFW, federal, and Tribal) is about 5.6 million Chinook and 0.5 million Coho salmon (Table 6). The PSRFE

funds only one program in Hood Canal (Table 3). PSRFE production in this region amounts to about 125,000 juveniles (representing about 2.2 percent of total Chinook production in Hood Canal) (Table 3).

3.4.1 Hoodsport Hatchery

Hoodsport Hatchery is located near the start of the boot of Hood Canal (Figure 13).



Source: WDFW 2011.

Figure 13. Hoodsport Hatchery near Hoodsport, Washington.

The PSRFE provides about \$85,000 to support the rearing of 120,000 yearling fall Chinook salmon at the Hoodsport Hatchery (about 8.6 percent of PSRFE total funding for fish production; Table 3). The program is identified as a segregated harvest program (Table 7). Segregation is achieved operationally by using only adult hatchery Chinook (distinguished by an adipose fin-clip) returning to the Hoodsport Hatchery trap and the Purdy Creek trap at George Adams.

The SAR is 0.64 percent. The harvest efficiency for this program (percent of total adults produced that contribute to the Puget Sound sport fishery) is 33.2 percent. Recent analysis by WDFW estimates that the cost per fish harvested in the winter Puget Sound sport fishery and the winter and summer sport fisheries combined for this program are \$399 and \$136, respectively (based on 2016 operating costs). This program ranks 1st out of 13 Chinook programs evaluated (Table 8). Information on the performance of the subyearling program at Hoodsport is provided for comparison and can be found in Appendix D.

The program does meet HSRG recommendations for segregated broodstock management (Table 1). Strays from this program are in a watershed that lacks a natural Chinook population (Finch Creek).

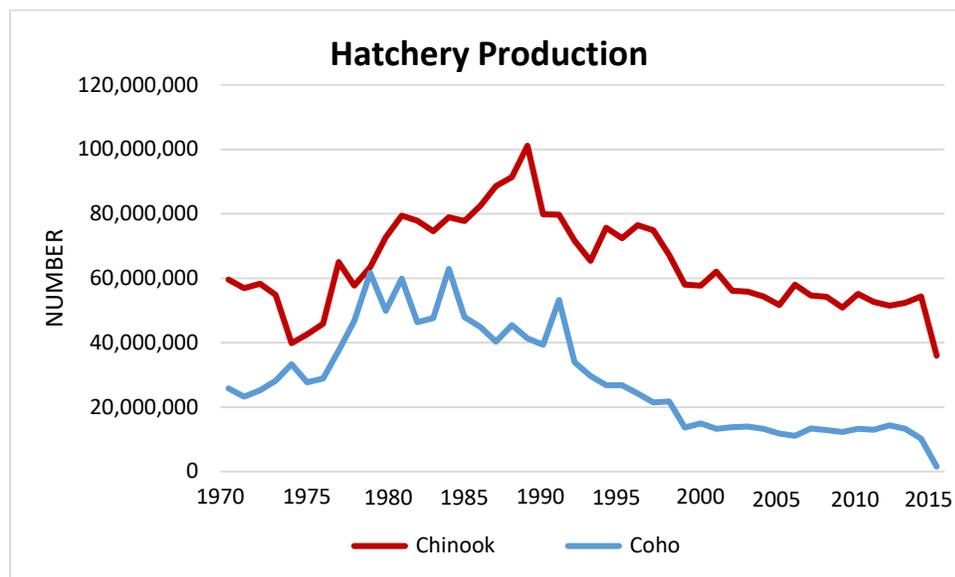
3.5 SUMMARY OF PROGRAM EVALUATION QUESTIONS

All of the PSRFE Puget Sound hatchery programs contribute to the Puget Sound recreational fisheries. Details about the specific contributions of each program are provided in Appendix D. In addition, all of the programs are consistent with the HSRG's principles and recommendations for broodstock management.

4.0 RESULTS OF HSRG EVALUATION OF PSRFE PROGRAMS

4.1 SPORT CATCH OPPORTUNITY IN THE PUGET SOUND

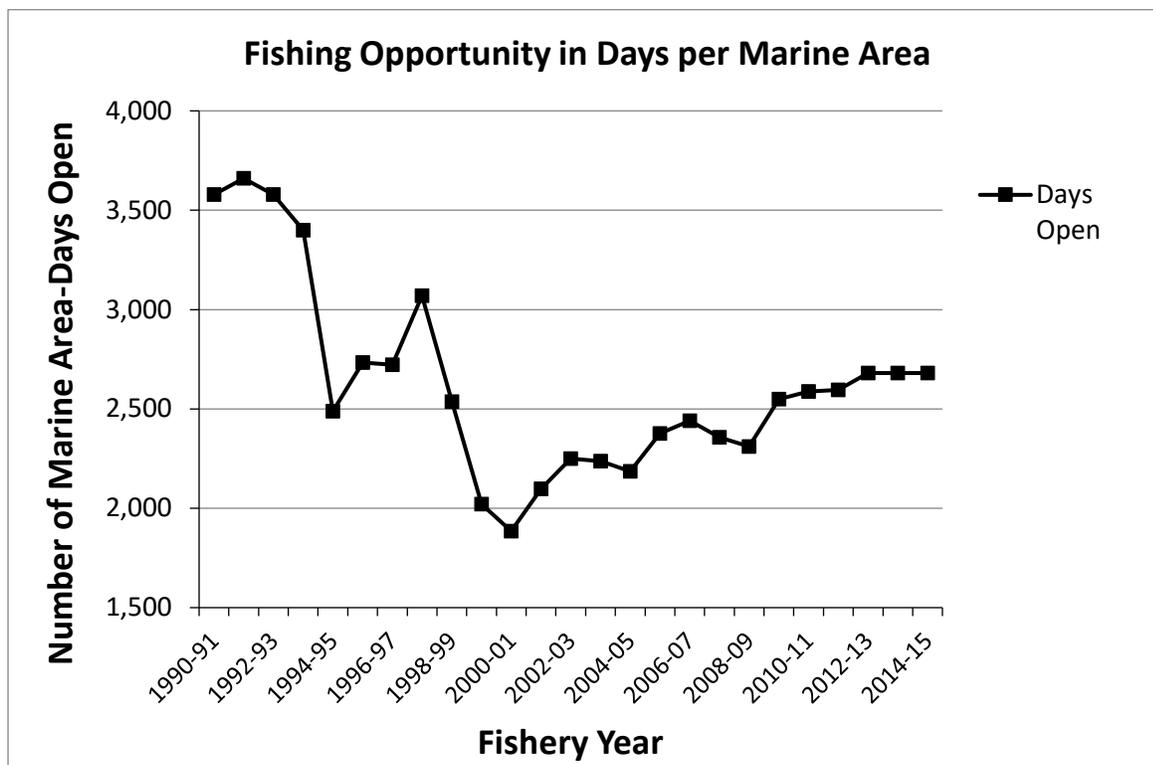
In 2011, the Legislature repealed several sections of RCW 75.54 including some, but not all, that focused on the winter blackmouth fishery, and reauthorized the PSRFE program under RCW 77.105. A key point of the revised legislation was to focus evaluation metrics on an increase in angler trips as a measure of fishing opportunity. For years, the Pacific Northwest was known for its large salmon populations and excellent fishing. However, a series of factors associated with human population trends, including habitat destruction, ESA listings, changes in ocean productivity, increases in cost of fish production and increases in harbor seal and sea lion predation have reduced salmon populations and fishing opportunity in the Pacific Northwest. A notable influence on reductions in sport fishing opportunity has been an overall decrease in WDFW Chinook and Coho salmon hatchery production beginning in the mid to late 1980s due primarily to budget reductions (Figure 14).



Source: WDFW data, as calculated by HSRG.

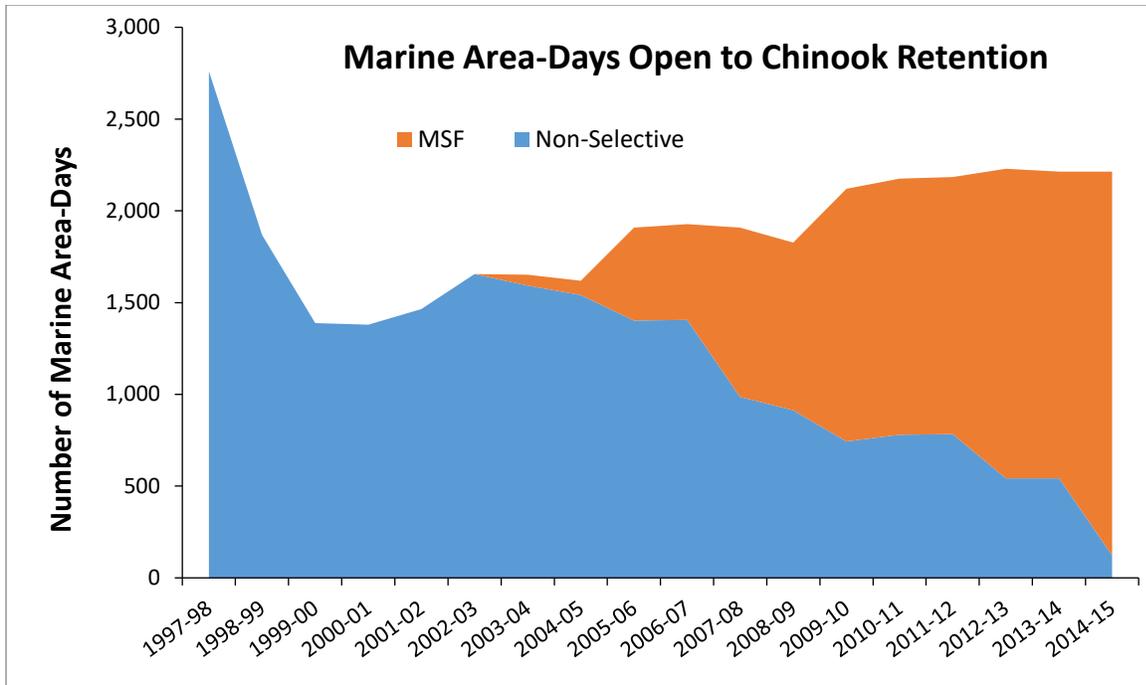
Figure 14. Total Chinook and Coho salmon releases in Washington State, 1970-2015.

Overall, sport salmon fishing opportunity in days per marine area in Puget Sound has been reduced since the early 1990s in terms of total days of allowable fishing (Figure 15). The largest reductions in opportunity occurred in the early 2000s, with overall opportunity increasing somewhat in recent years (Figure 15). Since the introduction of Puget Sound Sport Chinook mark-selective fisheries (MSFs) in the early 2000s, there has been a significant shift from non-selective to MSF opportunity (Figure 16).



Source: WDFW.

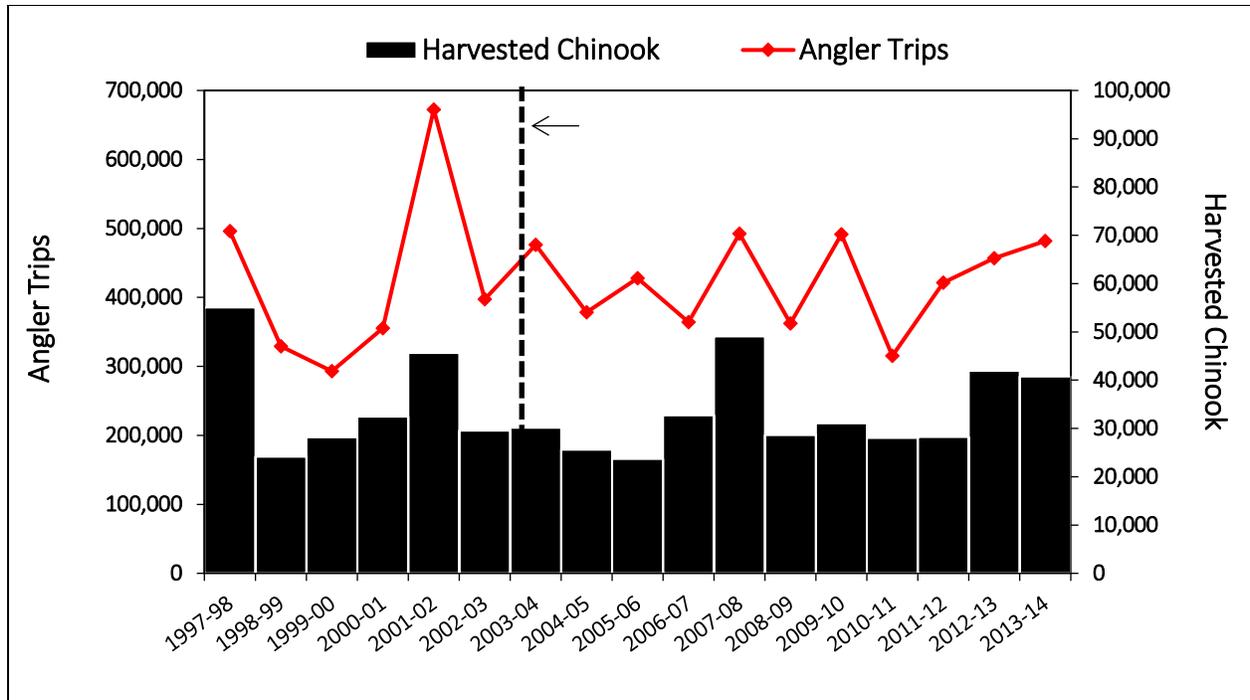
Figure 15. Number of marine area-days open to salmon fishing in the Puget Sound, 1990-2015.



Source: WDFW.

Figure 16. Number of marine area-days open to Chinook retention in mark-selective and non-selective fisheries in the Puget Sound, 1997-2015.

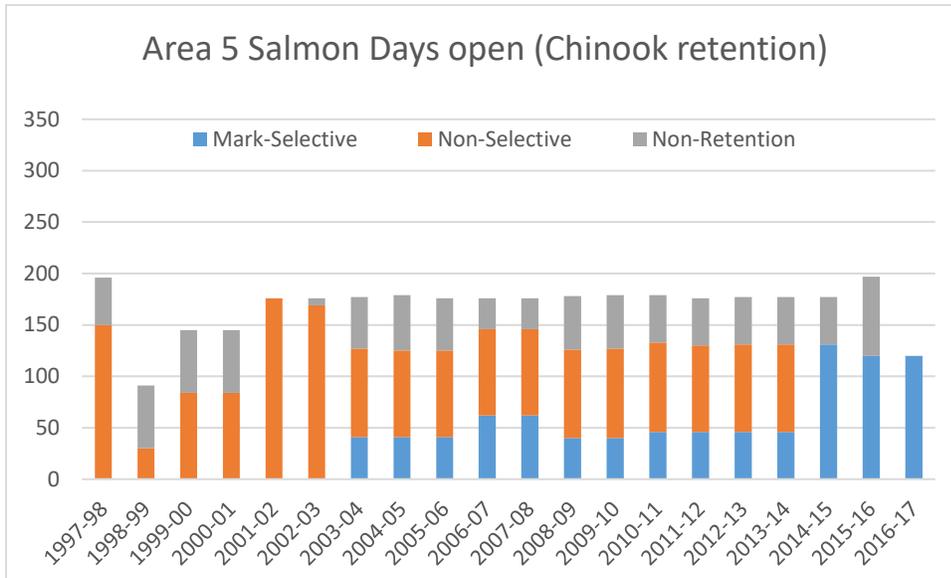
Overall, WDFW data indicates that neither of these increases in opportunity resulted in a significant increase in angler trips or Chinook salmon harvest (Figure 17). However, WDFW data suggests that allowing Coho-only sport fishing seasons (non-retention of Chinook salmon) has increased opportunity, particularly in MAs 9-10 (Figure 18).



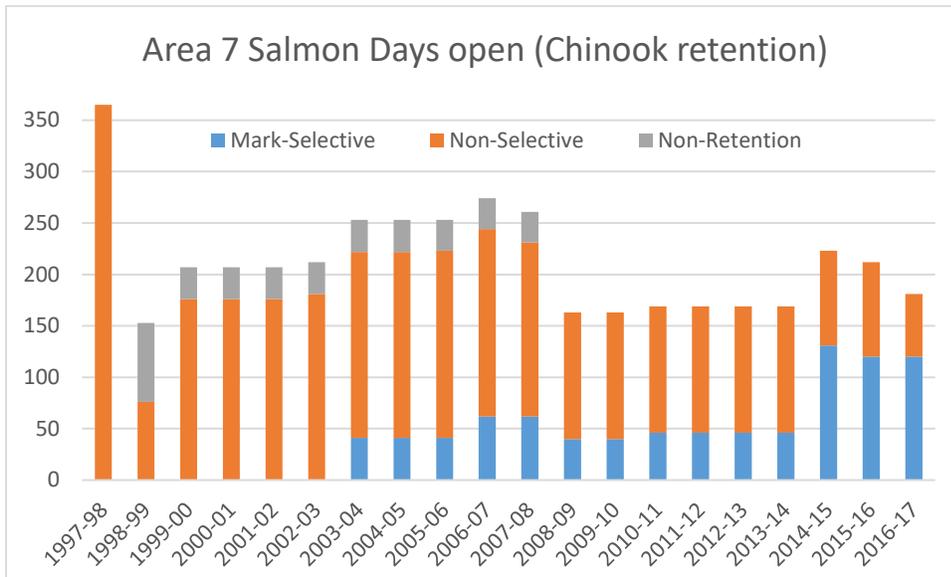
Source: WDFW.

Figure 17. Total Chinook salmon sport harvest and number of angler trips in Puget Sound. Dashed line indicates start of mark-selective fishery.

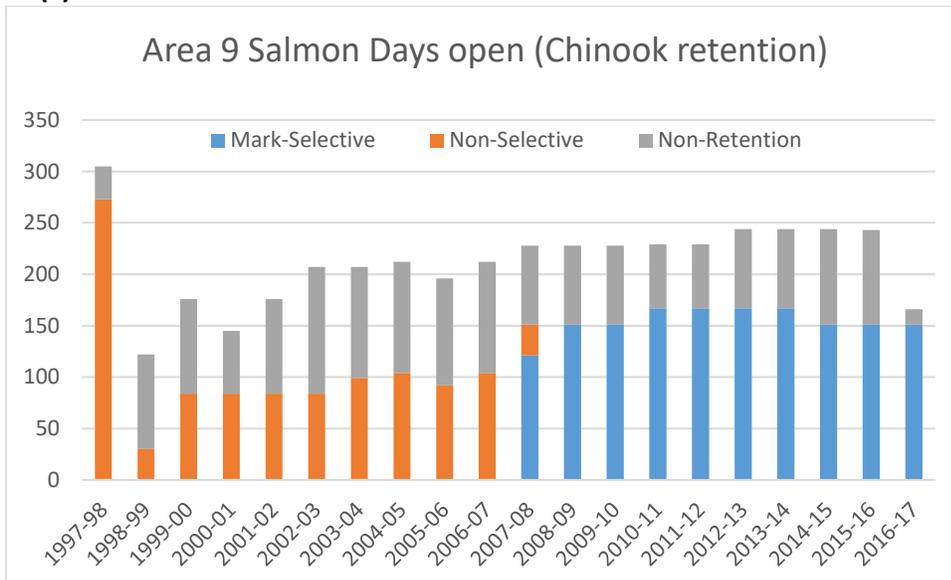
18(a)



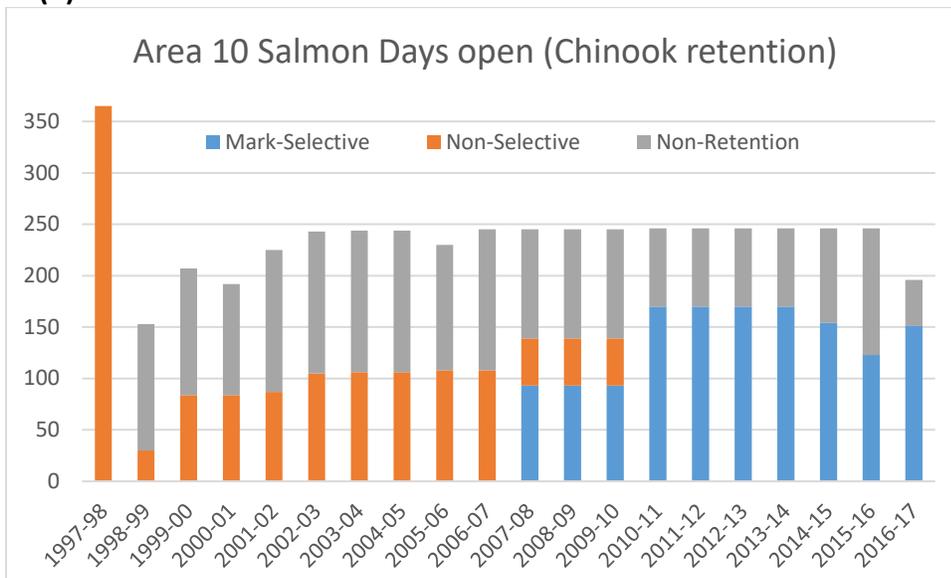
18(b)



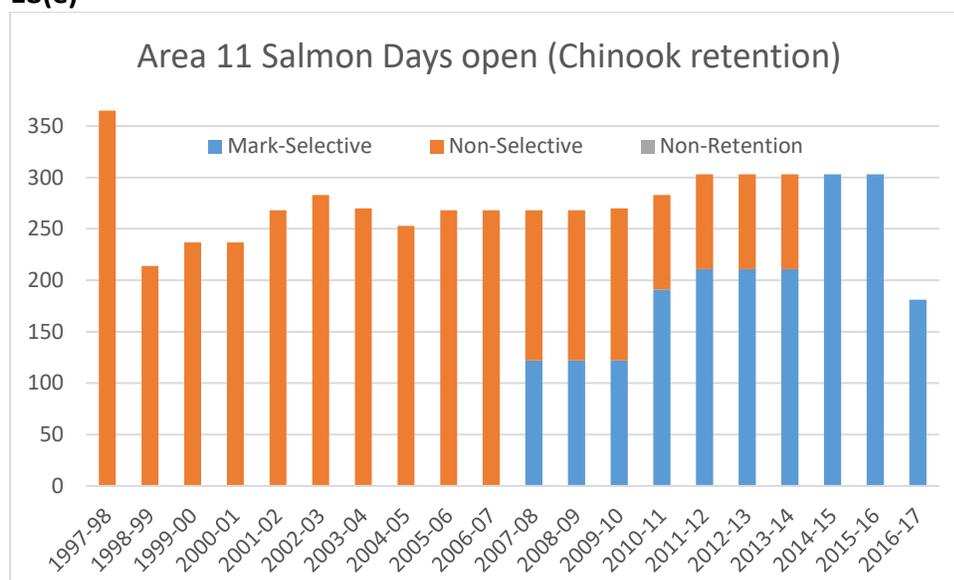
18(c)



18(d)



18(e)



Source: WDFW.

Figure 18. Fishing days available and mark-selective fishery (MSF), non-MSF, and non-retention opportunities in Areas 5, 7, 9, 10 and 11, from 1997-2017

The recent six-year average (2010 through 2016) sport catch of Chinook and Coho salmon approaches 0.8 per marine angler trip in MA 5 (Sekiu-Pillar Point); this is the most western MA in which the Legislature directed PSRFE to enhance fishing opportunity (Table 9). Reasonable fishing success of about half a fish per angler trip is also available in the east Juan de Fuca MA 6 (Table 9). However, catch per unit effort (CPUE) is greatly reduced in areas in the San Juan Islands and within the main body of Puget Sound (MAs 7 through 13). In areas around Everett and Seattle (MAs 9 through 10) sport catch is around 0.3 per marine angler trip, while it is even lower (about 0.1 or less) in MA 11 through 13 (Table 9). Although CPUE in MAs 11 through 13 is very low, average opportunity as measured in marine angler trips averages about 100,000 per year in these areas (Table 9), suggesting considerable unmet demand for fish to catch.

Table 9. Six-year average for Chinook and Coho catch, marine angler trips, and catch per trip, 2010-2016.

Marine Area	Chinook	Coho	Marine Angler Trips	Salmon per Trip
Sekiu-Pillar Point (Area 5)	6,405	38,056	54,620	0.78
East Juan de Fuca (Area 6)	5,161	8,199	26,238	0.48
San Juan Islands (Area 7)	7,363	1,995	44,173	0.21
Deception Pass, Hope Island (Area 8-1)	222	2,380	12,485	0.21
Port Susan & Port Gardner (Area 8-2)	584	7,658	40,659	0.19
Admiralty Inlet (Area 9)	5,597	29,245	109,574	0.31

Marine Area	Chinook	Coho	Marine Angler Trips	Salmon per Trip
Seattle-Bremerton (Area 10)	2,582	13,176	45,796	0.34
Tacoma-Vashon Island (Area 11)	3,516	2,192	60,687	0.10
Hood Canal (Area 12)	1,128	1,770	23,257	0.12
South Puget Sound (Area 13)	991	261	23,777	0.05

Source: WDFW data, as calculated by HSRG.

One source of excess fish theoretically available for sport catch is surplus fish returning to WDFW hatcheries. All hatcheries need more fish returning than are needed for broodstock, which is required to account for pre-spawning mortality. However, at times surplus fish can be excessive and may represent lost fish opportunity. For instance, in North Sound MAs 5 through 7, there are an average of about 5,000 Chinook and 3,000 Coho surplus fish that hatcheries must dispose of each year (Table 10). These surplus fish are only a fraction of the average annual catch (less than 20 percent) in MAs 5 through 7. However, in the MAs closer to the population centers in Puget Sound (MAs 10 through 13) these excess fish represent a major lost opportunity with hatchery surplus nearing or exceeding catch in MAs 10 through 11 and greatly exceeding catch (to over 10 times) in MAs 12 and 13 (Table 10).

For PSRFE-funded programs, the number of surplus fish can average over 5,000 fish per year at some facilities (Table 11). These data indicate that while PSRFE funding is helping provide fish, it is not providing as large a benefit as possible to recreational fishers, due most likely to fishing season regulation constraints and potentially lack of angler awareness. For instance, in MA 13 (South Puget Sound), the recent 10-year average Chinook and Coho sport catch was 32 percent and 6 percent of hatchery surpluses and most recently (2015-16 season) was about 7 percent and 2 percent, respectively (Table 10). MA 13 is currently open year round for salmon fishing, while the areas directly to the north (MAs 11 and 10) have numerous catch regulations and closures. Nonetheless, recent 6-year average angler trips were 2 to 2.5 times higher than for MA 13 (Table 9), suggesting anglers might be unaware of potential surpluses and increased angler opportunities in South Puget Sound (MA 13). Successful sport fisheries require a high abundance of fish, and with their limited ability to remove fish, some surpluses can be expected; however, it should be of interest to anglers to know where large surpluses of fish are occurring.

Table 10. Nine-year sport catch vs. surplus Chinook and Coho salmon returns to all hatcheries in MAs 5-13.

Catch Year	South Sound- Area 13				Central Sound Areas 10 & 11				Hood Canal - Area 12				North Sound Areas - 8.1, 8.2, 9				San Juans & Straits Areas - 5,6,7			
	Chinook Sport catch	Chinook Hatchery Surplus	Coho Sport catch	Coho Hatchery Surplus	Chinook Sport catch	Chinook Hatchery Surplus	Coho Sport catch	Coho Hatchery Surplus	Chinook Sport catch	Chinook Hatchery Surplus	Coho Sport catch	Coho Hatchery Surplus	Chinook Sport catch	Chinook Hatchery Surplus	Coho Sport catch	Coho Hatchery Surplus	Chinook Sport catch	Chinook Hatchery Surplus	Coho Sport catch	Coho Hatchery Surplus
2015-16	1,037	14,537	265	15,247	2,031	12,145	17,483	27,552	761	28,428	1,147	5,099	6,058	4,933	58,067	12,744	18,705	3,026	65,775	2,058
2014-15	617	4,407	106	1,782	4,882	2,059	13,461	1,543	710	9,667	1,436	2,568	5,584	2,910	44,160	1,288	20,412	4,050	64,978	219
2013-14	1,472	846	136	1,782	7,443	566	17,614	18,536	838	5,729	2,419	1,585	7,261	2,391	51,884	12,149	25,210	8,096	43,854	1,799
2012-13	1,001	9,279	748	4,489	8,970	3,859	28,464	26,345	2,546	23,175	2,034	7,597	9,834	2,063	60,090	18,622	20,549	6,868	79,347	2,827
2011-12	1,141	3,898	222	6,527	5,603	9,795	12,741	43,929	1,167	25,726	3,195	4,169	3,694	3,430	18,629	15,387	16,149	3,383	22,298	4,197
2010-11	678	673	91	5,116	7,654	5,080	2,755	22,334	746	11,410	329	6,861	5,983	1,865	2,870	12,509	12,544	5,112	14,245	6,269
2009-10	1,374	311	294	2,186	7,280	7,676	14,647	5,270	949	10,250	1,469	1,373	1,343	699	7,258	4,276	11,610	11,733	30,059	704
2008-09	1,493	1,498	720	9,142	11,607	8,571	5,875	20,606	1,375	10,454	588	3,725	6,144	1,013	2,620	12,750	7,959	278	11,662	8,279
2007-08	3,117	902	824	9,721	20,719	6,138	11,033	21,058	2,824	11,162	1,564	4,175	10,413	4,099	17,241	10,408	12,790	714	34,533	17
Total	11,930	36,351	3,406	55,992	76,189	55,889	92,518	187,173	11,916	136,001	14,181	37,152	38,414	23,403	235,700	100,133	113,569	43,260	290,497	26,369
Average	1,326	4,039	378	6,221	8,465	6,210	13,786	20,797	1,324	15,111	1,576	4,128	6,257	2,600	29,202	11,126	16,214	4,807	40,750	2,930

Source: WDFW data, as calculated by HSRG.

Table 11. Surplus fish at PSRFE funded propagation facilities.

Hatchery Name	2010	2011	2012	2013	2014	2015	2016	2017	Average 2010-2017
<i>Chinook</i>									
Glenwood Springs	384	0	975	690	24	250	153	192	333
Wallace River	578	3,937	6,236	5,592	4,598	274	4,086	1,669	3,371
Wallace (summer)	8	806	2,466	1,193	1,887	1,913	3,279	1,232	1,598
Soos Creek	7,047	3,911	6,857	2,851	65	603	8,475	13,883	5,462
Voights	83	537	558	661	363	606	2,821	5,909	1,442
Icy Creek			202						202
Chambers/Garrison	228	136	107	50	0	40	163	14	92
Minter Creek	4,319	7,184	364	1,889	204	1,323	2,841	12,107	3,779
Hoodsport	417	291	4,359	939	937	2,970	3,292	3,966	2,146
<i>Coho</i>									
Hupp/Minter	2,186	5,116	6,527	4,489	1,781	907	15,222	11,878	6,013

Source: WDFW data, as calculated by HSRG.

4.2 HSRG EVALUATION OF PSRFE PROGRAMS

The HSRG ranked PSRFE programs based on a number of metrics associated with 1) cost per adult harvested in Puget Sound sport fishery; 2) productivity of the individual programs; and 3) ratio of PSRFE production to total production in target regions (e.g., North, Central, and South Puget Sound and Hood Canal).

Based strictly on cost per fish in the Puget Sound sport fishery for Chinook, the Hoodsport Hatchery yearling program ranks first (1st) in cost efficiency at \$136/fish harvested in the summer/winter combined fishery and \$399/fish harvested in the winter fishery and a harvest efficiency of 33.2 percent and 11.3 percent, respectively (Table 12). The Wallace Hatchery subyearling program (not funded by PSRFE) ranks last (13th) for the combined summer/winter fishery at \$810/fish harvested and a harvest efficiency of 8.2 percent. For the winter fishery alone, the Soos Creek subyearlings ranks last (13th) with a harvest efficiency of 1.66 percent and a cost of \$1,985 per fish harvested (Table 12). For Coho, the Voight Creek Hatchery production (not funded by PSRFE) ranks first (1st) in production cost (\$75/fish harvested) and the Hupp Springs program may rank last (4th) in production cost (\$148/fish harvested), based on Minter Creek data. (Table 12).

When compared to all hatchery programs in Puget Sound, without considering cost, the Hoodsport Hatchery yearling Chinook program still ranks first (1st) for its contribution to overall Puget Sound sport fisheries with 213 adults harvested per 100,000 juveniles released, although this catch may be mostly limited to MA 12 (Table 13). The Wallace River Hatchery Chinook yearling program ranks first (1st) for its contribution to the winter Blackmouth fishery at 77 adults harvested per 100,000 juveniles released (Table 13).

Table 12. Cost per fish harvested for Chinook and Coho programs funded by PSRFE [modified from Table 8].

Hatchery Name	Age at Release	Run	PS Summer/Winter Combined			PS Winter		
			Harvest Efficiency*	Harvest per 100K releases	Rearing cost per fish harvested	Harvest Efficiency**	Harvest per 100K releases	Rearing cost per fish harvested
Chinook								
Hoodsport	Yearlings	Fall	33.2%	213	\$136	11.3%	73	\$399
Wallace	Yearlings	Summer	13.5%	151	\$323	6.9%	77	\$634
Chambers/Garrison	Jumbo subs	Fall	27.5%	170	\$152	5.8%	36	\$722
Minter Creek	Subs	Fall	17.8%	107	\$232	4.7%	28	\$878
Icy Creek	Yearlings	Fall	27.7%	15	\$328	9.0%	3	\$1,011
Chambers/Garrison	Yearlings	Fall	46.5%	136	\$202	8.9%	27	\$1,022
Voights	Subs	Fall	12.8%	77	\$200	2.5%	15	\$1,026
Hoodsport	Subs	Fall	9.7%	44	\$218	2.0%	9	\$1,049
Chambers/Garrison	Subs	Fall	21.5%	83	\$291	4.2%	16	\$1,485
Wallace***	Subs	Summer	8.2%	25	\$810	4.2%	13	\$1,585
Minter/Gorst	Subs	Fall	11.1%	45	\$378	2.2%	9	\$1,889
Soos Creek	Subs	Fall	12.6%	56	\$250	1.6%	7	\$1,985
Glenwood Springs (phasing funding out)	Subs	Fall	10.2%	43	\$534	2.6%	11	\$2,090
Coho								
Wallace		Fall	7.6%	171	\$89			
Hupp Springs (Minter data used)		Fall	13.0%	271	\$148			
Marblemount		Fall	12.5%	722	Not Avail.			
Voights***		Fall	11.7%	386	\$75			
South Sound Net Pens***		Fall	12.7%	354	\$122			

NOTE: Table 12 has been sorted by ranking for lowest cost to the Puget Sound Winter Fishery. Individual hatchery positions may change if ranking is instead based on cost to the Puget Sound Summer and Winter fisheries combined. Some non-PSRFE funded hatcheries were included for comparison.

* Percent of total fish harvested in PS summer and winter sport fishery

** Percent of total fish harvested in PS winter sport fishery

*** Not funded by PSRFE

Source: WDFW data, as calculated by HSRG.

Table 13. Ranking of Puget Sound Chinook hatchery programs by number of adults contributed to Puget Sound sport fisheries per 100K juveniles released. PSRFE funded programs are indicated by bold text.

#	Program	PS Sport Adults per 100K released	#	Program	PS Sport - May to September Adults per 100K released	#	Program	PS Sport - Winter Blackmouth Adults per 100K released
1	Hoodsport Fall Yearling	213	1	Hoodsport Fall Yearling	140	1	Wallace Summer Yearling	77
2	Chambers Fall Late-Sub (Jumbo)	170	2	Chambers Fall Late-Sub (Jumbo)	134	2	Hoodsport Fall Yearling	73
3	Wallace Summer Yearling	151	3	Chambers Fall Yearling	109	3	Marblemount Spring Yearling	54
4	Chambers Fall Yearling	136	4	Icy Fall yearling	83	4	UW Fall Subyearling	50
5	Icy Fall yearling	123	5	Minter Fall Subyearling	79	5	Icy Fall yearling	40
6	Minter Fall Subyearling	108	6	Wallace Summer Yearling	74	6	Ricks Pond Fall Yearling	39
7	Gorst Fall Yearling	99	7	Grovers Fall Subyearling	70	7	Gorst Fall Yearling	37
8	UW Fall Subyearling	98	8	Chambers Fall Subyearling	67	8	Chambers Fall Late-Sub (Jumbo)	36
9	Ricks Pond Fall Yearling	97	9	Gorst Fall Yearling	63	9	White River Spring Yearling	34
10	Grovers Fall Subyearling	95	10	Bernie Gobin Fall Subyearling	62	10	Bernie Gobin Summer Subyearling	31
11	Marblemount Spring Yearling	86	11	Clear Creek Fall Subyearling	59	11	Minter Fall Subyearling	28
12	Bernie Gobin Summer Subyearling	84	12	Ricks Pond Fall Yearling	58	12	Chambers Fall Yearling	27
13	Chambers Fall Subyearling	83	13	Kalama Cr Fall Subyearling	55	13	Grovers Fall Subyearling	25
14	Bernie Gobin Fall Subyearling	77	14	Voight Fall Subyearling	54	14	Hupp Spring Subyearling	23
15	Kalama Cr Fall Subyearling	76	15	Bernie Gobin Summer Subyearling	53	15	Kalama Cr Fall Subyearling	20
16	Clear Creek Fall Subyearling	71	16	George Adams Subyearling	52	16	Chambers Fall Subyearling	16
17	George Adams Subyearling	68	17	Soos Fall Subyearling	49	17	George Adams Subyearling	16
18	Hupp Spring Subyearling	67	18	UW Fall Subyearling	48	18	Marblemount Spring Subyearling	16

#	Program	PS Sport Adults per 100K released	#	Program	PS Sport - May to September Adults per 100K released	#	Program	PS Sport - Winter Blackmout h Adults per 100K released
19	Voight Fall Subyearling	66	19	Tumwater Fall Yearling	47	19	Samish Fall Subyearling	15
20	Tumwater Fall Yearling	62	20	Diru Creek Fall Subyearling	47	20	Bernie Gobin Fall Subyearling	15
21	Soos Fall Subyearling	56	21	Hupp Spring Subyearling	44	21	Tumwater Fall Yearling	14
22	White River Spring Yearling	55	22	Tumwater Fall Subyearling	41	22	Issaquah Fall Subyearling	13
23	Tumwater Fall Subyearling	51	23	Gorst Fall Subyearling	36	23	Clarks Creek Fall Subyearling	13
24	Diru Creek Fall Subyearling	51	24	Palmer Fall Subyearling	36	24	Voight Fall Subyearling	13
25	Samish Fall Subyearling	49	25	Hoodsport Fall Subyearling	35	25	Wallace Summer Subyearling	13
26	Gorst Fall Subyearling	45	26	Samish Fall Subyearling	34	26	Clear Creek Fall Subyearling	12
27	Hoodsport Fall Subyearling	44	27	Glenwood Fall Subyearling	32	27	Whitehorse Summer Subyearling	12
28	Glenwood Fall Subyearling	44	28	Marblemount Spring Yearling	32	28	Glenwood Fall Subyearling	11
29	Issaquah Fall Subyearling	43	29	Issaquah Fall Subyearling	30	29	Tumwater Fall Subyearling	11
30	Palmer Fall Subyearling	43	30	Upper Puyallup Fall Subyearling	27	30	Whatcom Creek Subyearling	11
31	Clarks Creek Fall Subyearling	33	31	White River Spring Yearling	21	31	Kendall Creek Spring Subyearling	10
32	Upper Puyallup Fall Subyearling	33	32	Clarks Creek Fall Subyearling	20	32	Hoodsport Fall Subyearling	9
33	Wallace Summer Subyearling	25	33	Hamma Fall Subyearling	15	33	Gorst Fall Subyearling	9
34	Whatcom Creek Subyearling	24	34	Whatcom Creek Subyearling	14	34	Lummi SeaPonds Fall Subyearling	8
35	Whitehorse Summer Subyearling	23	35	Wallace Summer Subyearling	12	35	Palmer Fall Subyearling	7
36	Marblemount Spring Subyearling	22	36	Whitehorse Summer Subyearling	11	36	Soos Fall Subyearling	7
37	Hamma Fall Subyearling	19	37	Marblemount Fall Subyearling	10	37	Upper Puyallup Fall Subyearling	5
38	Lummi SeaPonds Fall Subyearling	18	38	Lummi SeaPonds Fall Subyearling	9	38	Marblemount Fall Subyearling	5
39	Kendall Creek Spring Subyearling	17	39	McCallister Creek Fall Subyearling	8	39	Hamma Fall Subyearling	4
40	Marblemount Fall Subyearling	14	40	Minter Creek Fall Yearling	8	40	White River Spring Subyearling	4

#	Program	PS Sport Adults per 100K released	#	Program	PS Sport - May to September Adults per 100K released	#	Program	PS Sport - Winter Blackout h Adults per 100K released
41	Minter Creek Fall Yearling	12	41	Big Beef Creek Fall Subyearling	8	41	Minter Creek Fall Yearling	4
42	Big Beef Creek Fall Subyearling	12	42	Kendall Creek Spring Subyearling	7	42	Diru Creek Fall Subyearling	4
43	McCallister Creek Fall Subyearling	9	43	Marblemount Spring Subyearling	7	43	Big Beef Creek Fall Subyearling	4
44	White River Spring Subyearling	6	44	Marblemount Summer Subyearling	5	44	Hupp Springs Spring Yearling	4
45	Marblemount Summer Subyearling	6	45	Hupp Springs Spring Yearling	2	45	Upper Puyallup Spring Subyearling	4
46	Hupp Springs Spring Yearling	6	46	White River Spring Subyearling	2	46	Marblemount Summer Subyearling	2
47	Upper Puyallup Spring Subyearling	4	47	Glenwood Fall Yearlings	2	47	McCallister Creek Fall Subyearling	1
48	Glenwood Fall Yearlings	2	48	Samish Fall Yearling	1	48	Glenwood Fall Yearlings	0
49	Samish Fall Yearling	1	49	Upper Puyallup Spring Subyearling	0	49	Samish Fall Yearling	0

Source: WDFW data - Hatchery Contribution to PS; Marston 10/11; as calculated by HSRG.

When all Puget Sound hatchery programs are compared to only the PSRFE programs based on the number of adults harvested per 100,000 juveniles released, the results indicate that the PSRFE has chosen to support some of the best hatchery programs in Puget Sound (Table 14). Overall, for the May to September sport fishery, the PSRFE programs average over 68 fish per 100,000 juveniles released, compared to about 30 for non-PSRFE programs (Table 14). This relationship holds true for releases of both subyearling and yearling fish (Table 14).

Table 14. Comparison of Chinook sport catch in May-September and in Winter Blackmouth fishery.

Program	N	May-Sept Sport Catch # fish/100K released		Winter Sport Catch # fish/100K released	
		Ave	SD	Ave	SD
<i>All Programs</i>					
PSRFE	12	68.4	41	26.6	24.2
Non-PSRFE	37	29.5	23.6	15.2	14.2
<i>Subyearlings</i>					
PSFRE	8	45.5	21.2	13.3	6.7
Non-PSFRE	28	30.6	23.6	13.5	11.5
Subyearling (jumbo)	1	134	NA	35.8	NA
<i>Yearling</i>					
PSFRE	3	107.7	24.9	58.9	27.6
Non-PSFRE	9	26.1	33.2	20.6	20.3
<i>Fall Subyearlings</i>					
PSFRE	7	50.3	17.6	13.4	7.3
Non-PSFRE	20	36.4	22.6	13.9	12.1
Fall Subyearling (jumbo)	1	134	NA	35.8	NA
<i>Fall Yearling</i>					
PSFRE	2	124.6	22.5	49.8	32.1
Non-PSFRE	6	29.8	29.1	15.7	18
<i>Spring Subyearlings</i>					
PSFRE	7	50.3	17.6	13.4	7.3
Non-PSFRE	20	36.4	22.6	13.9	12.1
<i>Spring Yearling</i>					
PSFRE	0	NA	NA	NA	NA
Non-PSFRE	5	12.1	18.2	11.2	8.2
<i>Summer Subyearlings</i>					
PSFRE	1	12.1	NA	12.6	NA

Program	N	May-Sept Sport Catch # fish/100K released		Winter Sport Catch # fish/100K released	
		Ave	SD	Ave	SD
Non-PSFRE	3	22.9	26.1	14.6	14.8
<i>Summer Yearling</i>					
PSFRE	1	74.1	NA	77.1	NA

Source: WDFW data, as calculated by HSRG.

An important consideration in ranking PSRFE programs is the scale of production of PSRFE programs compared to overall production in each evaluation area (e.g., North, Central, South Sound, and Hood Canal). For instance, while the PSRFE Hoodsport Chinook program ranks high in harvest efficiency and number of adults harvested in the sport fishery, the overall production of 120,000 juveniles is only 2 percent of all hatchery Chinook production in Hood Canal (Table 15) and does little to contribute to Puget Sound catch overall. In the North Sound area, PSRFE production makes up 13 percent of Chinook production and 19 percent of Coho production while accounting for about 30 percent of the PSRFE budget for fish production (Table 15). In the Central Sound, PSRFE production comprises 36 percent of Chinook production and 0 percent of Coho production while accounting for about 36 percent of the PSRFE budget for fish production (Table 15). In the South Sound, PSRFE production makes up 29 percent of Chinook production and 5 percent of Coho production while accounting for about 28 percent of the PSRFE budget for fish production (Table 15). As mentioned above, for Hood Canal PSRFE production makes up 2 percent of Chinook production and 0 percent of Coho production while accounting for about 9 percent of the PSRFE budget for fish production (Table 15). It should be noted that for these comparisons, the HSRG recognizes that for many of the programs mentioned, PSRFE does not fully fund production. Therefore, the percent of Chinook and Coho production listed is undoubtedly overstated.

Table 15. Comparison of PSRFE production to total production in target areas.

Program	Production Number	PSRFE funding	Percent of total PSRFE fish production funding	PSRFE percent of total area fish production
<i>North Sound</i>				
Glenwood Springs Hatchery Chinook	550,000	\$30,000	3%	
Marble Mount Hatchery Coho	250,000	\$6,000	1%	
Wallace River Hatchery Chinook	500,000	\$229,800	23%	
Wallace River Hatchery Coho	150,000	\$25,100	3%	
North Sound - all Chinook hatcheries	8,300,000			13%

Program	Production Number	PSRFE funding	Percent of total PSRFE fish production funding	PSRFE percent of total area fish production
North Sound – all Coho hatcheries	2,100,000			19%
<i>Central Sound</i>				
Soos Creek Hatchery Chinook	3,500,000	\$277,000	28%	
Voight Creek Hatchery Chinook	1,200,000	\$64,300	6%	
Central Sound - all Chinook hatcheries	13,000,000			36%
Central Sound - all Coho hatcheries	3,000,000			0%
<i>South Sound</i>				
Garrison Springs Hatchery Chinook	1,150,000	\$172,400	17%	
Minter Creek Hatchery Chinook	2,150,000	\$77,000	8%	
Hupp Springs Coho	125,000	\$25,000	3%	
South Sound - all Chinook hatcheries	11,500,000			29%
South Sound - all Coho hatcheries	2,400,000			5%
<i>Hood Canal</i>				
Hoodport Hatchery Chinook	120,000	\$85,200	9%	
Hood Canal - all Chinook hatcheries	5,600,000			2%
Hood Canal - all Coho hatcheries	500,000			0%
Total PSRFE Production	9,695,000	\$991,800	100%	

Source: PSRFE data, as calculated by HSRG.

When the initial PSFRE legislation was created, it was primarily intended to enhance the winter recreational fishery in Puget Sound. The intent was to release yearling Chinook because previous studies have shown higher survival and residency in Puget Sound than subyearling releases. Yearling survival rates, on average, were 6.5 times higher than subyearlings in the 1970s. By the 1990s, survival was slightly higher for subyearling releases (Figure 3). Presently, yearling releases generally still have a higher Puget Sound recreational winter catch rate in terms of cost per fish and harvest efficiency than subyearling releases (Table 8). This is probably because yearling fish have a higher residency rate than subyearlings and contribute at a higher rate to the winter fishery even though overall survival is less than subyearlings.

One theory being discussed about the dramatic switch in survival rates of yearling versus subyearling releases in Puget Sound is that resident salmon from yearling releases are more vulnerable to predation by harbor seals than subyearling releases since the residents' experience predation throughout the year as opposed to just the first spring and early

summer when most subyearlings migrate to open ocean waters. Chasco et al. (2017) estimated that from October to April, harbor seal predation in Puget Sound increased from about 200,000 to 2,000,000 individuals per year from 1970 to 1990s. Discussions of methods for reducing harbor seal predation on Puget Sound Chinook have been occurring as a means to increase prey abundance for southern resident killer whales. If harbor seal predation rates were to decrease in the future, the survival rate advantage of yearling releases versus subyearling releases in Puget Sound could provide a greater catch rate in cost per fish and harvest efficiency that currently exists.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The HSRG's review of HGMPs associated with PSRFE supported hatchery programs indicates all program operations and broodstock management strategies align with the three guiding principles of Hatchery Reform of having 1) well-defined goals, 2) scientific defensibility and 3) ability to flexibly and adaptively respond to new information. All of the PSRFE Puget Sound hatchery programs contribute to the Puget Sound recreational fisheries.

Additionally, the PSRFE appears to have carefully chosen which programs to fund. When all Puget Sound hatchery programs are compared to only the PSRFE programs based on the number of adults harvested per 100,000 juveniles released, the results indicate that the PSRFE has chosen to support some of the best hatchery programs in Puget Sound. Overall, for the May to September sport fishery, the PSRFE programs average over 68 fish/100,000 juveniles released, compared to about 30 fish/100,000 for non-PSRFE supported programs.

The HSRG's recommendations include an endorsement of the PSRFE plan for phasing out production at Glenwood Springs Hatchery. Additionally, the HSRG suggests either phasing out or greatly increasing production at Hoodspout Hatchery. Currently, although the Hoodspout Hatchery yearling Chinook production ranks first in cost efficiency, the program is small with overall production of 120,000 juveniles accounting for only 2 percent of all hatchery Chinook production in Hood Canal (MA 12). Additionally, Chinook sport catch in Hood Canal is low (less than 1,250 fish/year) as are the number of combined Chinook and Coho angler trips (less than 23,300 per year; about 20 percent of MA 9 to the north). Greatly increasing Hoodspout Hatchery Chinook production might increase opportunity and catch, while phasing out the program should have no effect on either.

The HSRG also suggests the PSRFE consider rebalancing funding support to areas where potential angler effort is currently high and catch is low. For instance, in general, catch per effort in terms of angler trips is lowest in the Puget Sound areas with the highest population density (Seattle south to Olympia, MAs 10, 11, and 13). Although catch in MAs 11 and 13 is very low, average opportunity as measured in marine angler trips averages about 85,000 per year in these areas, suggesting considerable unmet demand for fish to catch. One potential source for fish theoretically available for sport catch is surplus fish returning to WDFW hatcheries. For instance, in MA 13 (South Puget Sound), the recent 10-year average Chinook and Coho sport catch was 32 percent and 6 percent of hatchery surpluses and most

recently (2015-16 season) was about 7 percent and 2 percent, respectively. MA 13 is currently open year round for salmon fishing, while the areas directly to the north (MAs 10 and 11) have numerous catch regulations and closures. Nonetheless, recent 6-year average angler trips were 2 to 2.5 times higher in MAs 10 and 11 than in MA 13, suggesting anglers might be unaware of potential surpluses and increased angler opportunities in South Puget Sound (MA 13).

The HSRG also suggests the PSRFE program consider increasing support for production of yearling Chinook to enhance fishing opportunities in areas with the highest population density (Seattle south to Olympia). Initially, PSFRE legislation was created to enhance the winter recreational fishery in Puget Sound. Presently, yearling releases generally still have a higher Puget Sound recreational winter catch rate in terms of cost per fish and harvest efficiency than subyearling releases.

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Appendix A

HSRG Guidelines

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HSRG Principles

As described in Flagg 2015, the HSRG has identified three foundational principles for best management practices for operation of hatcheries (Mobrand et al. 2005; HSRG 2009, 2014; Paquet et al. 2011):

- **Principle 1:** Every hatchery program must have well-defined goals in terms of desired benefits and purpose, including: 1) the intended number of fish to be harvested, 2) the number of fish returning to a hatchery or spawning naturally in a watershed (i.e., escapement), and 3) the expected results of any associated scientific research. Goals must reflect the purpose and desired benefits of the program (e.g., harvest, conservation, research, education), and monitoring plans need to be in place to track progress.
- **Principle 2:** The goals and day-to-day operations of hatchery programs must be scientifically defensible. Once the goals for a program are established, the scientific rationale for the design and operation of the program must be explicitly described so that they may be understood by all personnel and, ideally, the general public. The approach must represent a logical progression to achieve the management goals and should be based on knowledge of the target ecosystem and the best scientific information available. Scientific oversight and peer review should be integral components of every hatchery program.
- **Principle 3:** Hatchery programs must be flexible and respond adaptively to new information. Scientific monitoring and evaluation (M&E) are necessary for all stocking programs and should be evaluated annually to allow timely programmatic adjustments. Hatcheries should be managed flexibly/adaptively to respond to new goals, new scientific information, and changes in the status of natural stocks and habitat. Evaluations should include assessment of survival, contributions of hatchery-origin adults to harvest and natural reproduction, and assessments of genetic (e.g., inbreeding depression, outbreeding depression) and ecological (e.g., competition, predation, disease transmission) interactions between hatchery- and natural-origin fish.

The HSRG has concluded that the biological principles used to manage hatchery populations and programs should be the same principles used to manage natural populations. Although hatcheries and riverine ecosystems represent two totally different types of environments, the biological principles for maximizing population viability in each of those two environments are the same. This paradigm shift requires that fishery and hatchery managers focus on the biological viability of the populations propagated in, and/or influenced by, the hatchery environment, as opposed to focusing on the management of physical facilities.

The HSRG has additionally emphasized that maintaining healthy habitat is critical not only for viable, self-sustaining natural populations, but also to adequately control risks of hatchery programs and to realize maximum benefits of hatcheries to recover populations

and sustain healthy harvests in an increasingly populated world. In the HSRG's view, hatchery reform should center around a new, ecosystem-based approach premised on the concept that hatchery production is sustainable only if the targeted populations – both hatchery and wild – are themselves biologically viable, and operations are consistent with conservation goals for wild fish in the watershed.

Loss of fitness is a major concern in situations where hatchery fish interact (interbreed) with wild fish (Ford 2002). The relative reproductive fitness of first-generation hatchery-origin adults in the wild can be affected by both genetic and environmental factors. For example, domestication selection, choice of hatchery broodstock, release location and age/size at release may affect spawn timing, growth, maturation and choice of spawning location of hatchery fish. To represent this lower relative reproductive fitness of hatchery fish, a correction factor is used by the HSRG. For Coho and Chinook salmon a factor of 0.8 is used, while for steelhead this may range anywhere from 0.10 to 0.8 depending on stock and location (Araki et al. 2008; Chilcote et al. 2011; Ford et al. 2012; Bernston et al. 2011, HSRG 2014).

The HSRG described two overall genetic management options to address potential fitness loss from hatchery fish (Mobrand et al. 2005; HSRG 2009, 2014; Paquet et al. 2011): (1) manage a hatchery broodstock as a reproductively distinct population that is genetically segregated from naturally-spawning populations, or (2) manage a hatchery broodstock as a genetically integrated component of an existing natural population:

- *Genetically segregated broodstocks* are generally derived strictly from hatchery-origin adults returning back to the hatchery each year. Segregated hatchery programs are structured to create a genetically distinct, hatchery-adapted population. Segregated hatchery populations will diverge genetically from naturally-spawning populations over time because of founder effects, genetic drift, and domestication selection in the hatchery environment. Such changes may be intentional (e.g., via selective breeding) to maximize benefits or the operational efficiency of a hatchery program. Segregated hatchery programs can provide large benefits for harvest. Fish from segregated hatchery programs would ideally be propagated solely from hatchery returns and not allowed to spawn with the natural population. Natural spawning by hatchery-origin (HOS) fish from a segregated program may pose unacceptable genetic and ecological risks to natural populations.
- *Genetically integrated broodstocks* include a prescribed proportion of natural-origin fish in the broodstock (pNOB) each year to maintain genetic integration with a natural population. For most integrated hatchery programs, the intent is to minimize the genetic and reproductive fitness differences between the hatchery broodstock (fish used for spawning) and the naturally-spawning population from which they are derived. To achieve this, at a minimum, the proportion of hatchery broodstock comprised of natural-origin fish (pNOB) has to be greater than the proportion of the naturally-spawning population made up of hatchery-origin fish (pHOS). Integrated hatchery programs require a self-sustaining naturally-spawning population capable of providing

adult fish for broodstock each year. Integration thus requires suitable natural habitat capable of sustaining a natural population. Under this concept, an integrated hatchery does not replace habitat but adds to existing habitat, by operating as an unusually productive tributary. An implicit goal of an integrated program is to demographically increase the abundance of a natural population while minimizing the genetic effects of artificial propagation. The size of an integrated hatchery program will necessarily be limited by the habitat available to the natural populations with which it is integrated and by the ability of the hatchery program to restrain natural spawning by hatchery-origin adults.

Normally, conservation programs will be focused on integrated strategies and harvest programs on segregated strategies. However, integrated programs can, in many cases, also support harvest opportunity. Both integrated and segregated populations pose risks to natural populations. Thus, both types of programs will require methods (e.g., selective fisheries, control structures such as weirs, or limits to production levels) to remove/limit hatchery-origin fish prior to arriving on the spawning grounds to adequately control hatchery-to-wild fish ratios.

Basic HSRG Framework

The HSRG has used the designations developed by the Lower Columbia River Fish Recovery Board to identify the biological significance of salmonid populations as described by the Managers. These are: Primary (populations which must meet the highest viability levels), Contributing (populations intended to meet moderate viability levels), or Stabilizing (populations that can maintain current viability levels). The Primary, Contributing, and Stabilizing designations refer to the conservation priority of the population and whether a hatchery solution could be developed to maintain or improve the rating while meeting the Managers' goals. The HSRG (2009) established recommendations for each population designation for the allowable levels of hatchery influence on naturally spawning populations. Hatchery influence is quantified as the proportion of hatchery fish ($pHOS$) on the spawning grounds and the fraction of natural-origin parents in the hatchery broodstock ($pNOB$). Additionally, the HSRG calculated the allowable proportionate natural influence (PNI^5) to reflect the relative influence of the natural and hatchery environments on the mean phenotypic values of a population at equilibrium based on the relative rates of gene flow between the two environments, such that $0 < PNI < 1.0$.

For HSRG evaluations, Primary populations were determined to require the lowest level of hatchery influence, Contributing populations an intermediate level of influence, while Stabilizing populations required no changes. To address the fitness risks posed by hatchery fish, the HSRG adopted a set of recommendations for hatchery influence on natural

⁵ 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).

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. In addition, each Primary and Contributing population will be assigned one of four “Recovery Phases” (Preservation, Re-colonization, Local Adaptation, or Fully Recovered). Stabilizing populations don’t usually have a recovery phase assigned as their current status is deemed acceptable. This identifies the current status of a population in terms of abundance, growth rate, spatial structure, diversity and habitat. So, a given population will have a designation, as well as having the current recovery phase 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 A-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
Guidelines for pHOS and PNI during the <u>Local Adaptation</u> and <u>Full Restoration</u> Phases	
Primary	Integrated hatchery programs—PNI \geq 0.67; pHOS \leq 30%
	Segregated hatchery programs—pHOS < 5%
Contributing	Integrated hatchery programs—PNI \geq 0.50; pHOS \leq 30%
	Segregated hatchery programs—pHOS < 10%
Stabilizing	Integrated hatchery programs—current condition
	Segregated hatchery programs—current condition

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Appendix B

Effects of ESA on PSRFE Programs

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The US Endangered Species Act (ESA) places constraints on PSRFE production in terms of the number of fish released and release location. Most concerns are based on ecological and genetic factors stemming from negative interactions between hatchery juveniles and adults with wild populations.

In Puget Sound, all of the natural stocks of Chinook salmon are listed under the ESA as threatened (FR Notice 70 FR 37160; 6/28/2005). Additionally, Hood Canal summer Chum (*O. keta*; FR Notice 70 FR 37160, 6/28/2005) and Puget Sound Steelhead (*O. mykiss*; FR Notice 72 FR 26722, 5/11/2007) are also listed as threatened. In Puget Sound, no stocks of Coho salmon are listed under ESA.

RCW [77.105.160](#) provides that, consistent with available revenue, Commission policies, Tribal Co-manager agreements, and limitations of the ESA, the WDFW, in consultation with the oversight committee created, shall adaptively manage the Puget Sound recreational salmon and marine fish enhancement program to maximize benefits to the Puget Sound recreational fishery. Summary information on ESA-listed salmon in Puget Sound is provided below because the ESA impacts utilization of PSRFE produced fish.

ESA-listed Chinook salmon in Puget Sound

ESA Listing Status: *Threatened*

ESU Definition: This evolutionarily significant unit, or ESU, includes naturally spawned Chinook salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Also, Chinook salmon from 26 artificial propagation programs are currently included in the listing. These include the Kendall Creek Hatchery Program, Marblemount Hatchery Program (spring subyearlings and summer-run), Harvey Creek Hatchery Program (summer-run and fall-run), Whitehorse Springs Pond Program, Wallace River Hatchery Program (yearlings and subyearlings), Tulalip Bay Program, Issaquah Hatchery Program, Soos Creek Hatchery Program, Icy Creek Hatchery Program, Keta Creek Hatchery Program, White River Hatchery Program, White Acclimation Pond Program, Hupp Springs Hatchery Program, Voights Creek Hatchery Program, Diru Creek Program, Clear Creek Program, Kalama Creek Program, George Adams Hatchery Program, Rick's Pond Hatchery Program, Hamma Hamma Hatchery Program, Dungeness/Hurd Creek Hatchery Program, Elwha Channel Hatchery Program, and the Skookum Creek Hatchery Spring-run Program.

ESA-listed Hood Canal Summer-run Chum

ESA Listing Status: *Threatened*

ESU Definition: This ESU includes naturally spawned summer-run Chum salmon originating from Hood Canal and its tributaries as well as from Olympic Peninsula rivers between Hood

Canal and Dungeness Bay (inclusive). Also, summer-run Chum salmon from four artificial propagation programs are currently included in the listing. These include the Hamma Hamma Fish Hatchery Program, Lilliwaup Creek Fish Hatchery Program, Tahuya River Program, and Jimmycomelately Creek Fish Hatchery Program. In addition, there is currently a petition to list winter-run Puget Sound Chum in the Nisqually River system and Chambers Creek (FR Notice 82 FR 33064 (2017)).

ESA-listed Puget Sound Steelhead

ESA Listing Status: *Threatened*

DPS Definition: This distinct population segment, or DPS, includes naturally spawned anadromous *O. mykiss* (Steelhead) originating below natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Also, Steelhead from six artificial propagation programs are included in the listing, including the Green River Natural Program, White River Winter Steelhead Supplementation Program, Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers, and the Lower Elwha Fish Hatchery Wild Steelhead Recovery Program.

ESA-listed Coho salmon in Puget Sound

None are currently ESA-listed in Puget Sound.

ESA-listed Rockfish in Puget Sound

ESU Definition: Yelloweye rockfish and bocaccio were once part of a vibrant recreational and commercial groundfish fishery in Puget Sound, and like all rockfish species, are an important part of the food web. For instance, larval rockfish are eaten by juvenile salmon and other marine fish and seabirds. Thus, actions to support rockfish recovery would also benefit the Puget Sound ecosystem.

Rockfish are vulnerable to overfishing because many species do not begin to reproduce until they are 5-20 years old, and very few of their young survive to adulthood. In addition, yelloweye rockfish can live over 150 years and bocaccio over 50 years. These traits make them susceptible to overfishing and habitat degradation.

To protect and restore rockfish populations in Puget Sound, WDFW has developed a *Puget Sound Rockfish Conservation Plan*. The management plan – approved in March 2011 – includes policies, strategies and actions designed to help restore and maintain abundance, distribution, diversity and long-term productivity of rockfish populations in Puget Sound.

The plan also offers a framework for state fish managers to follow in developing regulations, establishing priorities, and providing guidelines for the development of additional plans with Tribal Co-managers.

Key provisions of the new plan include:

- Managing fisheries in Puget Sound to ensure the health and productivity of all rockfish species;
- Utilizing science-based marine conservation areas that, with other actions, aid in natural production of rockfish populations and their habitats;
- Working with the Northwest Straits Commission, tribes, fishers and others to improve the system for reporting and removing lost fishing gear from Puget Sound; and
- Promoting the restoration of depleted stocks to sustainable levels through the appropriate use of hatchery programs and artificial habitats.

Washington State has closed many commercial fisheries that caught rockfish incidentally, and there is no direct commercial harvest of rockfish in Puget Sound. In recreational fisheries, targeting or retaining any species of rockfish in Puget Sound waters east of Port Angeles is not allowed. Thus, the PSRFE program is not currently funding any marine fish programs.

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Appendix C

Web Links to Sources used in HSRG Review

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Web Links to Source Reports Used for HSRG PSRFE Review

1) Sport Catch Reports:

<https://wdfw.wa.gov/fishing/harvest/>

2) Hatchery Escapement Reports:

<https://wdfw.wa.gov/hatcheries/escapement/>

3) PSRFE info:

<https://wdfw.wa.gov/about/advisory/psrfef/>

a) History (PowerPoint 2012):

https://wdfw.wa.gov/about/advisory/psrfef/docs/psre_mtg_final2.pdf

b) Enabling legislation:

<http://apps.leg.wa.gov/rcw/default.aspx?cite=77.105.010>

c) Delayed Release Chinook Audit (2010):

https://wdfw.wa.gov/about/advisory/psrfef/docs/delayed_release_Chinook_audit_040910_ar1003365.pdf

d) WDFW response letter to 2010 Audit:

https://wdfw.wa.gov/about/advisory/psrfef/docs/transmittal_letter_final_to_sonntag_7_6_10.pdf

e) WFW Response letter 2:

https://wdfw.wa.gov/about/advisory/psrfef/docs/jlarcresponseletter51710_pdf.docx.pdf

f) Dedicated fund Audit (2010):

https://wdfw.wa.gov/about/advisory/psrfef/docs/dedicated_fund_performance_audit_revenue_and_expenditures_070910.pdf

g) Delayed Release summary (2010 pdf):

https://wdfw.wa.gov/about/advisory/psrfef/docs/blackmouth_summary.pdf

h) 2013 Goals & Objectives:

https://wdfw.wa.gov/about/advisory/psrfef/docs/psrfef_goals_and_objectives_final_01022_014.pdf

i) Deschutes support letter:

https://wdfw.wa.gov/about/advisory/psrfef/docs/support_letter_for_deschutes_2015.pdf

j) 2016 report to Commission (PowerPoint, 2016):

https://wdfw.wa.gov/about/advisory/psrfef/docs/psrfe_commission_briefing_nov_4.pdf

k) 2016-18 Coho Barging Study:

<https://wdfw.wa.gov/publications/01969/wdfw01969.pdf>

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Appendix D

PSRFE Program Summaries

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APPENDIX D

CHINOOK PROGRAMS

GLENWOOD SPRINGS FALL CHINOOK

The following information was taken from the Glenwood Springs Fall Chinook HGMP (2017).

“The Chinook program at Glenwood Springs was initiated in 1978 by Long Live the Kings (LLTK) Board Chairman Jim Youngren soon after he acquired the property in Eastsound, Orcas Island (WRIA 2). This program was an attempt to generate a Chinook run where none had previously existed. LLTK has managed Glenwood Springs Hatchery since its founding in 1985. Program fish are produced from adults, which have been returning to the facility since 1982. The initial stock was provided by the WDFW Samish Hatchery, although the supplemental egg source was switched to Minter Creek stock in 2009. The program annually releases up to 725,000 sub-yearling smolts directly into Eastsound Bay (Orcas Island) from the facility. This number was increased from 550,000 in 2015, with the discontinuation of the Glenwood Springs Coho program.

The program is operated in an area with no historical Chinook salmon populations and will be operated as a “segregated” program, with the intent to minimize the genetic and reproductive fitness differences between the hatchery broodstock and naturally spawning populations. There are no naturally-reproducing Chinook populations found within the San Juan Islands.

In addition, the Glenwood Springs' facilities and staff provide resources for the research community and local educators.”

Broodstock Collection

The broodstock is derived from adults returning to the Glenwood Springs adult pond. The current egg-take goal is 790,000, increased from 590,000 in 2015 with the discontinuation of the Coho program. In the event of broodstock shortfalls, eggs may be seined from the terminal area marine waters, or provided from Minter Creek Hatchery.

Harvest

Glenwood Springs Hatchery provides Chinook for commercial and sport fishing opportunities in north Puget Sound.

Tribal and non-Tribal commercial and recreational fisheries directed at salmon and steelhead produced through WDFW hatchery releases are managed to minimize incidental effects to listed Chinook salmon and steelhead. Compliance with the fisheries management strategy defined in the Comprehensive Chinook Salmon Management Plan (PSTT and WDFW 2004, revised 2010) allows fisheries on co-manager hatchery-origin stocks while minimizing adverse impacts on listed Chinook, steelhead or summer chum.

Each year state and tribal Co-managers plan and agree to a package of recreational and commercial salmon fisheries in consultation with Federal and Canadian fishery managers. These pre-season planning processes, known as the Pacific Fishery Management Council (PFMC), North of Falcon (NOF), and Pacific Salmon Commission planning processes, involve a series of public meetings between domestic and international federal, state, tribal and industry representatives and other concerned citizens.

All program fish are released with an adipose fin-clip (AD), with a portion (100,000) also coded-wire tagged (AD+CWT) and mass-marking is conducted on-site. Based on the average smolt-to-adult survival rate of 0.43% for brood years 2002-2011 (RMIS coded-wire tag database 2017), and the programmed release goal of 525,000 sub-yearlings, the estimated production (goal) level would be 2,400 adults.

Monitoring, Evaluation, and Adaptive Management

WDFW and the Co-managers conduct annual spawning ground surveys throughout Northern Puget Sound watersheds. Coded-wire tags recovered from Glenwood Springs releases on natural spawning grounds in adjacent basins are used to evaluate potential stray risks of this program to the listed Puget Sound Chinook ESU.

Species and population (or stock) under propagation, and ESA status

- Glenwood Springs Hatchery Fall Chinook (*Oncorhynchus tshawytscha*).
- This hatchery population is not included in NOAA Fisheries Hatchery Listing Policy (2016 81FR33468). The Technical Recovery Team (TRT) did not find any evidence that an independent population of Chinook salmon existed in San Juan Island region (Ruckelshaus et al. 2006).

The program is identified as a segregated harvest program.

Location(s) of hatchery and associated facilities

Table 1 Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Glenwood Springs	Broodstock collection, Adult holding/ spawning, Incubation, Rearing, Acclimation, Release	Hatchery is located on the eastern shore of Eastsound, Orcas Island, Washington, near an unnamed stream (WRIA 02.0063).

Table 2 Glenwood Springs Hatchery Sub-yearling/Yearling Fall Chinook Fishery Contributions.

Brood Year ^d		Total			
CWT Released ^a		751,248			
CWT Recovered (Adults)		3,210			
SAR		0.43%			
Sport Contribution		0.04%			
Adults^f					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	9.6	0	0	0.3
CDFO	All	771.2	4	1	24.0
ODFW	All	25.1	0	0	0.8
NMFS	All	10.5	0	0	0.3
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	54.7	0	0	1.7
MAKA	15- Treaty Troll	189.0	1	0	5.9
WDFW	15- Treaty Troll	26.4	0	0	0.8
LUMM	23- PS Net	42.4	0	0	1.3
MAKA	23- PS Net	3.0	0	0	0.1
WDFW	23- PS Net	1084.0	6	1	33.8
WDFW	23- PS Net (Strays)	14.9	0	0	0.5
WDFW	41- Ocean Sport- Charter	7.4	0	0	0.2
WDFW	42- Ocean Sport- Private	60.3	0	0	1.9
WDFW	45- PS Sport - May to September	243.4	1	0	7.6
WDFW	45- PS Sport - Winter Blackmouth ^b	83.4	0	0	2.6
SUQ	50- Hatchery Escapement (Strays)	1.0	0	0	0.0
WDFW	50- Hatchery Escapement	573.9	3	1	17.9
WDFW	50- Hatchery Escapement (Strays)	2.8	0	0	0.1
SSC	52 - Fish Trap	4.3	0	0	0.1
WDFW	54- Spawning Grounds	2.7	0	0	0.1
Total		3210.0	17	4	100.0
Jacks^f					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	50- Hatchery Escapement	40.1	0	0	1.2
WDFW	54- Spawning Grounds	5.6	0	0	0.2
Total		40.1	0	0	1.23

^a The Glenwood Springs Subyearling Tag Group is a 100k Ad+CWT release; this is a segregated harvest program

^b Winter Blackmouth fishery occurs between October and April

^c No CRC harvest data available; there is no directed freshwater sport fishery on this program

^d No CWT releases in 2000, 2001, 2004 or 2005

^e Adults are fish 3 years old or older

^f Jacks are fish 2 years old or younger

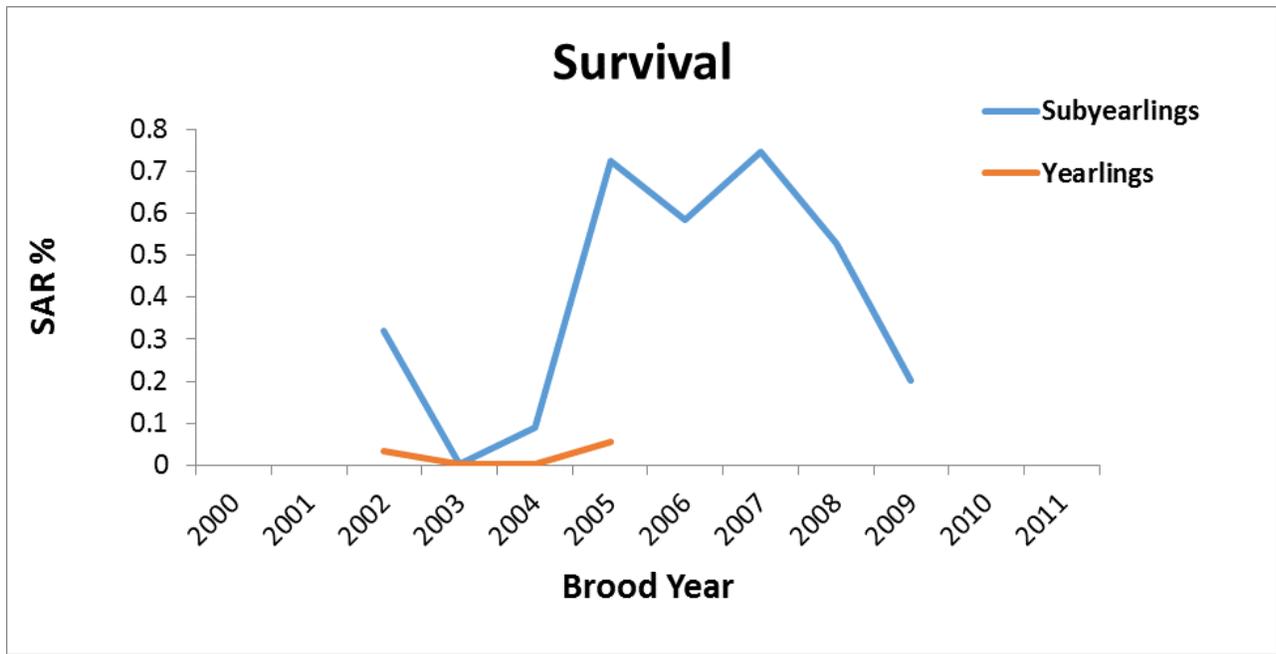


Figure 2 Smolt to adult survival (SAR %) of Glenwood Springs Fall Chinook releases.

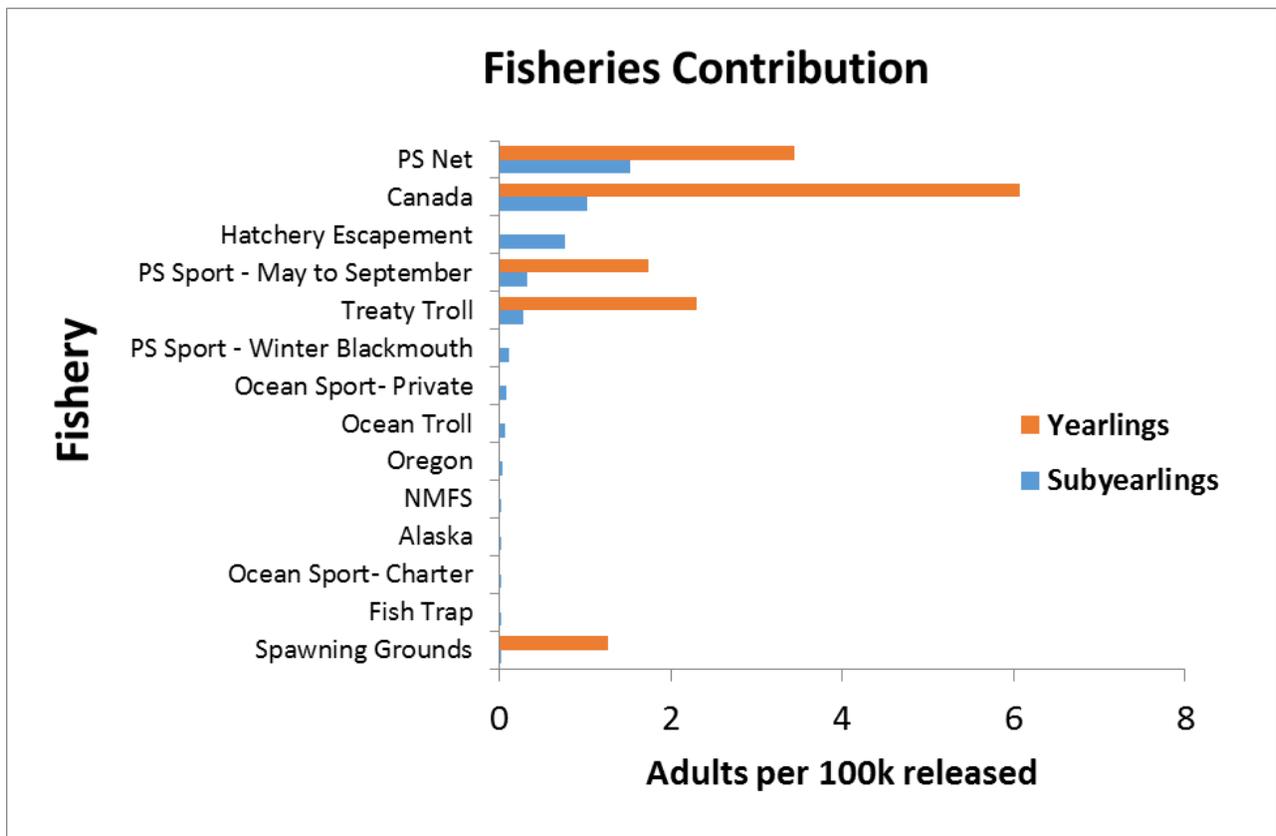


Figure 3 Fisheries contribution of Glenwood Springs Fall Chinook releases.

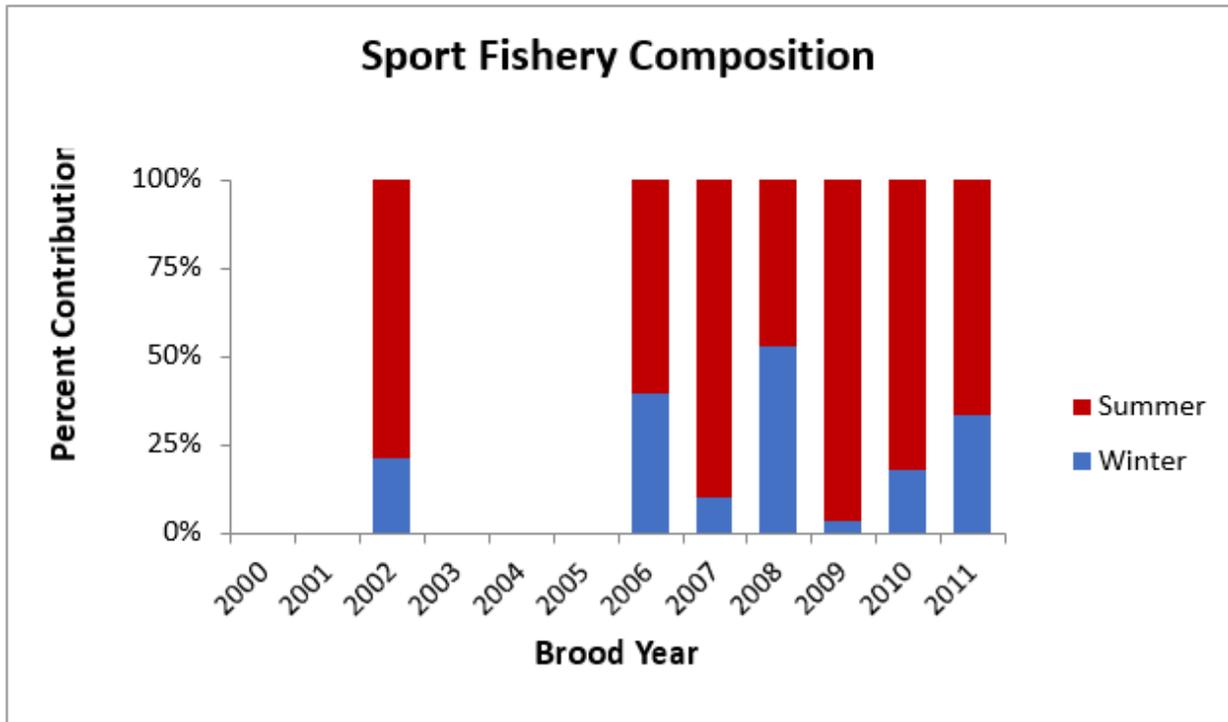


Figure 4 Sport fishery composition of Glenwood Springs Fall Chinook subyearling releases.

WALLACE RIVER SUMMER CHINOOK

The following information was taken from the Wallace River Summer Chinook HGMP (2013).

“The program mitigates for lost natural-origin fish production in the watershed by producing Skykomish population summer-run Chinook salmon for harvest in regional recreational fisheries, and Tulalip Tribal commercial and ceremonial and subsistence fisheries. The program helps meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in U.S. v. Washington (1974). Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada.”

Broodstock Collection

The Chinook escapement goal to Wallace River Hatchery is 3,200 Chinook. This is the minimum escapement goal projected to result, on average, in meeting the effective spawner and egg-take goals for both the Wallace and Tulalip hatchery programs at a risk level agreed to by the Co-managers, given expected survival rates and other biological factors that affect realized egg-takes for these two programs. The 1:1 effective spawner goal needed to achieve the 4.8 million egg-take goal based on average (2002-2011) Wallace River Hatchery summer Chinook fecundity (4,510) would be 2,129, which assumes no holding mortality, a sex ratio of 1:1, and no inter-annual variability in sex ratio or fecundity.

Based on the average adult equivalent survival (AEQ) rates of Wallace Hatchery sub-yearling and yearling Chinook salmon of 0.30% for sub-yearlings 1.12% for yearlings and the programmed release goal of 1,000,000 sub-yearlings and 500,000 yearlings, the estimated average recruitment would be 10,100 adults (see HGMP section 3.3.1).

Table 1 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Subyearling	Wallace River (WRIA 07.0940)	1,000,000
Yearling	Wallace River (WRIA 07.0940)	500,000

Data source: Future Brood Document (2012).

Species and population (or stock) under propagation, and ESA status

Skykomish River Summer Chinook (*Oncorhynchus tshawytscha*) - Re-affirmed threatened by five-year status review, completed August 15, 2011 (76FR50448). This population has been identified as a Contributing population in the Recolonization phase. (WDFW 2018).

The program is identified as an integrated harvest program.

Location(s) of hatchery and associated facilities. Broodstock collection, holding, spawning, incubation, rearing, release

Sunset Falls Fishway: Upper SF Skykomish River (WRIA 07.0012), RM 51.5 (see HGMP sections 6.2.3 and 6.3 for more details on the use of Sunset Falls).

Wallace River Hatchery: Wallace River (WRIA 07.0940), RM 4 at the confluence with May Creek (WRIA 07.0943); enters the Skykomish River (WRIA 07.0012) at RM 36.

Table 2 Wallace Summer Chinook yearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		549,710			
CWT Recovered (Adults)		6145			
SAR		1.12%			
Sport Contribution		0.21%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
ADFG	All	23.0	10	0	0.4
CDFO	All	947.8	412	2	15.4
NMFS	All	18.3	8	0	0.3
ODFW	All	2.0	1	0	0.0
WA	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	10- Ocean Troll	17.4	8	0	0.3
MAKA	15- Treaty Troll	36.9	16	0	0.6
WDFW	15- Treaty Troll	25.9	11	0	0.4
MAKA	23- PS Net	1.0	0	0	0.0
TULA	23- PS Net	6.9	3	0	0.1
WDFW	23- PS Net	50.8	22	0	0.8
WDFW	42- Ocean Sport- Private	23.3	10	0	0.4
WDFW	45- PS Sport - May to September	407.3	177	1	6.6
WDFW	45- PS Sport - Winter Blackmouth ^b	423.6	184	1	6.9
WDFW	46- Freshwater Sport ^c	316.9	138	1	5.2
TULA	50- Hatchery Escapement	9.5	4	0	0.2
WDFW	50- Hatchery Escapement	3617.7	1573	7	58.9
TULA	54- Spawning Grounds	129.4	56	0	2.1
WDFW	54- Spawning Grounds	86.5	38	0	1.4
WDFW	62- Test Fishery Seine	1.0	0	0	0.0
Total		6145.1	2672	11	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	46- Freshwater Sport ^c	27.1	12	0	0.4
WDFW	50- Hatchery Escapement	69.0	29	0	1.1
WDFW	54- Spawning Grounds	24.8	11	0	0.4
TULA	54- Spawning Grounds	10.3	4	0	0.2
Total		131.3	56	0	2.09

^a The Wallace Summer Chinook Yearling Tag Group is a 100k Ad+CWT group

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

Table 3 Wallace Summer Chinook subyearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		2,400,400			
CWT Recovered (Adults)		7,296			
SAR		0.30%			
Sport Contribution		0.04%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	39.4	15	0	0.5
CDFO	All	1583.2	591	1	21.7
NMFS	All	3.8	1	0	0.1
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	26.4	10	0	0.4
MAKA	15- Treaty Troll	44.0	16	0	0.6
WDFW	15- Treaty Troll	81.6	30	0	1.1
WDFW	22- Coastal Gillnet	2.0	1	0	0.0
SSC	23- PS Net	1.0	0	0	0.0
SUQ	23- PS Net	1.0	0	0	0.0
MAKA	23- PS Net	2.6	1	0	0.0
TULA	23- PS Net	14.4	5	0	0.2
WDFW	23- PS Net	51.0	19	0	0.7
WDFW	41- Ocean Sport- Chater	1.4	1	0	0.0
WDFW	42- Ocean Sport- Private	9.7	4	0	0.1
WDFW	45- PS Sport - May to September	289.6	108	0	4.0
WDFW	45- PS Sport - Winter Blackmouth ^b	302.8	113	0	4.2
WDFW	46- Freshwater Sport ^c	317.4	118	0	4.3
TULA	50- Hatchery Escapement	7.4	3	0	0.1
WDFW	50- Hatchery Escapement ^d	4528.5	1691	2	62.1
WDFW	50- Hatchery Escapement (Strays)	2.0	1	0	0.0
TULA	54- Spawning Grounds	136.3	51	0	1.9
WDFW	54- Spawning Grounds	180.9	68	0	2.5
WDFW	54- Spawning Grounds (Strays)	44.2	16	0	0.6
Total		7295.7	2724	3	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	46- Freshwater Sport ^c	49.9	18	0	0.7
WDFW	50- Hatchery Escapement	86.1	32	0	1.2
WDFW	54- Spawning Grounds	21.0	8	0	0.3
Total		157.0	57	0	2.11

^a The Wallace Summer Chinook Sub-yearling Tag Group was a 200k Ad+CWT group

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^dAdults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

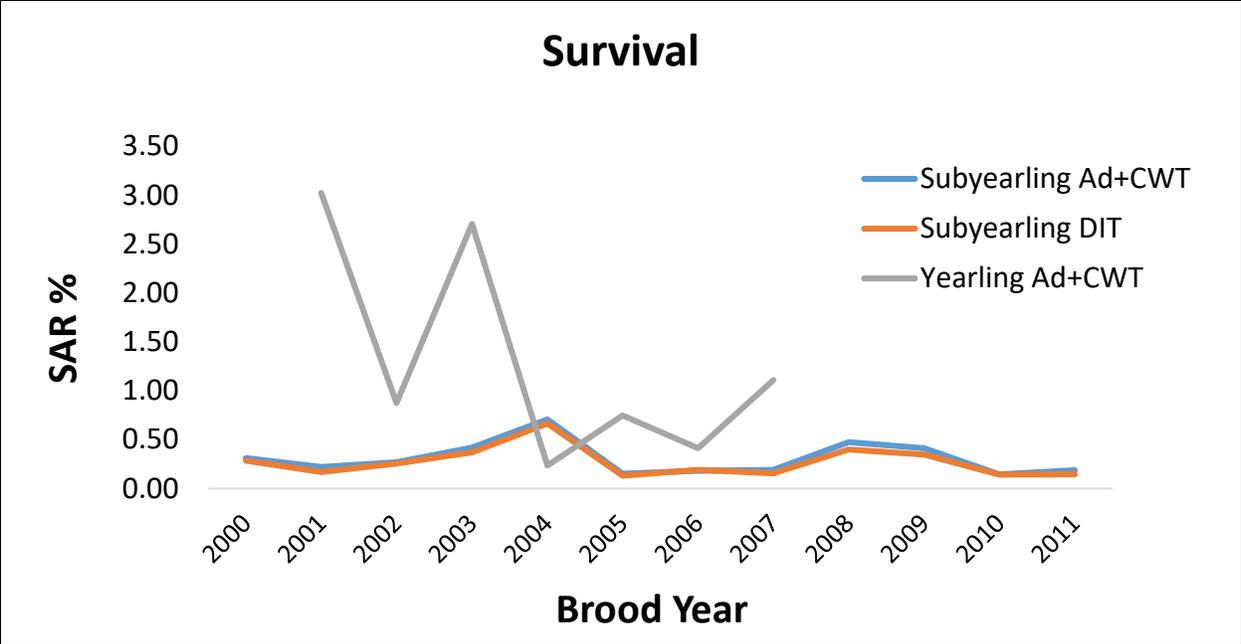


Figure 2 Smolt to adult survival (SAR %) of Wallace Summer Chinook releases.

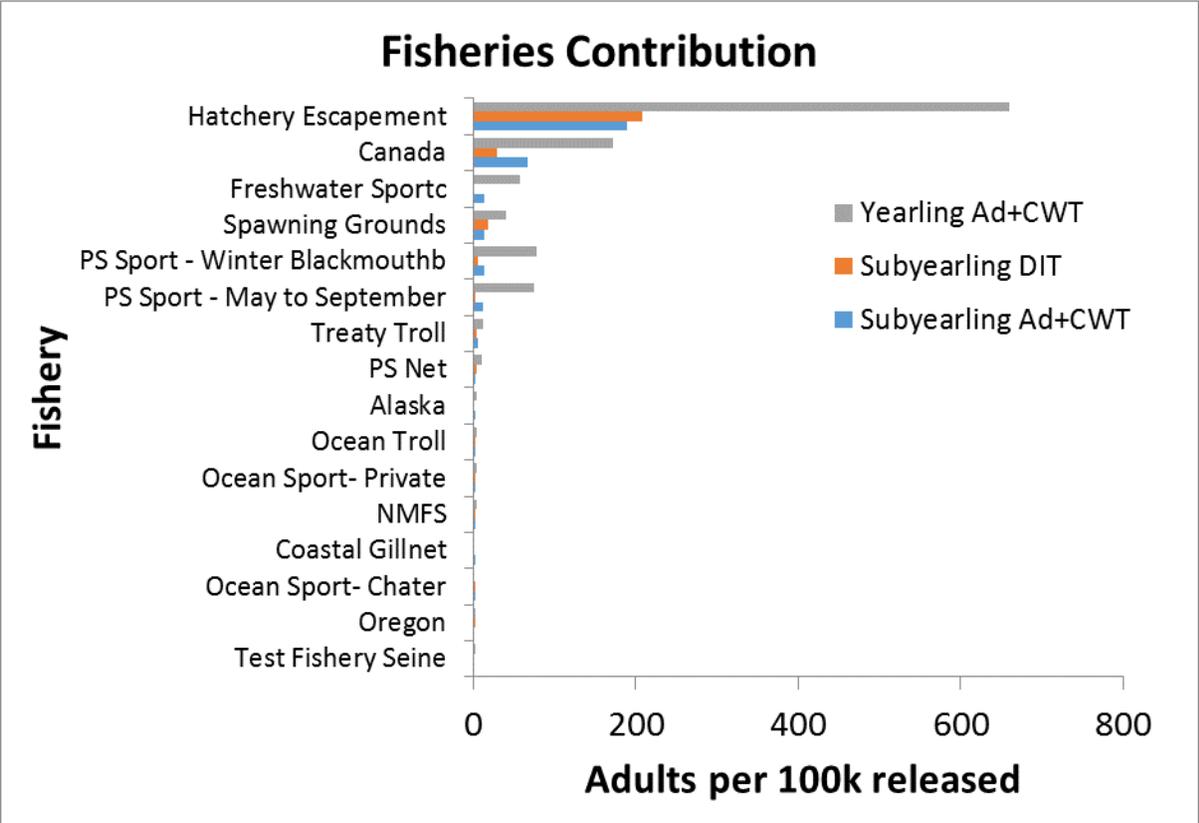


Figure 3 Fisheries contribution of Wallace Summer Chinook releases.

Table 4 Expected PNI in recent years of Wallace Hatchery Chinook broodstock.

Year	pHOS	w/Target pNOB Projected	PNI Sky	PNI Sky+Wall	PNI Wall	PNI Total
2006	0.168	0.40	0.70	0.88	N/A	0.81
2007	0.430	0.40	0.48	0.81	0.62	0.70
2008	0.178	0.40	0.69	0.60	0.33	0.55
2009	0.190	0.40	0.68	0.91	0.35	0.70
2010	0.269	0.40	0.60	0.71	0.43	0.64
2011	0.254	0.40	0.61	0.71	0.36	0.66
Average PNI			0.63	0.77	0.42	0.68

Integration (2006-2011) with actual (realized) pHOS and projected pNOB goal of 0.40 achieved. Data source: Mike Crewson, Tulalip Tribes 2012.

SOOS CREEK AND ICY CREEK FALL CHINOOK

The following information was taken from the Soos Creek Fall Chinook HGMP (2013).

“The purpose of the program is to produce Green River stock Chinook for sustainable fisheries (Magnuson/Stevens Act), for harvest in Puget Sound recreational fisheries and to fulfill Treaty Indian fishing right entitlements (US v Washington). The Soos Creek Hatchery fall Chinook sub-yearling program is used as PST Indicator Stock, and a Double-Index Tag (DIT) group. The DIT group serves as an index group for wild fall subyearling Chinook as well as provides data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds. With the exception of the DIT group, all releases are consistently mass-marked (see HGMP section 10.7).”

Broodstock Collection

Up to 2,922 adults are collected annually for Soos Creek, Icy Creek and Palmer Ponds program releases.

For brood years 2000 through 2011, the average smolt-to-adult survival rate was 0.44% for sub-yearlings yearlings (Table 3). Based on the average smolt-to-adult survival rates and the program release goal of 3,200,000 sub-yearlings and 300,000 yearlings, the estimated adult production would be 15,820 (see HGMP section 3.3.1). The Soos Creek fall Chinook program began in 1901. Yearlings have been released at Icy Creek since 1983. Sub-yearlings have been released at Palmer Ponds since 2011.

Chinook were not consistently mass-marked until 2000. Prior to consistent mass-marking the level of natural-origin fish incorporated into the hatchery brood stock was unknown.

The fall Chinook production at Soos Creek Hatchery is currently managed as an integrated program, which requires annual inclusion of natural-origin fish into hatchery broodstock (see Table 1). Natural-origin fish are trapped at Soos Creek, Icy Creek, and the TPU trap to incorporate into the broodstock at the Soos Creek Hatchery. Fish resulting from these integrated broodstock management actions will have different release strategies dependent on the number of natural-origin spawners observed in the Green River during the most recent three year period. If an average of 900 or less natural-origin spawners is observed in the mainstem in the three year period, then 3.2 million subyearlings will be released at Soos Creek, and 1.0 million subyearlings at Palmer Ponds. Preference to release the highly integrated fish will go to Palmer Ponds. If an average of 1,500 or more natural-origin spawners is observed in the mainstem over the last three years, 2.2 million limited integration sub-yearlings will be released from Soos Creek, 1.0 million highly-integrated from Soos Creek, and 1.0 million limited integration released from Palmer Ponds.

Table 1 Fall Chinook integration results at Soos Creek Hatchery, 2008-2012

Year	pNOB	pHOS	PNI
2008	0.07	0.35	0.17
2009	0.20	0.76	0.20
2010	0.15	0.60	0.20
2011	0.08	0.54	0.13
2012	0.13	0.47	0.21
Average	0.12	0.54	0.19

Source: Hatchery Evaluation and Assessment Team Broodstock Tracking Tables 2013. All pHOS estimates provided by WDFW District 12 Biologist, Aaron Bosworth. 2013.

Table 2 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Subyearling	Big Soos Creek (WRIA 09.0072)	3,200,000
Subyearling	Palmer Ponds (WRIA 09.0147)	1,000,000
Yearling	Icy Creek (WRIA 09.0125)	300,000

Species and population (or stock) under propagation, and ESA status

Green River Fall Chinook (*Oncorhynchus tshawytscha*) – Re-affirmed threatened by five-year status review, completed August 15, 2011 (76FR50448). This population has been identified as a Stabilizing population in the Recolonization phase (WDFW 2018).

The program is identified as an integrated harvest program.

Location(s) of hatchery and associated facilities

Soos Creek Hatchery: Located on Big Soos Creek (WRIA 09.0072) at RM 0.6, tributary to the Green River (WRIA 09.0001) at RM 33.6.

Acclimation and Release Locations

- Soos Creek Hatchery
- Icy Creek Hatchery: Located at the mouth of Icy Creek (WRIA 09.0125), L.B. tributary to the Green River (WRIA 09.0001) at RM 48.3.
- Palmer Rearing Ponds: Located on unnamed stream (WRIA 09.0147) at RM 0.2, tributary to Green River (WRIA 09.0001) at RM 56.1.

Table 3 Soos Creek Fall Chinook subyearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		2,375,171			
CWT Recovered (Adults)		10,524			
SAR		0.44%			
Sport Contribution		0.06%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	257	370	11	2.4
CDFO	All	1,679	2,419	71	16.0
NMFS	All	47	68	2	0.5
ODFW	All	45	65	2	0.4
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	89	128	4	0.8
MAKA	15- Treaty Troll	131	189	6	1.2
WDFW	15- Treaty Troll	191	276	8	1.8
MAKA	23- PS Net	1	1	0	0.0
SUQ	23- PS Net	3	4	0	0.0
WDFW	23- PS Net	1,981	2,856	83	18.8
WDFW	41- Ocean Sport- Charter	75	108	3	0.7
WDFW	42- Ocean Sport- Private	110	158	5	1.0
WDFW	45- PS Sport - May to September	1,153	1,661	49	11.0
WDFW	45- PS Sport - Winter Blackmouth ^b	166	240	7	1.6
WDFW	46- Freshwater Sport ^c	24	34	1	0.2
MUCK	50- Hatchery Escapement (Strays)	2	3	0	0.0
NIFC	50- Hatchery Escapement (Strays)	1	2	0	0.0
PUY	50- Hatchery Escapement (Strays)	1	1	0	0.0
WDFW	50- Hatchery Escapement	4,199	6,052	177	39.9
WDFW	50- Hatchery Escapement (Strays)	9	13	0	0.1
TULA	54- Spawning Grounds	6	8	0	0.1
WDFW	54- Spawning Grounds	293	422	12	2.8
WDFW	62- Test Fishery (Seine)	78	112	3	0.7
Total		10,524	15,168	443	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	46- Freshwater Sport ^c	3	4	0	0.0
NIFC	50- Hatchery Escapement	4	6	0	0.0
WDFW	50- Hatchery Escapement	449	618	18	4.1
WDFW	54- Spawning Grounds	37	51	1	0.3
Total		493	678	20	4.47

^a The Soos Creek Fall Chinook Sub-yearling Tag Group is a 200k CWT only group

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CWT harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

Table 4 Soos Creek Fall Chinook yearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		2,350,680			
CWT Recovered (Adults)		8,899			
SAR		0.38%			
Sport Contribution		0.02%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	3	0	0	0.0
CDFO	All	630	54	27	7.1
ODFW	All	21	2	1	0.2
NMFS	All	41	4	2	0.5
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	50	4	2	0.6
MAKA	15- Treaty Troll	155	13	7	1.7
WDFW	15- Treaty Troll	213	18	9	2.4
QDNR	22- Coastal Gillnet	4	0	0	0.0
SSC	23- PS Net	1	0	0	0.0
TULA	23- PS Net	1	0	0	0.0
WDFW	23- PS Net	1,972	168	84	22.2
WDFW	41- Ocean Sport- Charter	16	1	1	0.2
WDFW	42- Ocean Sport- Private	55	5	2	0.6
WDFW	45- PS Sport - May to September	281	24	12	3.2
WDFW	45- PS Sport - Winter Blackmouth ^b	73	6	3	0.8
WDFW	46- Freshwater Sport ^c	30	3	1	0.3
MUCK	50- Hatchery Escapement	3	0	0	0.0
NIFC	50- Hatchery Escapement	4	0	0	0.0
NISQ	50- Hatchery Escapement	1	0	0	0.0
TULA	50- Hatchery Escapement	1	0	0	0.0
WDFW	50- Hatchery Escapement	4,908	418	209	55.2
PUYA	54- Spawning Grounds	2	0	0	0.0
WDFW	54- Spawning Grounds	469	40	20	5.3
WDFW	62- Test Fishery Seine	2	0	0	0.0
Total		8,899	757	379	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	46- Freshwater Sport	3	26	0	0.0
MUCK	50- Hatchery Escapement	1	10	0	0.0
NIFC	50- Hatchery Escapement	1	10	0	0.0
WDFW	50- Hatchery Escapement	494	4,940	20	5.2
WDFW	54- Spawning Grounds	22	218	1	0.2
Total		517	5,168	21	5.49

^a The Soos Creek Sub-yearling Chinook Tag Group is a 200k Ad+CWT group

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CWT harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

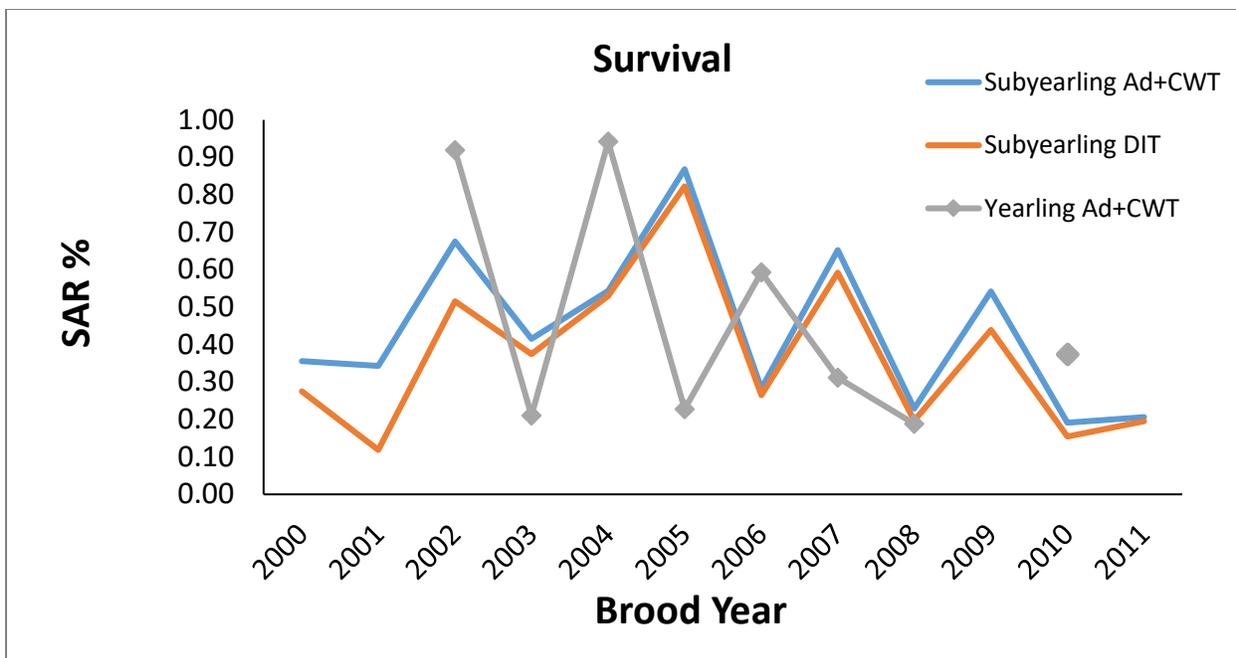


Figure 2 Smolt to adult survival (SAR %) of Soos Creek Fall Chinook subyearling and yearling releases.

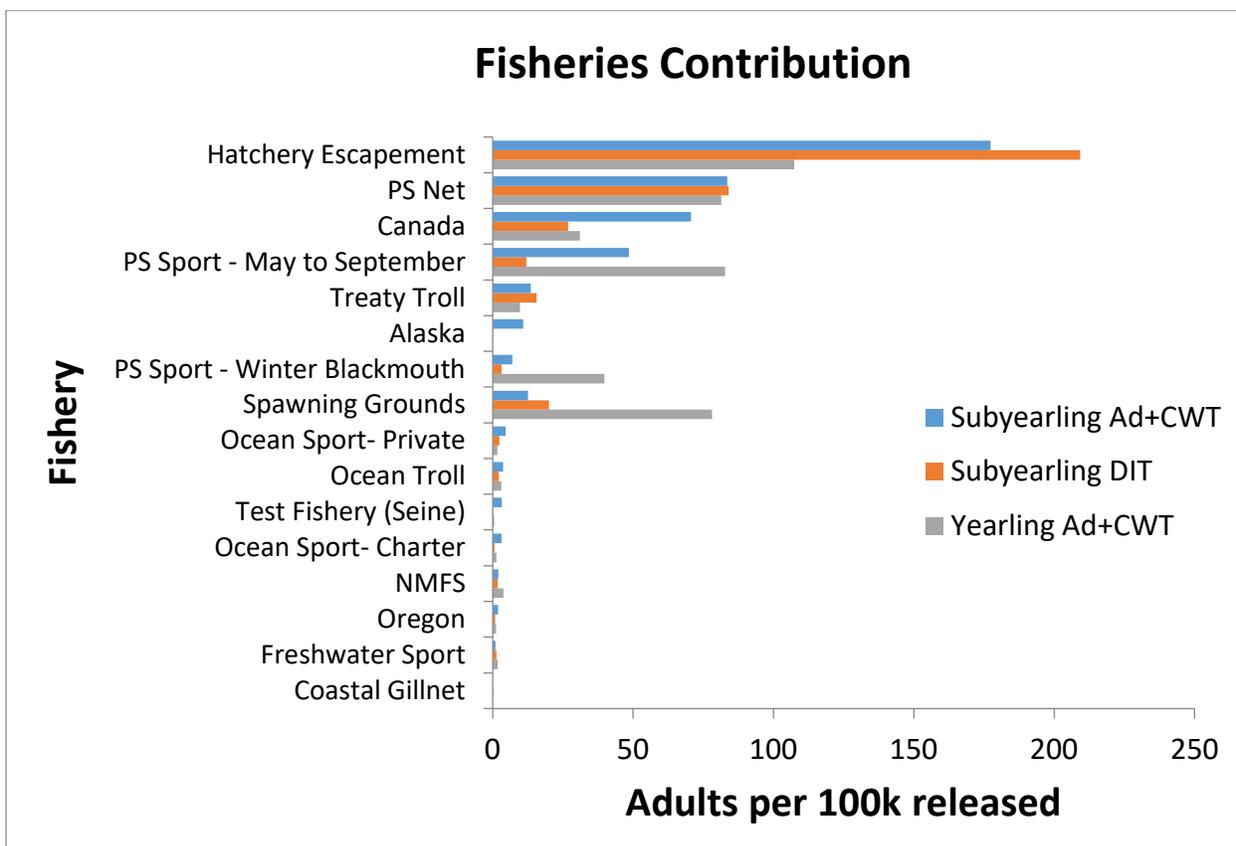


Figure 3 Fisheries contribution of Soos Creek Fall Chinook releases.

VOIGHTS CREEK FALL CHINOOK

The following information was taken from the Voights Creek Fall Chinook HGMP (2013).

“The purpose of the program is to produce native-origin Chinook salmon for tribal harvest and Puget Sound recreational fisheries, while minimizing adverse genetic, demographic or ecological effects on listed fish. It also provides up to 900,000 eggs (per FBD 2011) for the Puyallup Tribal production program at Clarks Creek Hatchery.”

“The program mitigates for lost natural-origin fish production in the watershed by producing Puyallup River Chinook salmon for harvest in regional recreational fisheries, and Puyallup Tribal commercial and ceremonial and subsistence fisheries. The program helps meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in U.S. v. Washington (1974). Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada.”

“In addition, Chinook are transferred to the Puyallup Tribe's facility on Clarks Creek. Up to 500 surplus hatchery adult fish are provided to the Puyallup Tribe to plant above the Electron Diversion Dam.”

Broodstock Collection

Up to 1,100 adults are collected annually at Voights Creek Hatchery.

Based on the average smolt-to-adult survival rate of 0.65% for 2002-2004 brood years (RMIS 2012), and a programmed release goal of 1,600,000 sub-yearlings, the estimated adult production (goal) level would be 10,400.

Table 1 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Subyearling	Voights Creek	1,600,000*

Source: WDFW, Future Brood Document 2012.

Note: At the request of the Puyallup Tribe of Indians, surplus adults will be transferred into the upper Puyallup River, above Electron Dam, to re-introduce Chinook into the watershed. The transfer goal was 4,000 adult fish, but changed to a maximum of 500, depending upon availability, as of FBD 2009.

* Program release level was restored following decrease due to budget reductions in 2009.

Species and population (or stock) under propagation, and ESA status

Puyallup River Fall Chinook (*Oncorhynchus tshawytscha*) - Re-affirmed threatened by five-year status review, completed August 15, 2011 (76FR50448). The management of Puyallup Fall Chinook as a “Sustaining” population is consistent with its assignment as a “Tier 3”

population under the NOAA Fisheries Population Recovery Approach, and as adopted by other recovery domains and the Hatchery Scientific Review Group. It is classified as in the recolonization phase (HSRG 2004).

The program is identified as an integrated harvest program.

Location(s) of hatchery and associated facilities

- **Voights Creek Hatchery:** Located on Voights Creek (WRIA 10.0414) at RM 0.5; a tributary to the Carbon River (10.0413) at RM 4. The Carbon River is a tributary to the Puyallup River at RM 17.8.
- **Puyallup Hatchery:** Located on Clarks Creek (WRIA 10.0027) at RM 3.5, a tributary of the Puyallup River (WRIA 10.0021) at RM 5.8.

Past and proposed level of natural fish in broodstock

Past levels of natural broodstock incorporated into the hatchery population are unknown. 100% mass-marking, as of brood year 1999, allows identification of returning hatchery fish.

The Puyallup River natural Chinook population is managed as a stabilizing population. The goal for the hatchery program is to attain the HSRG standards for a stabilizing population which is to keep pNOB, PNI and pHOS values at current level.

Table 2 Voights Creek Fall Chinook Integration Results, 2008-2012.

Year	pNOB	pHOS	PNI
2008	0.02	0.26	0.07
2009	0.05	0.67	0.06
2010	0.01	0.69	0.02
2011	0.02	0.62	0.04
	0.05	----	----
Average	0.03	0.56	0.04

Data source: WDFW Hatchery Evaluation and Assessment Team Broodstock Tracking Tables 2013. *2012 estimates in progress.

Table 3 Voights Creek Fall Chinook subyearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		1,466,670			
CWT Recovered (Adults)		8,835			
SAR		0.60%			
Sport Contribution		0.23%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per (100k)	% of Catch
ADFG	All	12	11	1	0.1
CDFO	All	1,391	1274	95	15.7
NMFS	All	49	45	3	0.6
ODFW	All	29	26	2	0.3
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	75	69	5	0.8
MAKA	15- Treaty Troll	56	52	4	0.6
WDFW	15- Treaty Troll	208	191	14	2.4
WDFW	22- Coastal Gillnet (Non-treaty)	5	4	0	0.1
MAKA	23- PS Net	2	2	0	0.0
SUQ	23- PS Net	5	5	0	0.1
WDFW	23- PS Net	863	790	59	9.8
WDFW	41- Ocean Sport- Charter	5	5	0	0.1
WDFW	42- Ocean Sport- Private	42	39	3	0.5
WDFW	45- PS Sport - May to September	911	834	62	10.3
WDFW	45- PS Sport - Winter Blackmouth ^b	222	203	15	2.5
WDFW	46- Freshwater Sport ^c	2,169	1986	148	24.5
MUCK	50- Hatchery Escapement	2	2	0	0.0
PUYA	50- Hatchery Escapement	7	7	0	0.1
WDFW	50- Hatchery Escapement	2,504	2293	171	28.3
WDFW	50- Hatchery Escapement (Strays)	55	50	4	0.6
WDFW	54- Spawning Grounds	220	201	15	2.5
WDFW	62- Test Fishery	2	2	0	0.0
Total		8,835	8091	602	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	46- Freshwater Sport ^c	233	208	15	2.6
WDFW	50- Hatchery Escapement	541	467	34	5.8
Total		774	652	49	8.06

^a The Voights Creek Fall Chinook Sub-yearling Tag Group was a 200k Ad+CWT group, currently 150k Ad+CWT

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

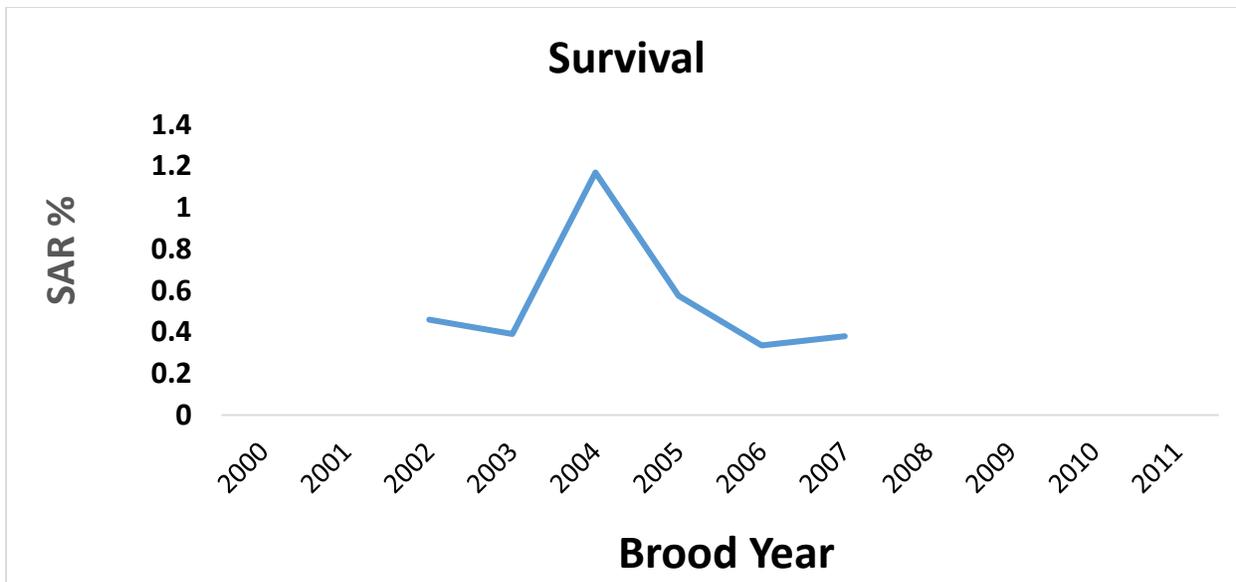


Figure 2 Smolt to adult survival (SAR %) of Voights Creek Fall Chinook releases.

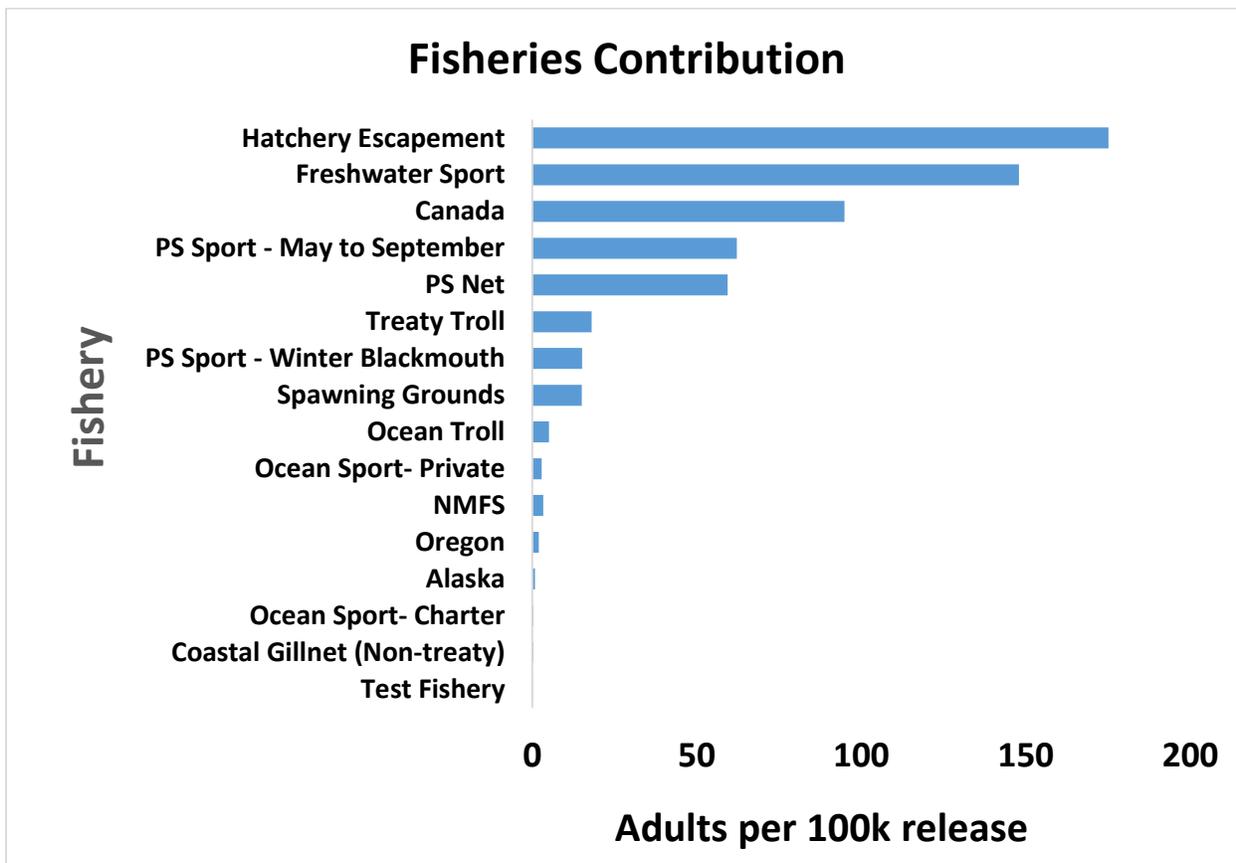


Figure 3 Fisheries contribution of Voights Creek Fall Chinook releases.

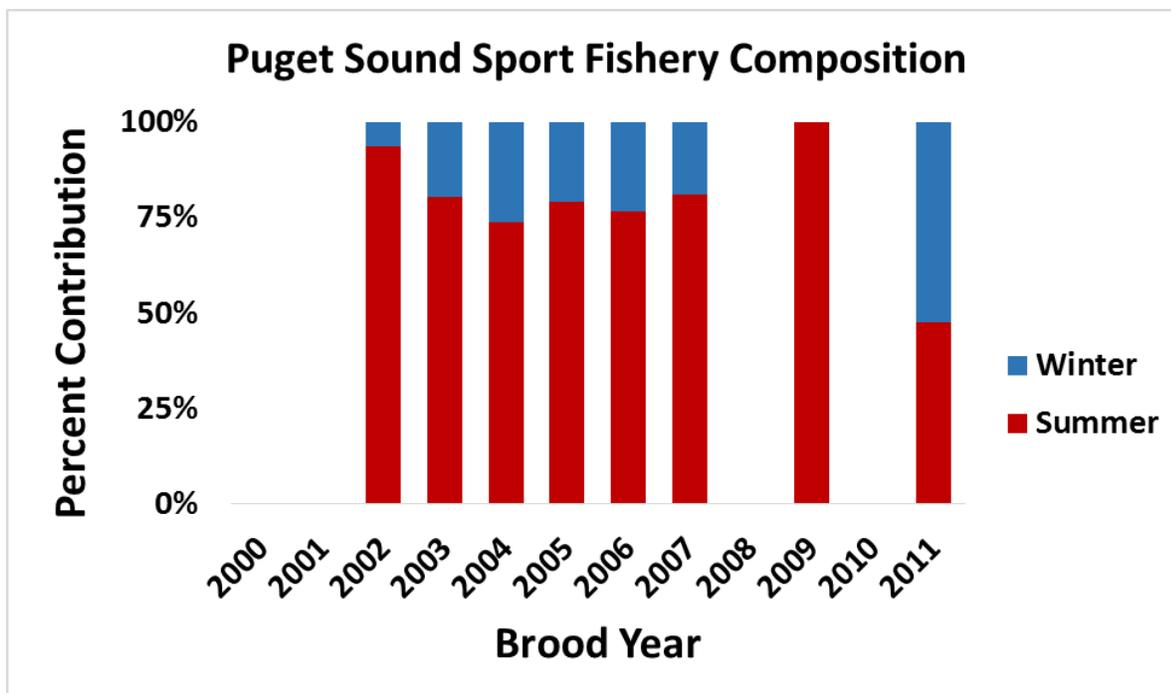


Figure 4 Sport fishery composition of Voights Creek Fall Chinook releases.

CHAMBERS/GARRISON CREEK FALL CHINOOK

The following information was taken from the Chambers Creek Fall Chinook HGMP (2014).

“The purpose of the program is to produce Chambers Creek Fall Chinook for sustainable escapement to the watershed, while providing recreational fisheries. Program fish will be released at Chambers Creek Hatchery and trap (WRIA 12.0007). The program will annually release 850,000 sub-yearlings to the Chambers Creek.”

“The broodstock is derived from stock returning to south Puget Sound. The current egg-take goal is 1.0 million at Tumwater Falls Hatchery; up to 450 adult pairs may be collected. Surplus hatchery fish in excess of broodstock may be passed upstream per agreement with the co-managers, donated to food banks or used for nutrient enhancement.”

“Due to limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Based on the average SAR of 0.41% for brood years 2002-2009 (fishery years 2006-2013), and a programmed release goal of 850,000 sub-yearlings, the estimated production goal would be 3,485 adults.”

The program has released an average of 793,933 sub-yearlings annually (2000-2013).

Species and population (or stock) under propagation, and ESA status:

- Chambers Creek (WRIA 12.0007) Hatchery Fall Chinook (*Oncorhynchus tshawytscha*)
- Not ESA-listed. Chambers Creek hatchery stock is not considered part of the Puget Sound Evolutionarily Significant Unit (ESU) for Puget Sound Chinook.

The program is identified as a segregated harvest program. Brood stock for this program is normally collected at Tumwater Falls Hatchery (located near Olympia, WA). Broodstock may be taken from several facilities located in south Puget Sound and is aggregated for use in several hatchery programs located in this region.

Location(s) of hatchery and associated facilities.

Table 1 Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Tumwater Falls Hatchery	Broodstock collection	Located on Deschutes River (WRIA 13.0028) at RM. 0.2.

Facility	Culturing Phase	Location
Chambers Creek Fishway trap	Broodstock collection, Release	Located on Chambers Creek (WRIA 12.0007), at RM 0.4. The Chambers Creek trap may be operated for broodstock collection in the event a shortfall is identified at Tumwater Falls.
Minter Creek Hatchery	Broodstock collection	Located on Minter Creek (WRIA 15.0048) at RM 0.5. Eggs collected at this facility may be used as a back-up in the event of a shortfall at Tumwater Falls.
Lakewood Hatchery	Incubation	Located on Chambers Creek (WRIA 12.0007), at RM 3.4.
Garrison Springs Hatchery	Rearing	Located on Chambers Creek (WRIA 12.0007), at RM 0.9.
Chambers Creek Hatchery	Release	Located on Chambers Creek (WRIA 12.0007), at RM 3.5.

Table 2 Chambers Creek Fall Chinook Subyearlings BYs 2002-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		1,479,500			
CWT Recovered (Adults)		5,713			
SAR		0.39%			
Sport Contribution		0.09%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	16	11	1	0.3
CDFO	All	836	587	56	14.6
NMFS	All	9	7	1	0.2
ODFW	All	31	22	2	0.5
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	65	46	4	1.1
MAKA	15- Treaty Troll	64	45	4	1.1
WDFW	15- Treaty Troll	152	106	10	2.7
MAKA	23- PS Net	1	1	0	0.0
SUQ	23- PS Net	2	2	0	0.0
WDFW	23- PS Net	3,098	2,176	209	54.2
WDFW	41- Ocean Sport- Charter	14	10	1	0.2
WDFW	42- Ocean Sport- Private	25	18	2	0.4
WDFW	45- PS Sport - May to September	991	696	67	17.3
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	242	170	16	4.2
WDFW	46- Freshwater Sport ^c	63	44	4	1.1
PUYA	50- Hatchery Escapement (Strays)	2	1	0	0.0
UW	50- Hatchery Escapement (Strays)	5	4	0	0.1
WDFW	50- Hatchery Escapement	81	57	5	1.4
WDFW	50- Hatchery Escapement (Strays)	8	6	1	0.1
WDFW	50- Hatchery Escapement (Strays)	8	6	1	0.1
Total		5,713	4,013	386	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	%
WDFW	46- Freshwater Sport ^c	6	4	0	0.1
PUYA	50- Hatchery Escapement	1	1	0	0.0
NISQ	50- Hatchery Escapement	1	1	0	0.0
UW	50- Hatchery Escapement	2	1	0	0.0
WDFW	50- Hatchery Escapement	237	160	15	4.0
Total		246	166	16	4.1

^a Garrison Springs Fall Chinook Sub-yearling Tag Group is a 90k Ad+CWT; Segregated Harvest Program

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

Table 3 Chambers Creek Fall Chinook Jumbo Subyearlings BYs 2002-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		391,267			
CWT Recovered (Adults)		2,412			
SAR		0.62%			
Sport Contribution		0.14%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
ADFG	All	3	1	1	0.1
CDFO	All	359	77	92	14.9
NMFS	All	17	4	4	0.7
ODFW	All	21	5	5	0.9
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	16	4	4	0.7
MAKA	15- Treaty Troll	11	2	3	0.5
WDFW	15- Treaty Troll	79	17	20	3.3
WDFW	23- PS Net	1,089	235	278	45.2
WDFW	23- PS Net (Strays)	100	22	26	4.2
WDFW	41- Ocean Sport- Charter	9	2	2	0.4
WDFW	42- Ocean Sport- Private	12	2	3	0.5
WDFW	45- PS Sport	524	113	134	21.7
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	140	30	36	5.8
WDFW	46- Freshwater Sport ^c	16	4	4	0.7
NISQ	50- Hatchery Escapement	1	0	0	0.0
UW	50- Hatchery Escapement	1	0	0	0.0
WDFW	50- Hatchery Escapement	10	2	3	0.4
MAKA	53- Wild Broodstock Collection	1	0	0	0.0
WDFW	62- Test Fishery Seine	1	0	0	0.0
Total		2,412	521	616	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	%
WDFW	46- Freshwater Sport ^c	7	1	2	0.3
NIFC	50- Hatchery Escapement	2	0	1	0.1
WDFW	50- Hatchery Escapement	14	3	4	0.6
Total		23	5	6	0.94

^a The Chambers-Garrison Springs Fall Chinook Jumbo Sub-yearling Tag Group was a 100k Ad+CWT group; the program has been **DISCONTINUED; No releases 2000-2002.**

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

Table 4 Chambers Creek Fall Chinook Yearlings BYs 2002-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		649,257			
Tag Code					
CWT Recovered (Adults)		1,889			
SAR		0.29%			
Sport Contribution		0.11%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
CDFO	All	103	34	16	5.4
NMFS	All	3	1	0	0.1
ODFW	All	11	4	2	0.6
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	11	4	2	0.5
MAKA	15- Treaty Troll	4	1	1	0.5
WDFW	15- Treaty Troll	17	6	3	1.3
WDFW	22- Coastal Gillnet	6	2	1	1.3
WDFW	23- PS Net	749	246	115	40.6
WDFW	41- Ocean Sport- Charter	3	1	0	0.1
WDFW	42- Ocean Sport- Private	10	3	2	0.3
WDFW	45- PS Sport	706	232	109	37.6
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	176	58	27	8.9
WDFW	46- Freshwater Sport ^c	35	11	5	1.5
NISQ	50- Hatchery Escapement	1	0	0	0.1
WDFW	50- Hatchery Escapement	49	16	8	3.0
WDFW	50- Hatchery Escapement (Strays)	4	1	1	3.0
WDFW	54- Spawning Grounds	1	0	0	0.1
Total		1,889	620	291	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	46- Freshwater Sport ^c	4	1	1	0.2
PUYA	50- Hatchery Escapement	8	2	1	0.4
UW	50- Hatchery Escapement	4	1	1	0.2
WDFW	50- Hatchery Escapement	284	80	38	13.1
SUQ	54- Spawning Grounds	2	1	0	0.1
WDFW	54- Spawning Grounds	1	0	0	0.1
Total		304	86	40	13.87

^a The Garrison Springs Fall Chinook Yearling Tag Group was a 90k Ad+CWT group and has been discontinued

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CRC harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

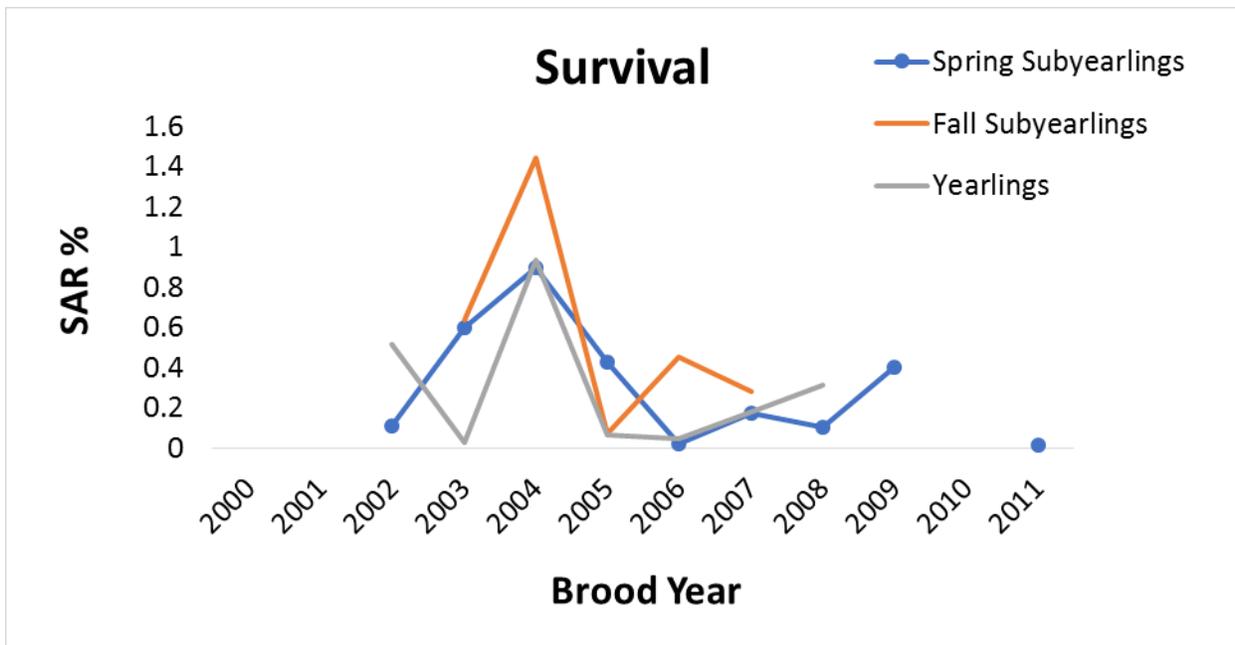


Figure 2 Smolt to adult survival (SAR %) of Chambers-Garrison Fall Chinook releases.

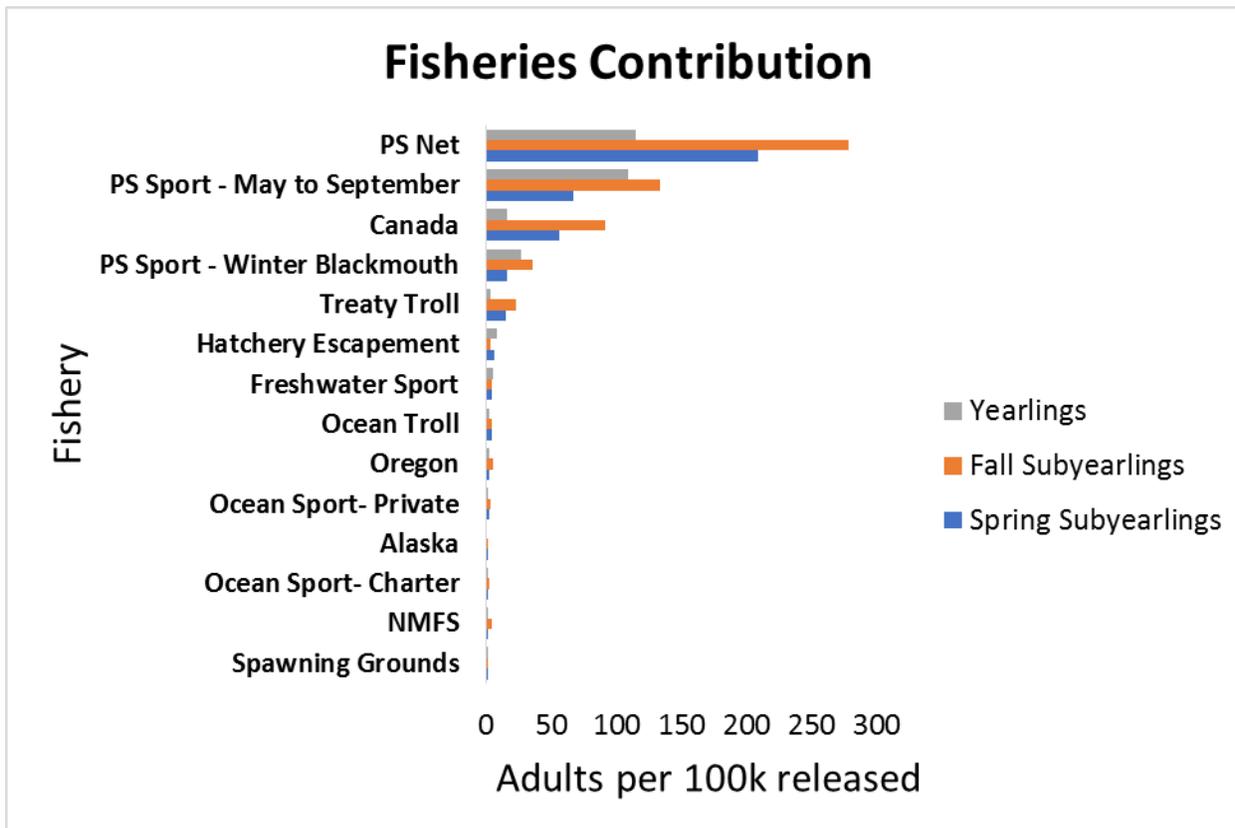


Figure 3 Fisheries contribution of Chambers-Garrison Fall Chinook releases.

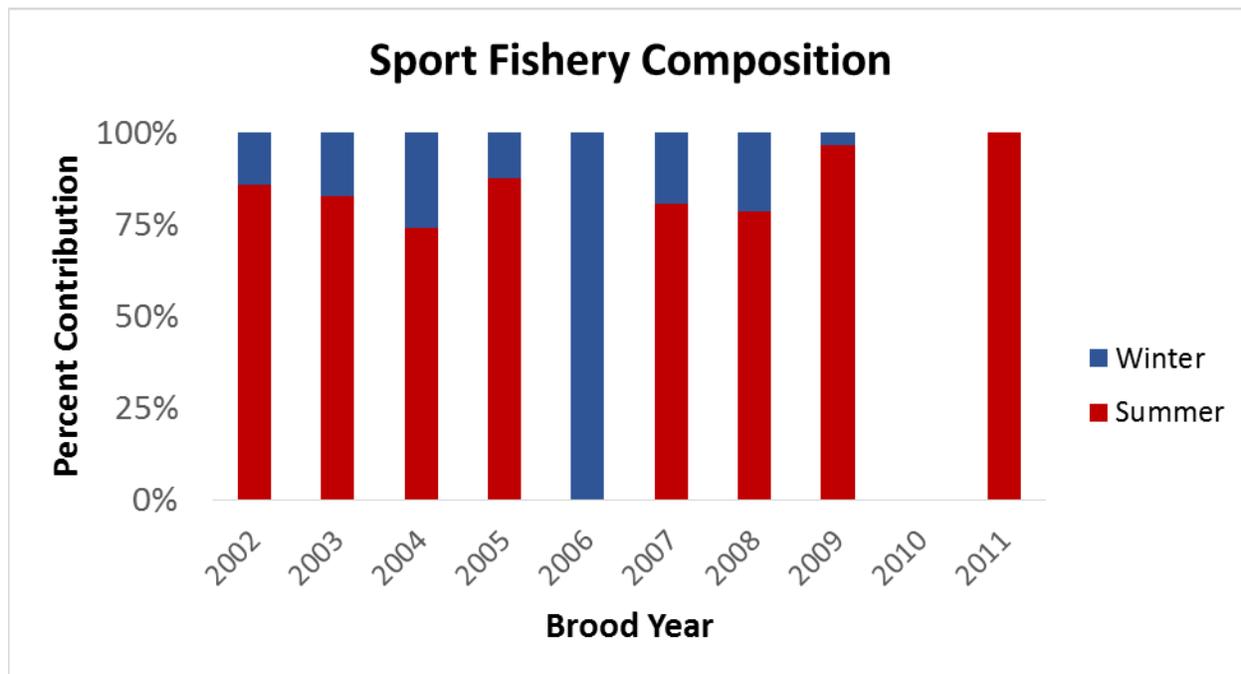


Figure 4 Sport fishery composition of Chambers-Garrison Fall Chinook releases.

MINTER CREEK FALL CHINOOK

The following information was taken from the Minter Creek Fall Chinook HGMP (2013).

“The goal of this program is to provide adult fish for harvest opportunity in Puget Sound terminal marine area recreational and Treaty Indian fisheries. Production from this program may also contribute to harvests and fishing opportunity for directed and incidental Chinook salmon fisheries in British Columbia and Puget Sound pre-terminal fishing areas. In addition, the program may provide eyed-eggs to the Suquamish Tribal facilities (Grovers Creek Hatchery and Gorst Creek rearing ponds) to help their Chinook program meet their egg-take goal, as well as Long Live the Kings Glenwood Springs Hatchery, as of 2009.”

“The program produces fall Chinook salmon for harvest in regional recreational fisheries that are of high value to the State of Washington. The Minter Creek Hatchery program is implemented in accordance with the 1993 legislatively-mandated Puget Sound Recreational Enhancement (PSRE) program. Adult fish produced also help meet harvest allocations that are guaranteed through treaties, as affirmed in U.S. v. Washington (1974). Additionally, program-origin Chinook salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada.”

“These harvest augmentation objectives are met in a manner that is of low impact to listed Chinook populations. No native natural-origin Chinook population exists in Minter Creek that could be impacted by the hatchery program. Interactions with listed salmon populations in Puget Sound are reduced by relying on localized broodstock, by fully imprinting juveniles through rearing at the release site (to minimize straying) and by releasing fish as smolts (to minimize marine area ecological interactions), as programmed in the Future Brood Document.”

Broodstock Collection

Up to 1,300 adults collected annually at Minter Creek Hatchery.

The smolt-to-adult survival for the sub-yearling releases was 0.52% for brood years 2002-2004 (RMIS 2012). Based on the smolt-to-adult survival and programmed release of 1,400,000 the production goal is 7,300.

Minter Hatchery initiated a yearling Chinook program in 2008. As of the 2009 brood year, 75,000 fish are adipose fin-clipped + coded-wire tagged (AD+CWT) and 45,000 are adipose fin-clipped only; the data for survival-to-adult analysis and harvest contribution will not be available until 2013-2014.

Table 1 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Yearlings	Hupp Springs Ponds, RM 3 Minter Creek (WRIA 15.0048)	120,000
Sub-yearlings	Minter Creek Hatchery, RM 0.5 Minter Creek (WRIA 15.0048)	1,400,000

Species and population (or stock) under propagation, and ESA status

Minter Creek Chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy (June 16, 2005). The stock is designated as Category 2b. This stock was founded from fish that are considered part of the ESU, but are released outside of its native watershed. Historically, fall-run Chinook salmon were not present in Minter Creek (SSHAG 2003). In this watershed, adult Chinook salmon returns and any resulting natural production are dependent upon local hatchery program production. The available habitat is not judged to be typical, productive fall Chinook habitat and would not likely support a self-sustaining, naturally spawning fall Chinook salmon population.

The program is identified as a segregated harvest program.

Location(s) of hatchery and associated facilities

Located on Minter Creek (WRIA 15.0048) at RM 0.5. Minter Creek is a tributary to Carr Inlet on Puget Sound, Washington.

Acclimation and Release Locations

Minter Creek Hatchery (subyearlings) and Hupp Springs Rearing Ponds (yearlings): Located at RM 3 on Minter Creek (WRIA 15.0048), tributary to Carr Inlet on Puget Sound.

Table 2 Minter Fall Chinook Subyearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		487,098			
CWT Recovered (Adults)		2956			
SAR		0.61%			
Sport Contribution		0.10%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
ADFG	All	29	79	5	0.9
CDFG	All	3	9	1	0.1
CDFO	All	679	1,875	124	20.4
NMFS	All	34	93	6	1.0
ODFW	All	28	77	5	0.8
WA	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	10- Ocean Troll	71	195	13	2.1
MAKA	15- Treaty Troll	5	15	1	0.2
WDFW	15- Treaty Troll	188	520	34	5.7
WDFW	23- PS Net	756	2,087	138	22.7
WDFW	41- Ocean Sport- Charter	13	37	2	0.4
WDFW	42- Ocean Sport- Private	23	63	4	0.7
WDFW	45- PS Sport - May to September	435	1,200	79	13.1
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	156	431	28	4.7
WDFW	50- Hatchery Escapement	885	2,443	161	26.6
WDFW	50- Hatchery Escapement (Strays)	5	13	1	0.1
SUQ	54- Spawning Grounds	6	16	1	0.2
WDFW	54- Spawning Grounds	15	40	3	0.4
Total		3,330	9,194	607	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	50- Hatchery Escapement	280	713	47	7.8
WDFW	54- Spawning Grounds	4	9	1	0.1
Total		284	722	48	8.76

^a The Minter Creek Fall Chinook sub-yearling program is was a 200k Ad+CWT group, but is no longer tagged; no tagged releases for 2000-2001 and 2005-2010

^b Winter Blackmouth fishery occurs between October and April

^c No CRC data available for Freshwater sport

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

Table 3 Minter Fall Chinook Yearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		232,263			
CWT Recovered (Adults)		56			
SAR		0.02%			
Sport Contribution		0.00%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
CDFO	All	6	4	3	11.6
WA	Fishery	# tags	# fish	# fish per 100k	% of catch
MAKA	15- Treaty Troll	4	2	2	6.9
WDFW	23- PS Net	4	3	2	7.7
WDFW	45- PS Sport - May to September	19	11	8	34.7
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	10	6	4	17.3
WDFW	50- Hatchery Escapement	12	7	5	21.8
Total		56	33	24	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	50- Hatchery Escapement	4	2	0	6.7
WDFW	54- Spawning Grounds	0	0	0	0.0
Total		4	16	0	50.00

^a The Minter Creek Fall Chinook Yearling program is a 90k Ad+CWT group

^b Winter Blackmouth fishery occurs between October and April

^c No CRC data available for Freshwater sport

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

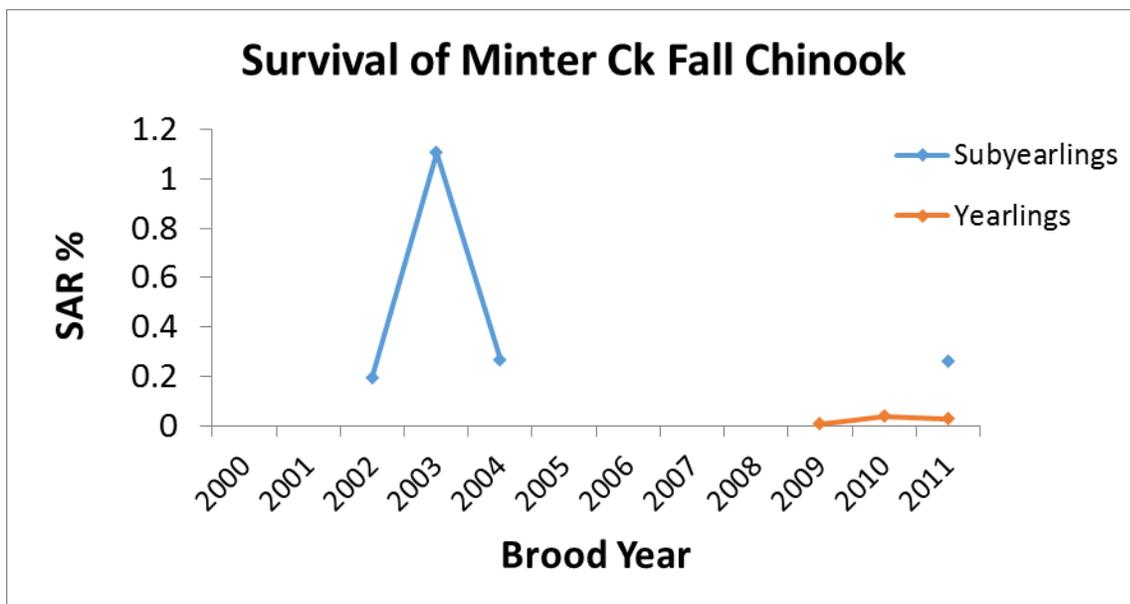


Figure 2 Smolt to adult survival (SAR %) of Minter Creek Fall Chinook releases.

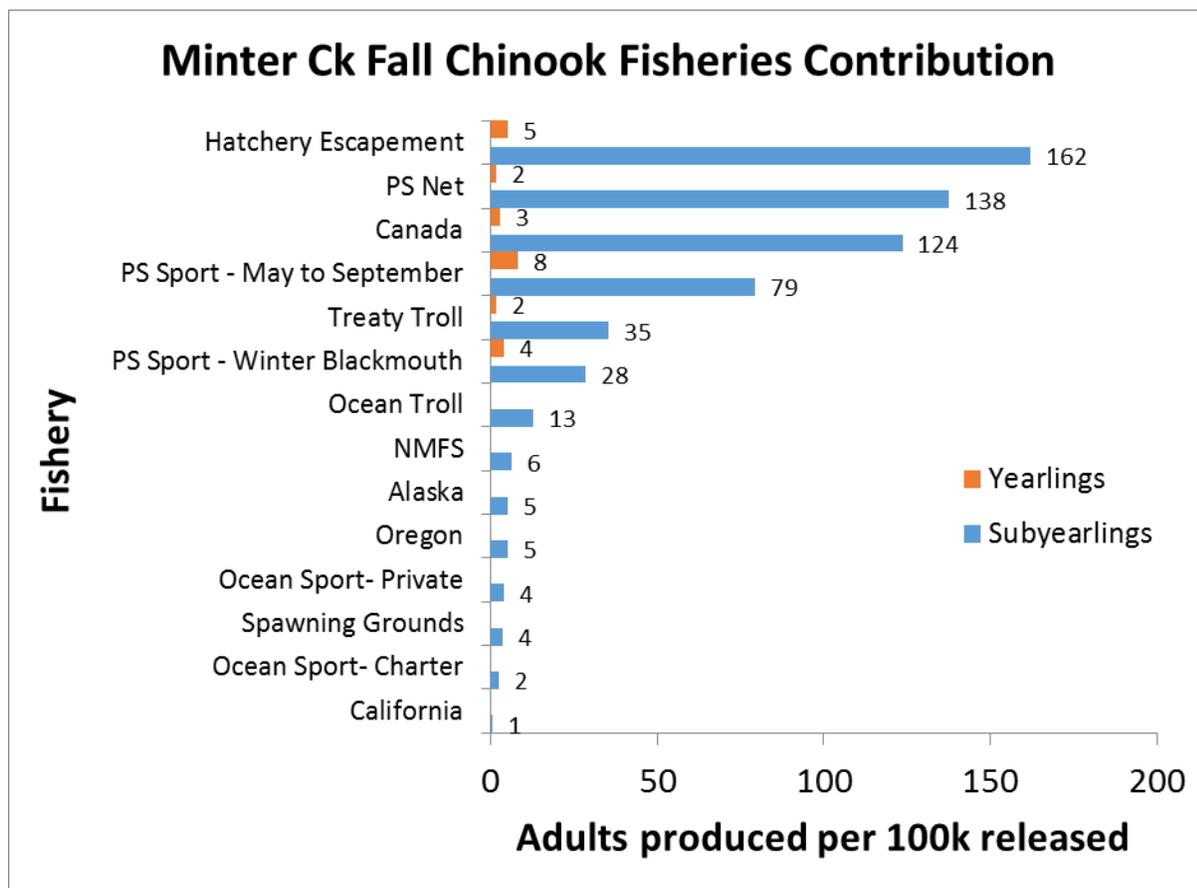


Figure 3 Fisheries contribution of Minter Creek Fall Chinook releases.

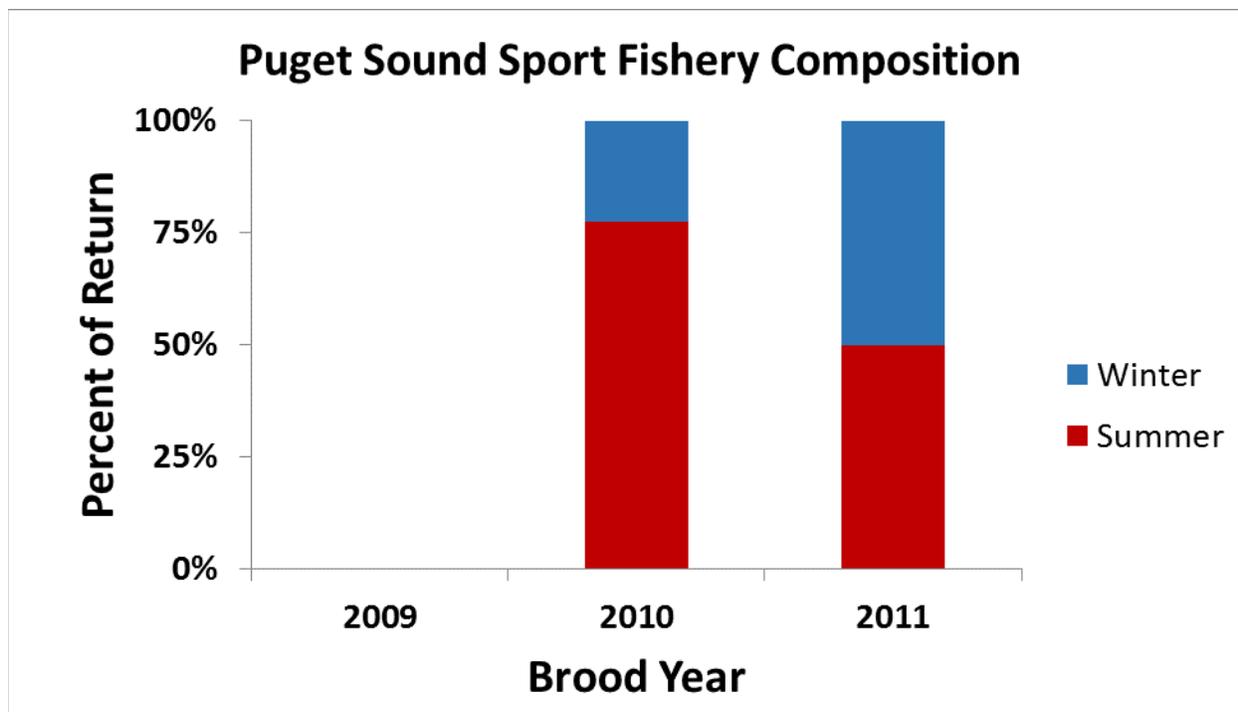


Figure 4 Sport fishery composition of Minter Creek Fall Chinook yearling releases.

GORST CREEK FALL CHINOOK

The following information was taken from the Gorst/Groves Creek Fall Chinook HGMP (2000).

“The goal of the Suquamish Tribe’s fall Chinook program is to restore and maintain Tribal Treaty Chinook fisheries in Area 10E.”

“The Suquamish program will provide fall Chinook salmon for tribal, subsistence and ceremonial, commercial, and sport fisheries that can be harvested in an isolated terminal area.”

Broodstock Collection

The entire Groves Creek Hatchery run is utilized to collect broodstock most years. The number of returning adults averages 2,400 but can range up to 6,400 adults. The hatchery attempts to spawn all adults, keeping a proportion of each egg take, relative to the entire run, to maximize genetic diversity. Approximately 800,000 of the 1.6 million fall Chinook fingerlings released at Gorst Creek are supplied by Minter Creek Hatchery and is funded by the PSRFE program. Initially a yearling fall Chinook release was conducted at Gorst Creek; however, due to poor water quality, that program was suspended after the 2006 release.

Table 1 Proposed fish release levels

Life Stage	Release Location	Annual Release Level
Fingerling	Gorst Creek Rearing Ponds	1,600,000/yr*

*= 800,000 fall Chinook eggs are transferred from Minter Creek Hatchery (WDFW).

Species and population (or stock) under propagation, and ESA status

- Fall Chinook (*Oncorhynchus tshawytscha*) Gorst/Groves Creek (Green River lineage) stock.
- Groves and Gorst Creeks listed by NMFS August 15, 2011 (76FR50448) as not essential to recovery for the Puget Sound ESU. Same designation should apply to Dogfish and Clear Creeks as they are components of the same Tribal program.

The program is identified as an isolated (segregated) harvest program.

Location(s) of hatchery and associated facilities

- Gorst Creek Rearing Ponds = 0.0 rkm Gorst Creek, WRIA 15.0216, E. Kitsap, WA.

Table 2 Gorst Creek Fall Chinook Subyearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		1,378,828			
CWT Recovered (Adults)		5645			
SAR%		0.41%			
Sport Contribution Adults^c		0.04%			
Agency	Fishery	# tags	# fish	# fish per (100k)	% of Catch
ADFG	All	25.5	0	0	0.45
CDFO	All	936.0	12	1	16.58
ODFW	All	21.5	0	0	0.38
NMFS	All	7.5	0	0	0.13
WA	Fishery	# tags	# fish	# fish per (100k)	% of Catch
WDFW	10- Ocean Troll	66.1	1	0	1.17
MAKA	15- Treaty Troll	127.3	2	0	2.26
WDFW	15- Treaty Troll	80.6	1	0	1.43
MAKA	23- PS Net	3.4	0	0	0.06
SUQ	23- PS Net	1228.0	16	1	21.76
TULA	23- PS Net	2.8	0	0	0.05
WDFW	23- PS Net	1354.5	17	1	24.00
WDFW	41- Ocean Sport- Charter	7.4	0	0	0.13
WDFW	42- Ocean Sport- Private	58.7	1	0	1.04
WDFW	45- PS Sport - May to September	500.7	6	0	8.87
WDFW	45- PS Sport - Winter Blackmouth (October)	125.8	2	0	2.23
PUYA	50- Hatchery Escapement	1.0	0	0	0.02
SUQ	50- Hatchery Escapement	18.5	0	0	0.33
WDFW	50- Hatchery Escapement	17.1	0	0	0.30
PUYA	54- Spawning Grounds	1.6	0	0	0.03
SUQ	54- Spawning Grounds	1053.4	13	1	18.66
WDFW	54- Spawning Grounds	7.2	0	0	0.13
Total		5644.5	72	4	100.00
Jacks^d					
Agency	Fishery	# tags	# fish	# fish per (100k)	% of Catch
SUQ	50- Hatchery Escapement	1.0	0	0	0.02
WDFW	50- Hatchery Escapement	5.0	0	0	0.09
SUQ	54- Spawning Grounds	241.8	3	0	4.11
WDFW	54- Spawning Grounds	26.3	0	0	0.46
Total		274.2	3	0	4.63

^a The Gorst Creek Fall Chinook sub-yearling program is a Segregated program with a 200k tag group; no tagged releases for 2000 and 2004-2007

^b Winter Blackmouth fishery occurs between October and April

^c Adults are fish 3 years old or older

^d Jacks are fish 2 years old or younger

Table 3 Gorst Creek Fall Chinook Yearlings BYs 2000-20011 (Ad + CWT).

Brood Year		Total			
CWT Released		171,082			
CWT Recovered (Adults)		495			
SAR		0.29%			
Sport Contribution		0.06%			
Adults					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
CDFO	All	8	4	5	1.7
ODFW	All	3	2	2	0.6
WA	Fishery	# tags	# fish	# fish per 100k	% of Catch
WDFW	10- Ocean Troll	2	1	1	0.4
WDFW	15- Treaty Troll	4	2	2	0.8
WDFW	23- PS Net	233	121	136	47.0
WDFW	45- PS Sport - May to September	107	56	63	21.6
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	63	33	37	12.7
SUQ	54- Spawning Grounds	70	36	41	14.1
WDFW	54- Spawning Grounds	5	3	3	1.0
Total		495	257	289	100.0
Jacks					
Agency	Fishery	# tags	# fish	# fish per 100k	% of Catch
SUQ	54- Spawning Grounds	58	27	30	10.5
Total		58	27	15	10.46

^a The Gorst Creek Fall Chinook yearling program is no longer tagged; no tagged releases for 2000-2001 or 2004-2007.

^b No reliable CRC data available for Freshwater sport

^c Adults are fish 3 years old or older

^d Jacks are fish 2 years old or younger

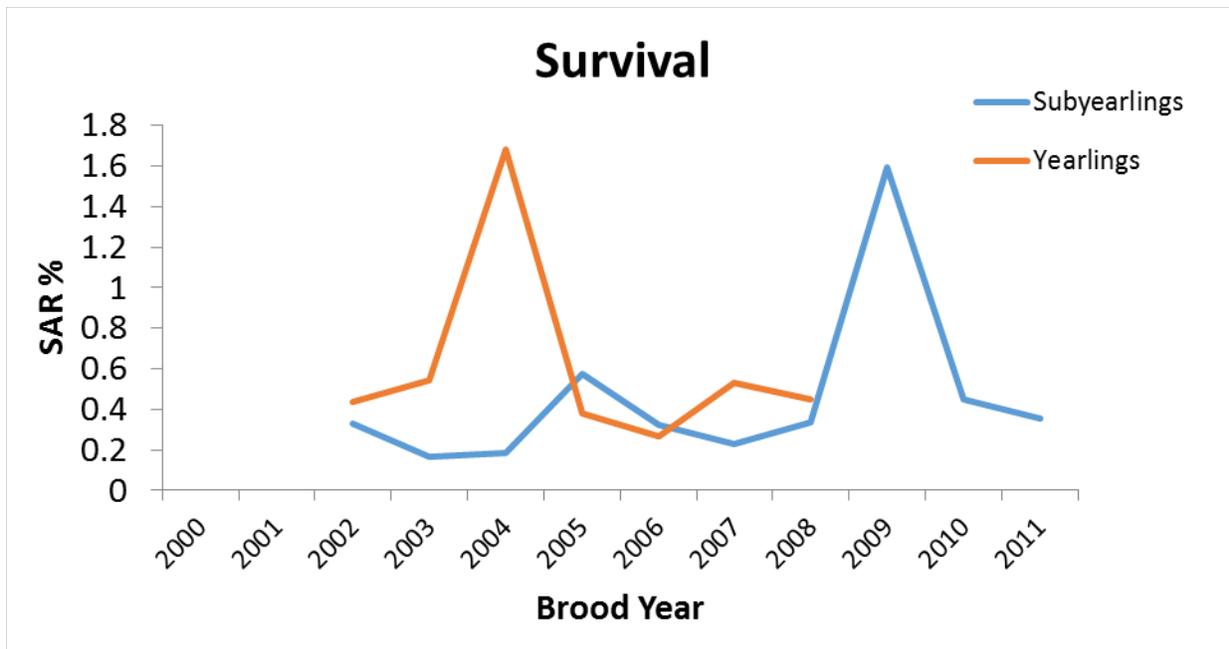


Figure 2 Smolt to adult survival (SAR %) of Gorst Creek Fall Chinook releases.

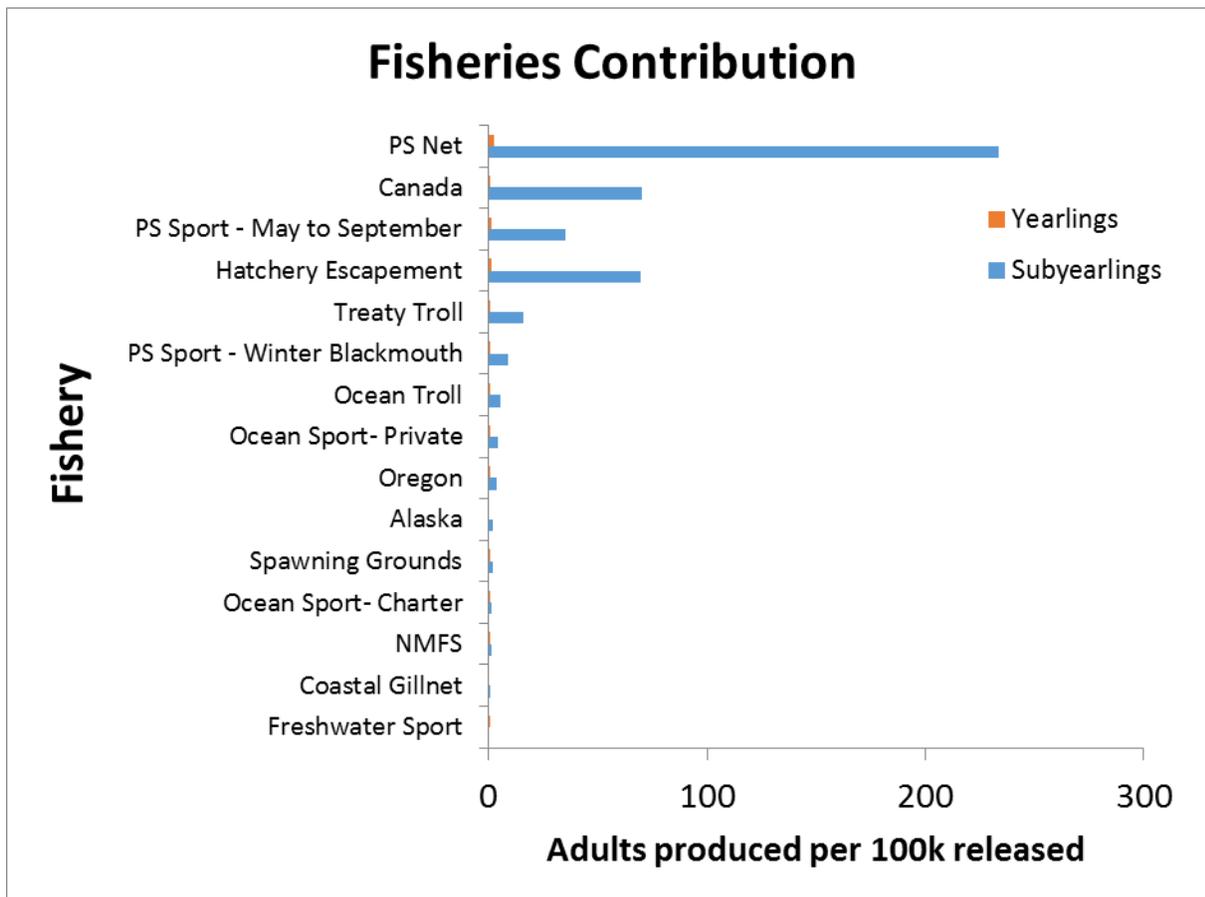


Figure 3 Fisheries contribution of Gorst Creek Fall Chinook subyearling releases.

HOODSPORT FALL CHINOOK

The following information was taken from the Hoodsport Fall Chinook HGMP (2014).

“The purpose of the program is to produce fall Chinook for sustainable recreational and tribal fisheries. Juvenile fish will be produced at the Hoodsport Hatchery (located on the mouth of Finch Creek, on Hood Canal). The program will release 3.0M sub-yearling and 120,000 yearling smolts into Hood Canal annually.

The program will be operated as a “segregated” program with the intent for the hatchery population to represent a distinct population that is reproductively isolated from naturally-spawning populations. Segregation will be achieved operationally by using only adult hatchery Chinook (distinguished by an adipose fin-clip) returning to the Hoodsport Hatchery trap and the Purdy Creek trap at George Adams, and by operating the program in a manner to limit gene flow to the wild Mid Hood Canal fall Chinook population.”

The program produces salmon for harvest in regional recreational fisheries that are of high value to the State of Washington. Adult fish produced also help meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in *U.S. v. Washington* (1974). Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada. These harvest objectives are met in a manner that minimizes diverse effects on listed fish. Returning fall Chinook adults provide for tribal commercial and subsistence use and provide a localized recreational sport fishery, mostly from July through October each year. Puget Sound Recreational Enhancement Funding provides the funding to produce the yearling portion of the program to support recreational fisheries in Hood Canal and Puget Sound.

The yearling portion of this program is implemented in accordance with the legislatively-mandated Puget Sound Recreational Fisheries Enhancement (PSRFE) program. The purpose of the Hoodsport Hatchery program is to provide localized hatchery-origin adult Chinook salmon for harvest, primarily in the Puget Sound and Hood Canal recreational fisheries. Yearlings reared for an 18 month period generally have a higher propensity to residualize in Puget Sound and Hood Canal after release, thus enhancing their year-around availability for harvest in "inside" Puget Sound and Hood Canal fisheries.

Broodstock Collection

Up to 2,500 adults are collected annually.

Table 1 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Sub-yearling	Finch Creek (WRIA 16.0222)	3,000,000 ^a
Yearling	Finch Creek (WRIA 16.0222)	120,000 ^b

Source: WDFW Future Brood Document 2013.

^a Sub-yearling releases will increase from 3,000,000 to 2,800,000 beginning with 2015 release, 2014 brood in accordance with the Skokomish Fall Chinook Management Plan (Skokomish Indian Tribe and WDFW Draft 2014). Release levels were originally reduced in 2005 release (2004 brood) from 3,000,000 to 2,800,000.

^b Beginning with the 2006 release (2004 brood).

Species and population (or stock) under propagation, and ESA status

- Hoodsport Hatchery/Finch Creek fall Chinook (*Oncorhynchus tshawytscha*) are not included in the ESA-listed Puget Sound Chinook ESU.

The program is identified as a segregated harvest program.

Location(s) of hatchery and associated facilities. Broodstock collection, holding, spawning, incubation, rearing, release:

Hoodsport Hatchery: Located at the mouth of Finch Creek (WRIA 16.0222) near Hoodsport WA. Finch Creek drains directly into Hood Canal.

Table 2 Hoodsport Fall Chinook Yearlings BYs 2000-2011 (Ad + CWT).

Brood Year		Total			
CWT Released ^a		789,184			
CWT Recovered (Adults)		5,052			
SAR		0.64%			
Sport Contribution		0.22%			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
CDFO	All	318	52	40	6.3
ODFW	All	11	2	1	0.2
NMFS	All	1	0	0	0.0
WA	Fishery	# tags	# fish	# fish per 100k	% of catch
WDFW	10- Ocean Troll	36	6	5	0.7
MAKA	15- Treaty Troll	61	10	8	1.2
WDFW	15- Treaty Troll	32	5	4	0.6
SUQ	23- PS Net	2	0	0	0.0
WDFW	23- PS Net	1,817	298	230	36.0
WDFW	41- Ocean Sport- Charter	13	2	2	0.3
WDFW	42- Ocean Sport- Private	21	3	3	0.4
WDFW	45- PS Sport - May to September	1,108	182	140	21.9
WDFW	45- PS Sport - Winter Blackmouth (Oct - April) ^b	572	94	73	11.3
WDFW	46- Freshwater Sport ^c	53	9	7	1.0
WDFW	50- Hatchery Escapement	915	150	116	18.1
WDFW	50- Hatchery Escapement (Strays)	18	3	2	0.4
WDFW	54- Spawning Grounds	68	11	9	1.3
WDFW	62- Test Fishery Seine	5	1	1	0.1
Total		5,052	829	640	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	% of catch
SUQ	50- Hatchery Escapement	1	0	0	0.0
WDFW	50- Hatchery Escapement	2,325	260	201	31.5
WDFW	54- Spawning Grounds	26	3	2	0.5
Total		2,351	263	203	31.8

^a The George Adams Yearling Fall Chinook Tag Group is a 100k AD+CWT group

^b Winter Blackmouth fishery occurs between October and April

^c Freshwater Sport based on CWT harvest data

^d Adults are fish 3 years old or older

^e Jacks are fish 2 years old or younger

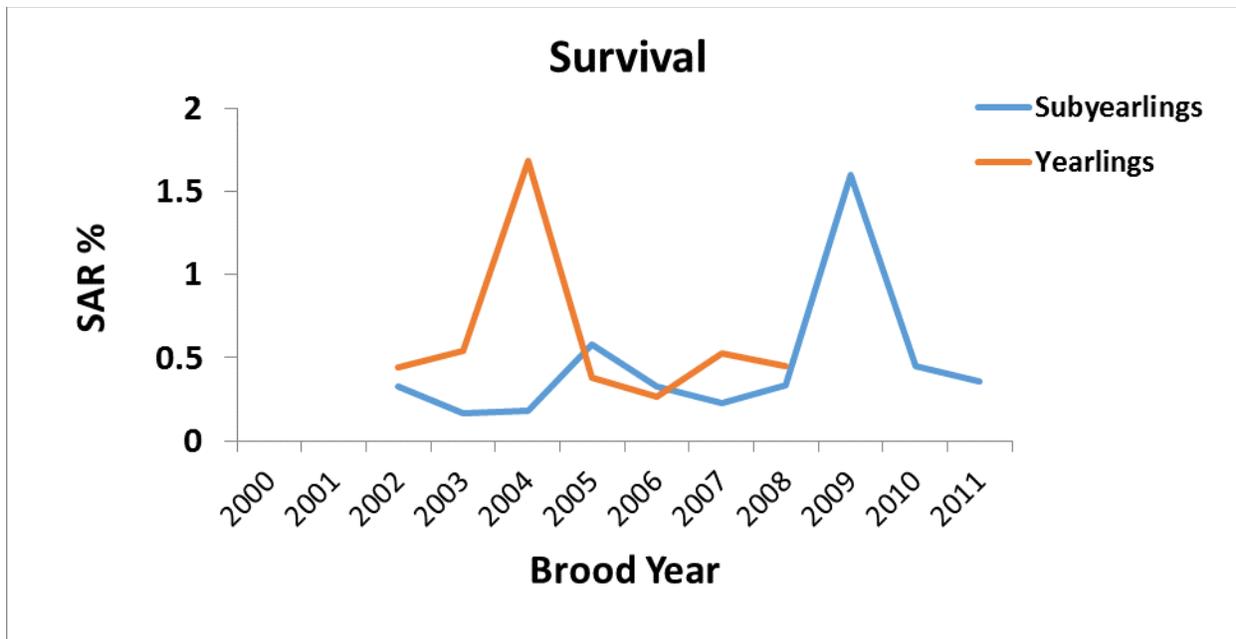


Figure 2 Smolt to adult survival (SAR %) of Hoodsport Fall Chinook releases.

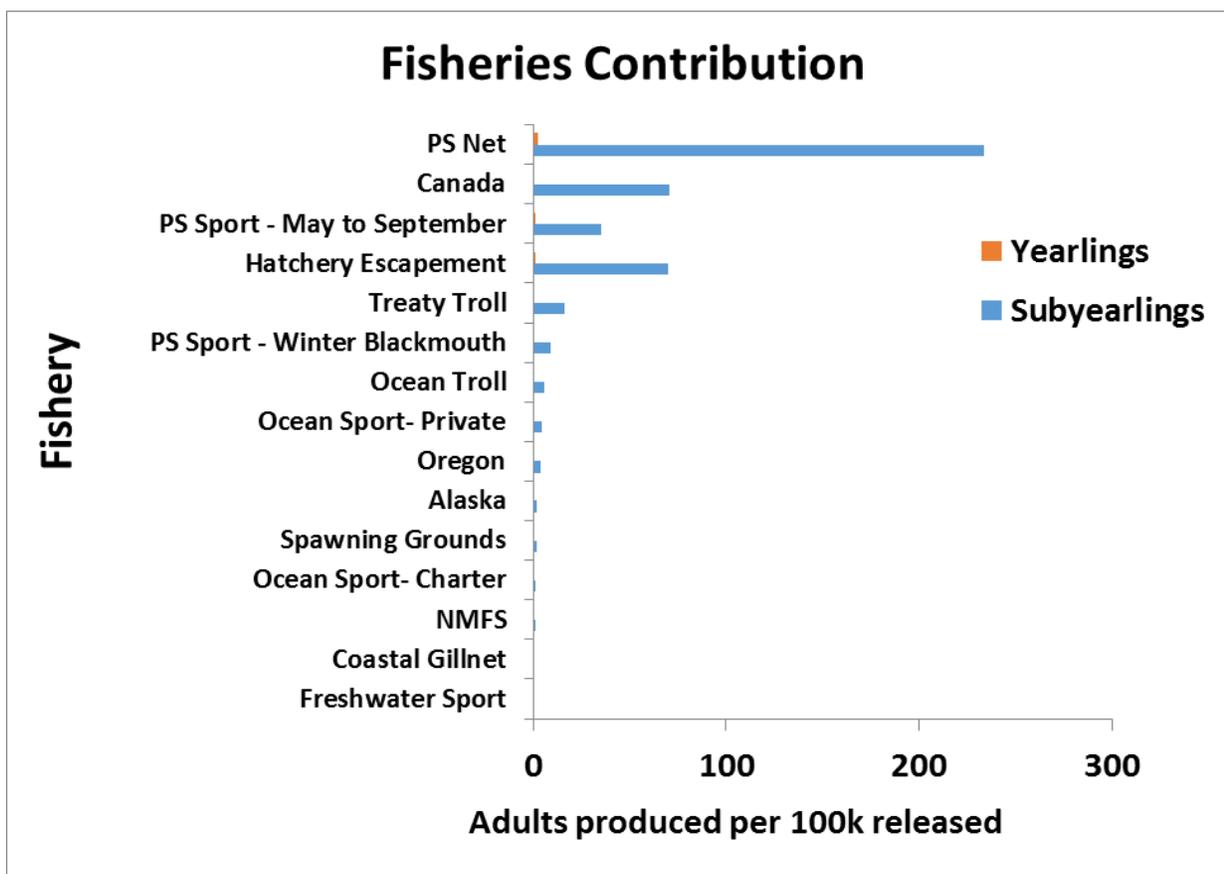


Figure 3 Fisheries contribution of Hoodsport Fall Chinook releases.

COHO PROGRAMS

WALLACE RIVER COHO

The following information was taken from the Wallace River Coho HGMP (2013).

“The program mitigates for lost natural-origin fish production in the watershed by producing Skykomish population Coho salmon for harvest in regional recreational fisheries, and Tulalip Tribal commercial and ceremonial and subsistence fisheries. The program helps meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in U.S. v. Washington (1974). Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada.”

Broodstock Collection

Around 3,462 viable spawners, or 1,731 spawning pairs are needed to provide the overall egg-take of 4.50 million, which provides: 700,000 green eggs for the on-station (200,000) and regional net pen releases (~500,000); up to 2.1-million eggs for the Tulalip Hatchery program; and around 2.0-million eggs for the South Sound and Squaxin Island net pen programs (see HGMP section 1.11.2). The average total escapement needed to achieve the overall Wallace Hatchery Coho egg-take goal is a minimum escapement of 4,638 adults, given the average female sex ratio of 44.5%, survival rate to spawning of 83.9%, and fecundity of 2,599 (1995-2007 averages).

Based on the average survival rate (SAR) of Wallace Hatchery yearling Coho salmon of 6.25% (2001-2009 BY) and the program released goal of 150,000, the estimated average production would be 9,375 adults (personal communication WDFW 2016).

Table 1 Proposed fish release levels.

Life Stage	Release Location	Annual Release Level
Yearling	Wallace River (WRIA 07.0940)	150,000

Data source: Future Brood Document (2012).

Species and population (or stock) under propagation, and ESA status

Skykomish River Coho (*Oncorhynchus kisutch*) – not ESA listed. This population has been identified as biologically significant and has been assigned a key wild management unit status (one of five) in Puget Sound. The HSRG assumes this to equate to a “Primary” population.

The program is identified as an integrated harvest program.

Location(s) of hatchery and associated facilities. Broodstock collection, holding, spawning, incubation, rearing, release

Wallace River Hatchery: Wallace River (WRIA 07.0940), RM 4 at the confluence with May Creek (WRIA 07.0943); enters the Skykomish River (WRIA 07.0012) at RM 36.

Table 2. Wallace River Coho Releases 2000-2011 Ad+CWT

Brood Year		Total	2000-2011		
CWT Released ^a		511,346			
CWT Recovered (Adults)		33,190			
SAR%		6.49%			
Sport contribution		0.0201			
Adults^c					
Agency	Fishery	# tags	# fish	# fish per 100k	%
ADFG	All	11.3	2	2	0.03
CDFO	All	1014.5	168	198	3.06
NMFS	All	1.3	0	0	0.00
ODFW	All	228.3	38	45	0.69
WA	Fishery	# tags	# fish	# fish per 100k	%
WDFW	10- Ocean Troll	145.2	24	28	0.44
MAKA	15- Treaty Troll	203.7	34	40	0.61
WDFW	15- Treaty Troll	390.2	65	76	1.18
QDNR	22- Coastal Gillnet	6.3	1	1	0.02
MIT	23- PS Net	0.0	0	0	0.00
SUQ	23- PS Net	0.0	0	0	0.00
TULA	23- PS Net	164.2	27	32	0.49
WDFW	23- PS Net	874.7	145	171	2.64
WDFW	41- Ocean Sport- Charter	335.7	56	66	1.01
WDFW	42- Ocean Sport- Private	618.6	103	121	1.86
WDFW	45- PS Sport	2,514.8	418	492	7.58
WDFW	46- Freshwater Sport ^b	6,789.1	1,127	1,328	20.46
WDFW	50- Hatchery Escapement	19,884.5	3,302	3,889	59.91
WDFW	52- Fish Trap	7.3	1	1	0.02
	<i>Total</i>	<i>33,189.7</i>	<i>5,512</i>	<i>6,491</i>	<i>100.00</i>
Jacks^d					
Agency	Fishery	# tags	# fish	# fish per 100k	%
WDFW	46- Freshwater Sport ^b	85.7	14	17	51.76

WDFW	50- Hatchery Escapement	79.9	13	16	0.24
	<i>Total</i>	<i>165.6</i>	<i>27</i>	<i>32</i>	<i>0.50</i>

^a The Wallace River Coho Yearling Tag Group is a 45k AD+CWT group

^b Freshwater Sport based on CRC harvest data

^c Adults are fish 3 years old or older

^d Jacks are fish 2 years old or younger

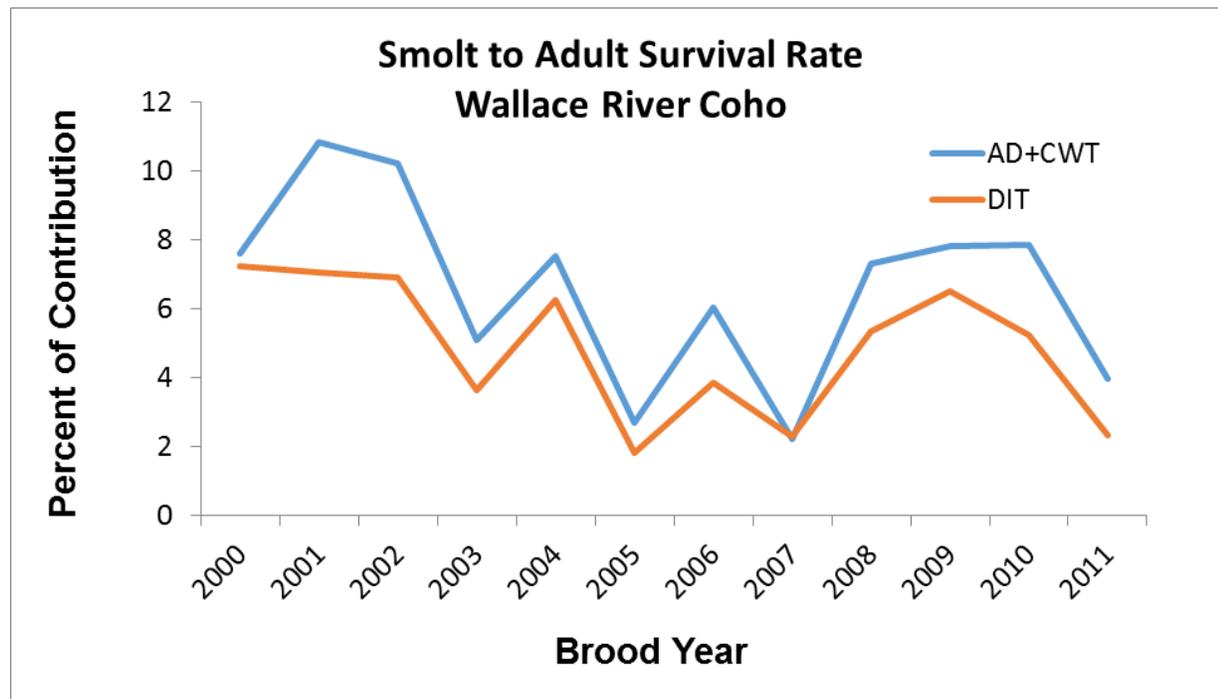


Figure 1 Smolt to adult survival (SAR %) of Wallace Coho releases.

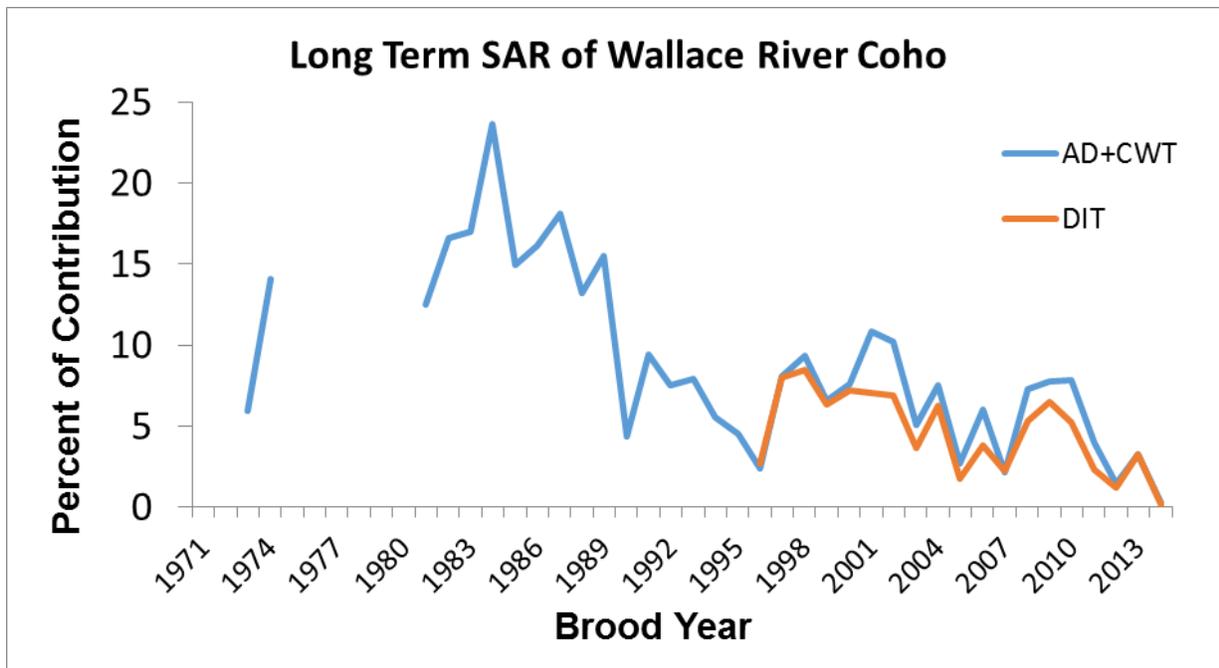


Figure 2 Smolt to adult survival (SAR) of Wallace River Coho.

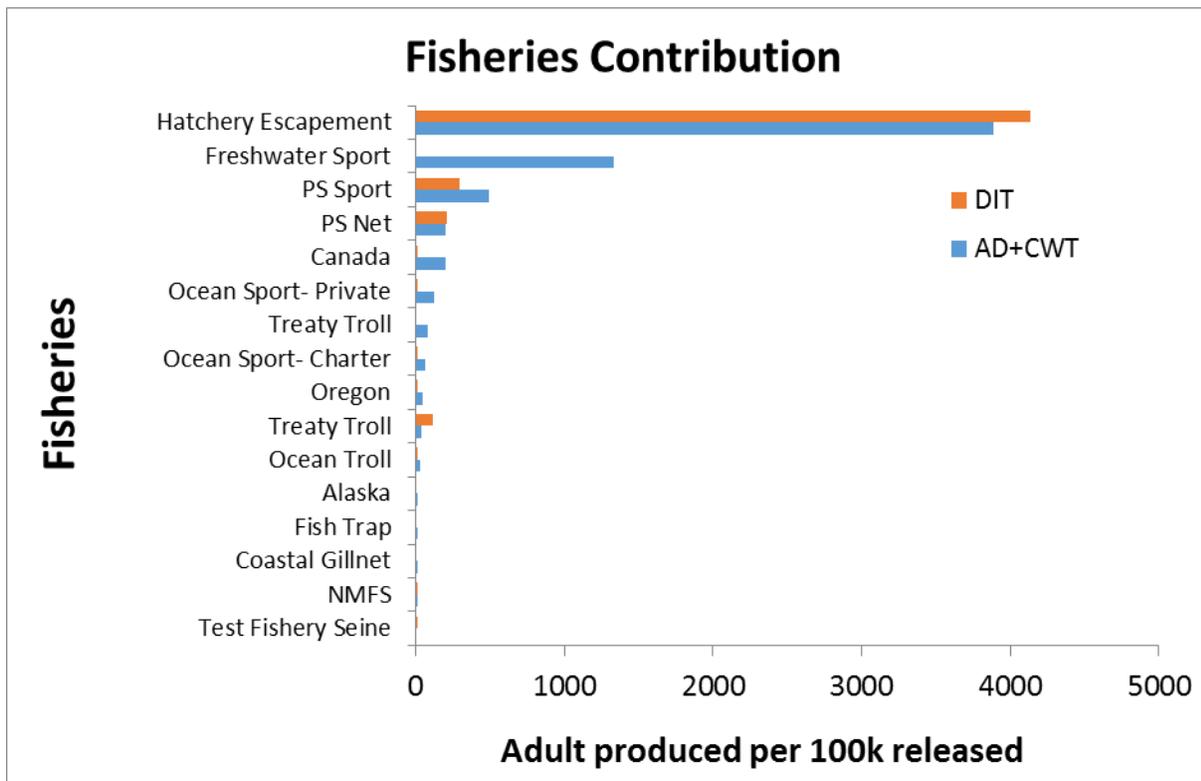


Figure 3 Fisheries contribution of Wallace Coho releases.

Recent analysis by WDFW estimates that the cost per fish harvested in the Puget Sound Sport Fishery (winter and summer) is \$89 (based on 2017 operating costs). This program ranks 2th out of 3 Coho programs Chinook programs funded by PSRFE (see Table 4).

Table 3. Average Recreational Catch by Marine Area and WRIA for Wallace Hatchery Coho.

Catch Area	# Tags	% Sport Contribution
AK	0	0.00%
BC	997.89	23.12%
OR	197.33	4.57%
MA 01	176.15	4.08%
MA 02	339.42	7.86%
MA 03	89.51	2.07%
MA 04	289.38	6.70%
MA 05	916.23	21.23%
MA 06	143.17	3.32%
MA 07	0	0.00%
MA 08	328.18	7.60%
MA 09	769.81	17.83%
MA 10	61.54	1.43%
MA 11	3.5	0.08%
MA 12	0	0.00%
MA 13	0	0.00%
WRIA 1	0	0.00%
WRIA 2	0	0.00%
WRIA 3	0	0.00%
WRIA 4	0	0.00%
WRIA 5	0	0.00%
WRIA 6	0	0.00%
WRIA 7	0	0.00%
WRIA 8	0	0.00%
WRIA 9	4.36	0.10%
Total	4,316	100%

Table 4. Wallace Coho integration results 2008-2012, using 0.01 presumed pHOS estimate.

Year	pNOB	pHOS	PNI
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2008	0.33	0.01	0.97
2009	0.18	0.01	0.95
2010	0.09	0.01	0.90
2011	0.12	0.01	0.92
2012	0.16	0.01	0.94
Average	0.18	0.01	0.95

Source: Mike Crewson, Tulalip Tribes; Co-manager's Equilibrium Brood Database; and WDFW Hatcheries Evaluation and Assessment Team (HEAT) Broodstock Tracking Tables 2013.

Table 5. Wallace Coho integration results 2008 – 2012, using 0.10 presumed pHOS estimate.

Year	pNOB	pHOS	PNI
2008	0.33	0.10	0.77
2009	0.18	0.10	0.64
2010	0.09	0.10	0.48
2011	0.12	0.10	0.55
2012	0.16	0.10	0.62
Average	0.18	0.10	0.64

Source: Mike Crewson, Tulalip Tribes; Co-manager's Equilibrium Brood Database; and WDFW HEAT Broodstock Tracking Tables 2013.

Table 6. Cost per fish for Coho programs funded by PSFRE (with additional programs for comparison).

Hatchery/Stock	Run	Puget Sound Sport (summer + winter)			
		% of total survival to this fishery	Actual Harvest	Harvest/100K	\$/Fish in PS sport
Wallace	Fall	7%	145	171	\$89
Hupp Springs (Minter Data used)	Fall	13%	448	271	\$148
Marblemount	Fall	12%	1,526	722	Not Avail.
Voights (not funded by PSRFE)	Fall	11%	2,860	386	\$75
South Sound Net Pens (not funded by PSRFE)	Fall	13%	5806	354	\$122

OTHER COHO PROGRAMS OF INTEREST

MARBLEMOUNT COHO

Table 1. Marblemount Coho Releases Ad + CWT.

Brood Year		Total			
CWT Released ^a		840,262			
CWT Recovered (Adults)		48,084			
SAR%		5.72%			
Sport contribution		0.0142			
Adults ^c					
Agency	Fishery	# tags	# fish	# fish per 100k	%
ADFG	All	6.2	2	1	0.0
CDFO	All	1,498.5	377	178	3.1
ODFW	All	505.5	127	60	1.1
WA	Fishery	# tags	# fish	# fish per 100k	%
WDFW	10- Ocean Troll	163.4	41	19	0.3
MAKAH	15- Treaty Troll	80.3	20	10	0.2
WDFW	15- Treaty Troll	341.6	86	41	0.7
WDFW	22- Coastal Gillnet	3.0	1	0	0.0
MAKAH	23- PS Net	4.0	1	0	0.0
SRSC	23- PS Net	520.1	131	62	1.1
TULA	23- PS Net	119.2	30	14	0.2
WDFW	23- PS Net	11,270.3	2,834	1,341	23.4
WDFW	23- PS Net (Strays)	10.3	3	1	0.0
WDFW	41- Ocean Sport- Charter	730.4	184	87	1.5
WDFW	42- Ocean Sport- Private	2,010.4	505	239	4.2
WDFW	45- PS Sport	5,992.0	1,507	713	12.5
WDFW	46- Freshwater Sport ^b	3,225.4	811	384	6.7
UW	50- Hatchery Escapement	1.0	0	0	0.0
WDFW	50- Hatchery Escapement	21,587.6	5,428	2,569	44.9
WDFW	50- Hatchery Escapement (Strays)	3.7	1	0	0.0
WDFW	62- Test Fishery Seine	11.8	3	1	0.0
	<i>Total</i>	<i>48,084.5</i>	<i>12,091</i>	<i>1,439</i>	<i>100.0</i>
Jacks ^d					
Agency	Fishery	# tags	# fish	# fish per 100k	%

WDFW	46- Freshwater Sport ^b	28.2	7	3	20.4
WDFW	50- Hatchery Escapement	122.8	31	15	0.3
	<i>Total</i>	<i>138.0</i>	<i>35</i>	<i>16</i>	<i>50.00</i>

a The Marblemount Coho Yearling Tag Group is a 45k Ad+CWT release

b Freshwater Sport based on CRC harvest data

c Adults are fish 3 years old or older

d Jacks are fish 2 years old or younger

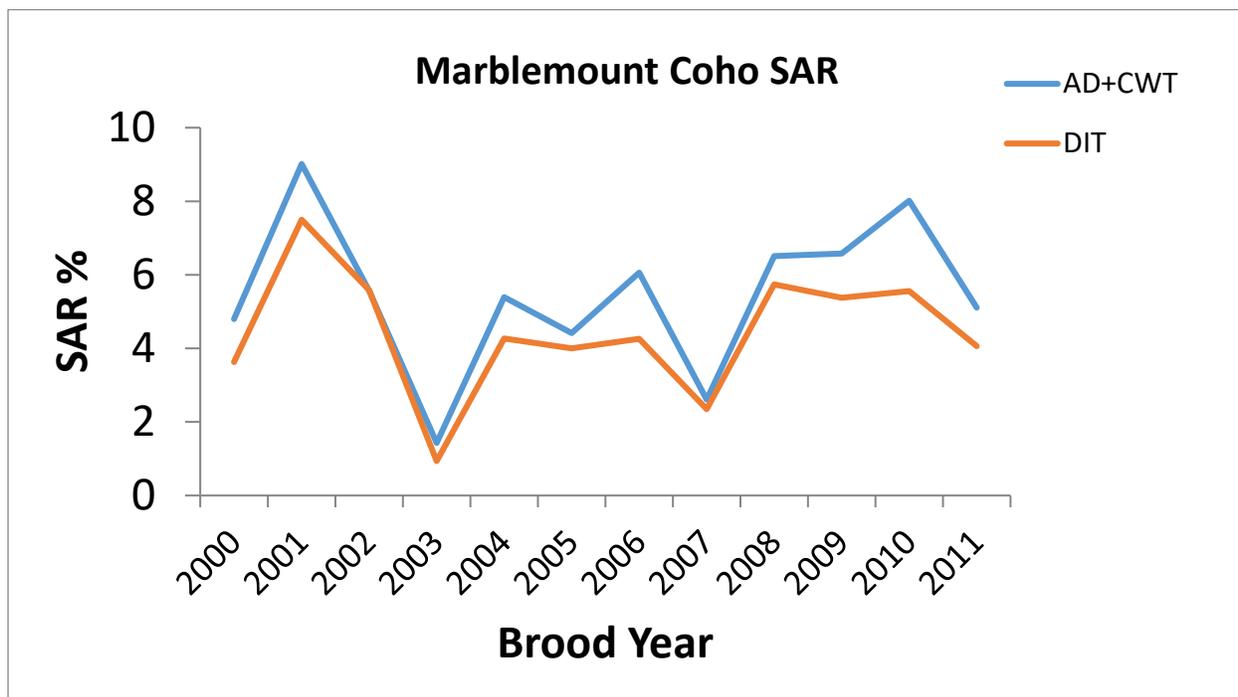


Figure 1. Smolt to adult survival (SAR) of Marblemount Coho.

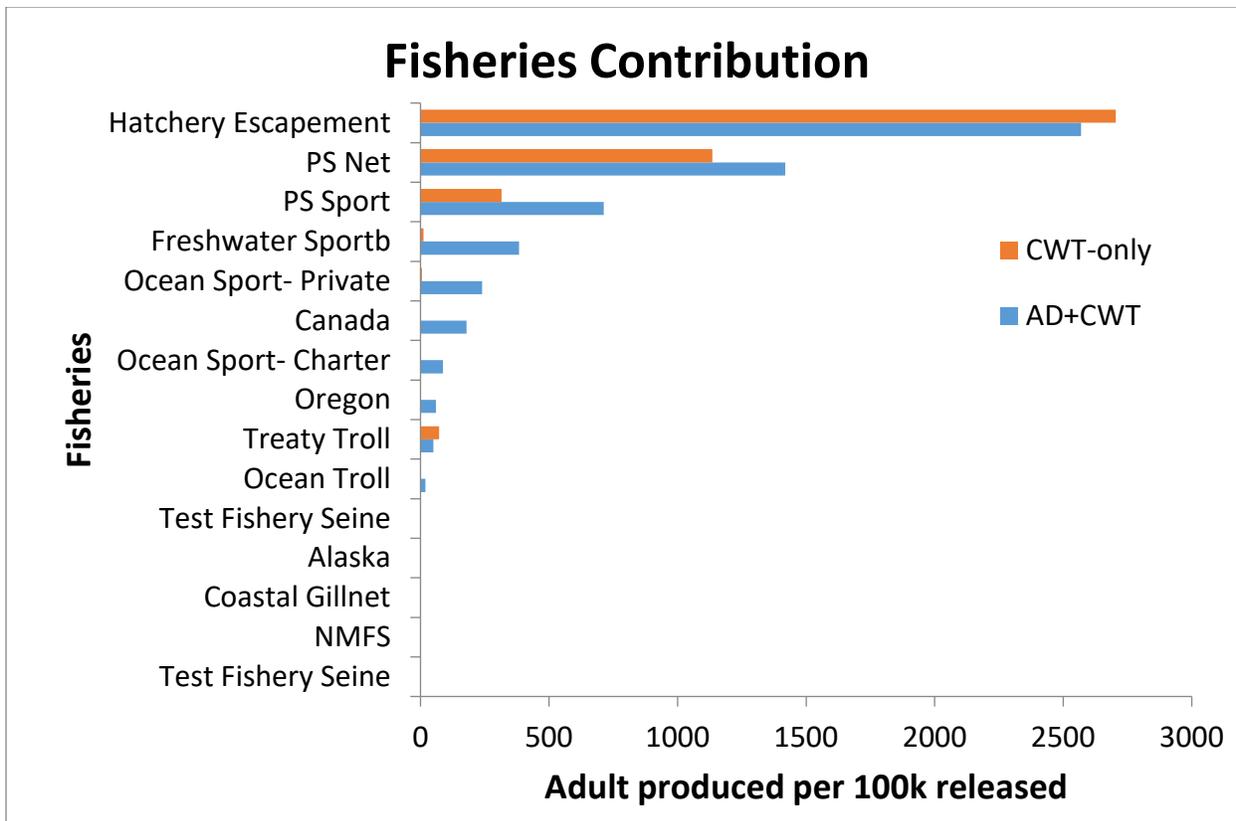


Figure 2. Fisheries contribution of Marblemount Coho.

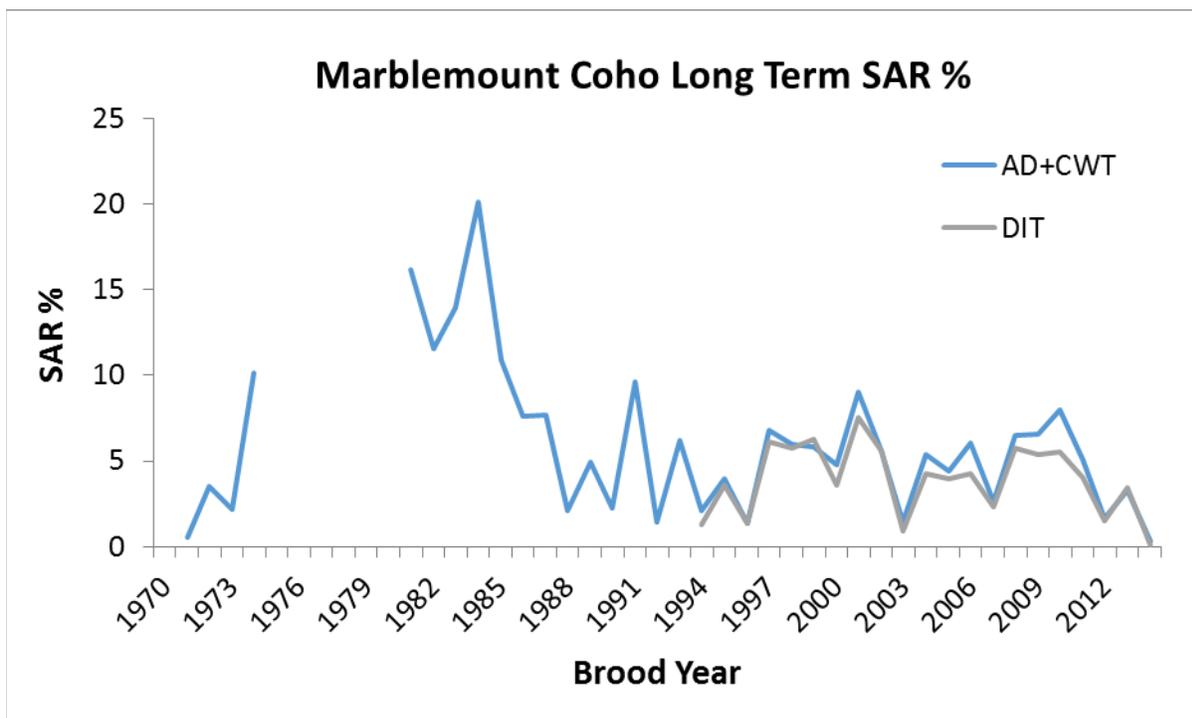


Figure 3. Long-term smolt to adult survival of Marblemount Coho.

Table 2. Average Recreational Catch by Marine Area and WRIA

Catch Area	# Tags	% Sport Contribution
AK	0.00	0.00%
BC	1,840.39	15.61%
OR	512.20	4.34%
MA 01	556.43	4.72%
MA 02	783.52	6.64%
MA 03	128.35	1.09%
MA 04	1,377.10	11.68%
MA 05	3,055.14	25.91%
MA 06	211.06	1.79%
MA 07	11.96	0.10%
MA 08	1,129.48	9.58%
MA 09	1,541.56	13.07%
MA 10	510.23	4.33%
MA 11	94.57	0.80%
MA 12	0.00	0.00%
MA 13	0.00	0.00%
WRIA 1	0.00	0.00%
WRIA 2	0.00	0.00%
WRIA 3	41.04	0.35%
WRIA 4	0.00	0.00%
WRIA 5	0.00	0.00%
WRIA 6	0.00	0.00%
WRIA 7	0.00	0.00%
WRIA 8	0.00	0.00%
WRIA 9	0.00	0.00%
<i>Total</i>	<i>11,793</i>	<i>100%</i>

VOIGHTS CREEK COHO

Table 1. Voights Creek Coho BYs 2000-2011 Ad + CWT

Updated By G. Marston 6/7/2018

Brood Year		Total			
CWT Released ^a		550,623			
Tag Code					
CWT Recovered (Adults)		18,170			
SAR%		3.30			
Sport Contribution		0.0048			
Adults^d					
Agency	Fishery	# tags	# fish	# fish per 100k	%
ADFG	All	0.0	-	-	0.0
CDFO	All	559.1	911	102	3.1
NMFS	All	73.7	120	13	0.4
ODFW	All	65.6	107	12	0.4
WA	Fishery	# tags	# fish	# fish per 100k	%
WDFW	10- Ocean Troll	40.4	66	7	0.2
MAKA	15- Treaty Troll	88.9	145	16	0.5
WDFW	15- Treaty Troll	185.7	303	34	1.0
MAKA	23- PS Net	7.8	13	1	0.0
WDFW	23- PS Net	4883.6	7,957	887	26.9
WDFW	23- PS Net (Strays)	59.7	97	11	0.3
WDFW	41- Ocean Sport- Charter	120.5	196	22	0.7
WDFW	42- Ocean Sport- Private	402.5	656	73	2.2
WDFW	45- PS Sport	2127.4	3,466	386	11.7
WDFW	46- Freshwater Sport ^b	2830.3	4,612	514	15.6
PUYA	50- Hatchery Escapement - Strays	1.0	2	0	0.0
WDFW	50- Hatchery Escapement	6723.2	10,955	1,221	37.0
WDFW	50- Hatchery Escapement - Strays	1.0	2	0	0.0
Total		18170.3	29607	3300	100.0
Jacks^e					
Agency	Fishery	# tags	# fish	# fish per 100k	%
WDFW	46- Freshwater Sport ^b	157.8	253	28	37.0
WDFW	50- Hatchery Escapement	111.3	179	20	29.3
Total		269.1	432	48	1.46

^a The Voights Creek Coho Yearling Tag Group is a 45k Ad+CWT group (DIT)

^b Freshwater Sport based on CRC harvest data for BY 2001-2008; CRC data not available for marked fish in 2

^c Adults are fish 3 years old or older

^d Jacks are fish 2 years old or younger

^e Emergency release due to flooding

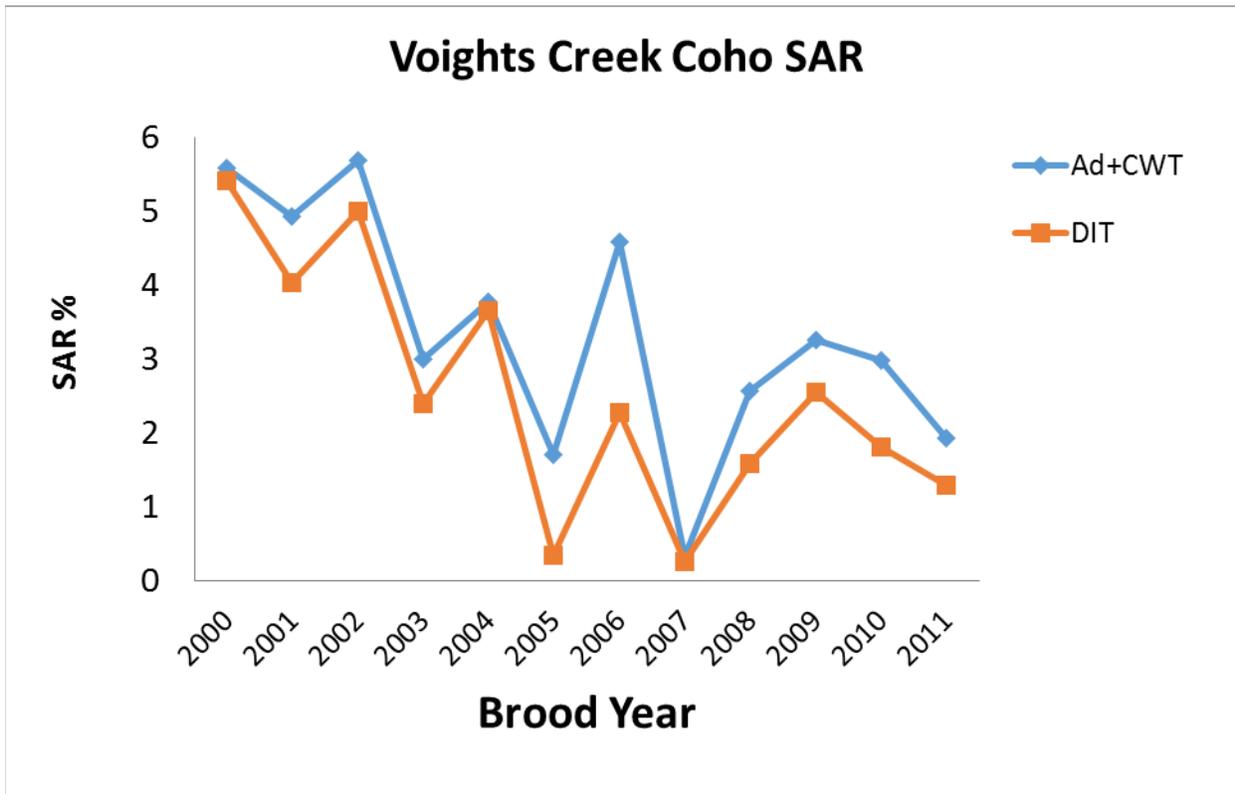


Figure 1. Smolt to adult survival (SAR) of Voights Creek Coho.

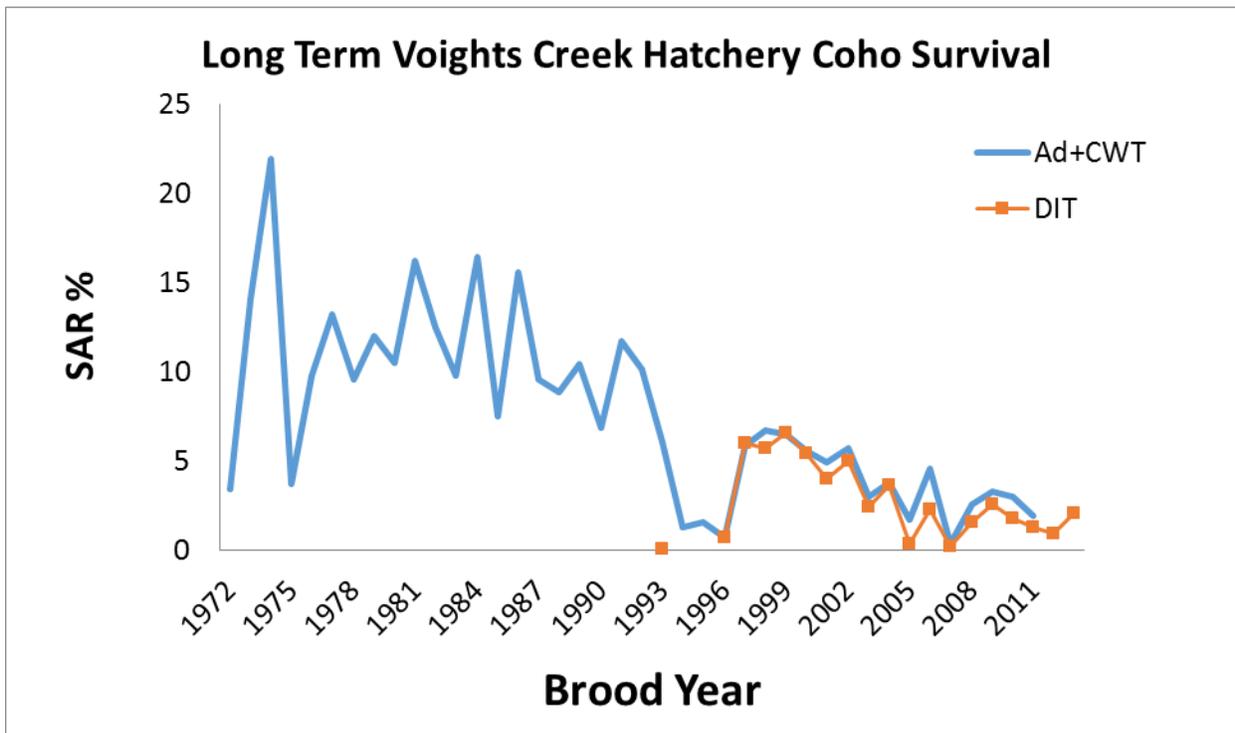


Figure 2. Long term survival of Voights Creek Coho

Table 2 Average Recreational Catch by Marine Area and WRIA for Voights Creek Coho

Catch Area	# Tags	% Sport Contribution
BC	622.05	16.9%
OR	61.05	1.7%
MA 1	65.76	1.8%
MA 2	131.56	3.6%
MA 3	29.61	0.8%
MA 4	285.85	7.8%
MA 5	839.92	22.9%
MA 6	141.51	3.9%
MA 7	0	0.0%
MA 8	12.66	0.3%
MA 9	255.82	7.0%
MA 10	457.61	12.5%
MA 11	316.62	8.6%
MA 12	0	0.0%
MA 13	0	0.0%
WRIA 10	452.84	12.3%
<i>Total</i>	<i>3,673</i>	<i>100%</i>

SOUTH SOUND NET PEN COHO

Table 1. South Sound Net Pen Coho Releases Ad + CWT.

Brood Year		Total			
CWT Released ^a		1,125,289			
CWT Recovered (Adults)		31,446			
SAR %		2.79%			
Sport Contribution		0.5%			
Adults^c					
Agency	Fishery	# tags	# fish	# fish per 100k	%
CDFO	All	820.7	973	73	2.61
NMFS	All	1.3	1	0	0.00
ODFW	All	248.4	294	22	0.79
WA	Fishery	# tags	# fish	# fish per 100k	%
WDFW	10- Ocean Troll	87.5	104	8	0.28
MAKA	15- Treaty Troll	101.3	120	9	0.32
WDFW	15- Treaty Troll	438.4	520	39	1.39
WDFW	22- Coastal Gillnet	1.7	2	0	0.01
MAKA	23- PS Net	4.6	6	0	0.01
SUQ	23- PS Net	1.9	2	0	0.01
WDFW	23- PS Net	23,404.2	27,742	2,080	74.43
WDFW	23- PS Net (Strays)	235.0	279	21	0.75
WDFW	41- Ocean Sport- Charter	436.1	517	39	1.39
WDFW	42- Ocean Sport- Private	1,218.0	1,444	108	3.87
WDFW	45- PS Sport	3,988.0	4,727	354	12.68
WDFW	46- Freshwater Sport ^b	4.4	5	0	0.01
NISQ	50- Hatchery Escapement	2.2	3	0	0.01
WDFW	50- Hatchery Escapement	401.2	476	36	1.28
WDFW	52- Fish Trap	48.2	57	4	0.15
WDFW	62- Test Fishery Seine	3.0	4	0	0.01
	<i>Total</i>	<i>31,446.2</i>	<i>37,275</i>	<i>2,794</i>	<i>100.00</i>
Jacks^d					
Agency	Fishery	# tags	# fish	# fish per 100k	%
WDFW	50- Hatchery Escapement	27.6	33	2	0.09
	<i>Total</i>	<i>27.6</i>	<i>33</i>	<i>2</i>	<i>0.09</i>

^a The South Sound Net Pen Coho Tag Group is a 50k Ad+CWT group

^b Freshwater Sport based on CWT harvest data

^c Adults are fish 3 years old or older

^d Jacks are fish 2 years old or younger

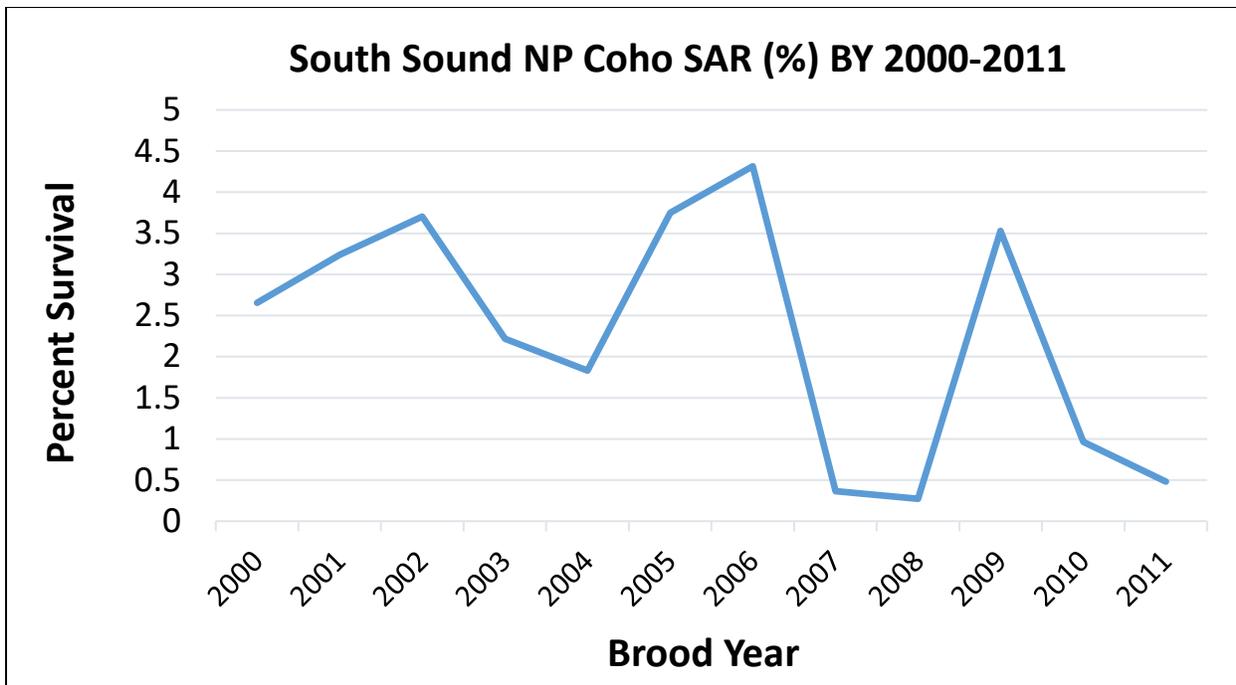


Figure 1. Smolt to adult survival (SAR) of South Sound NP Coho.

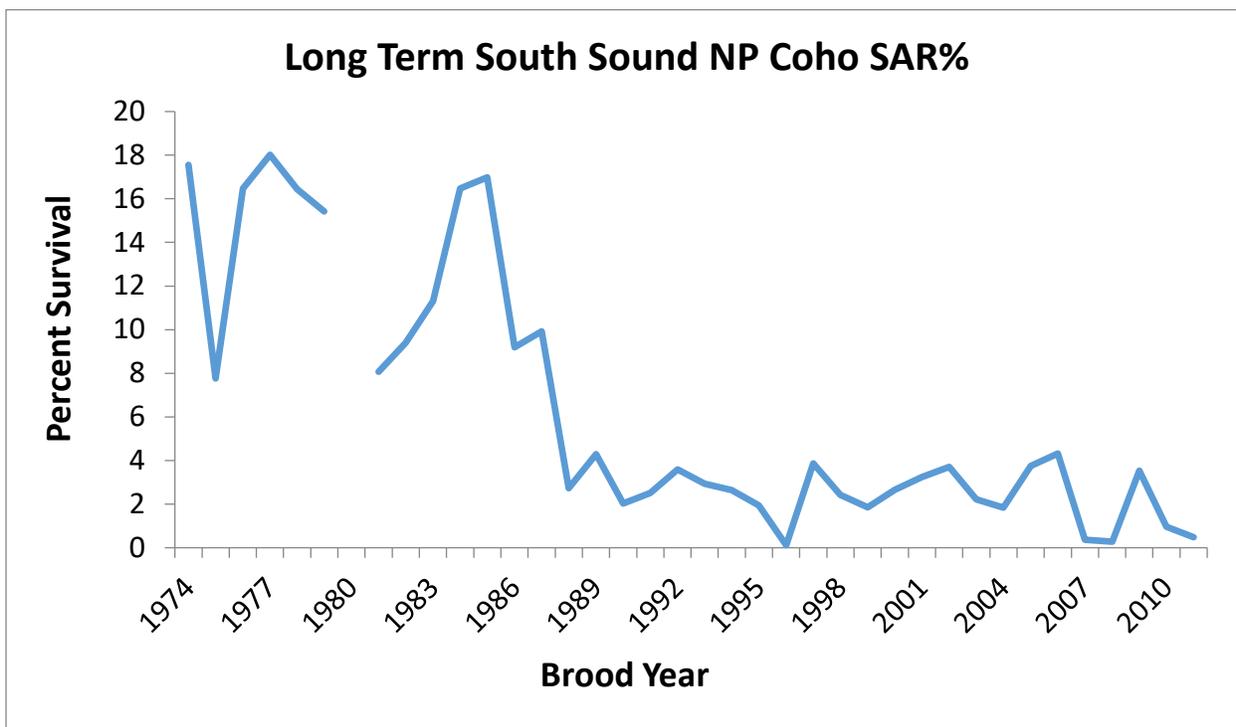


Figure 2. Long term smolt to adult survival (SAR) of South Sound NP Coho.

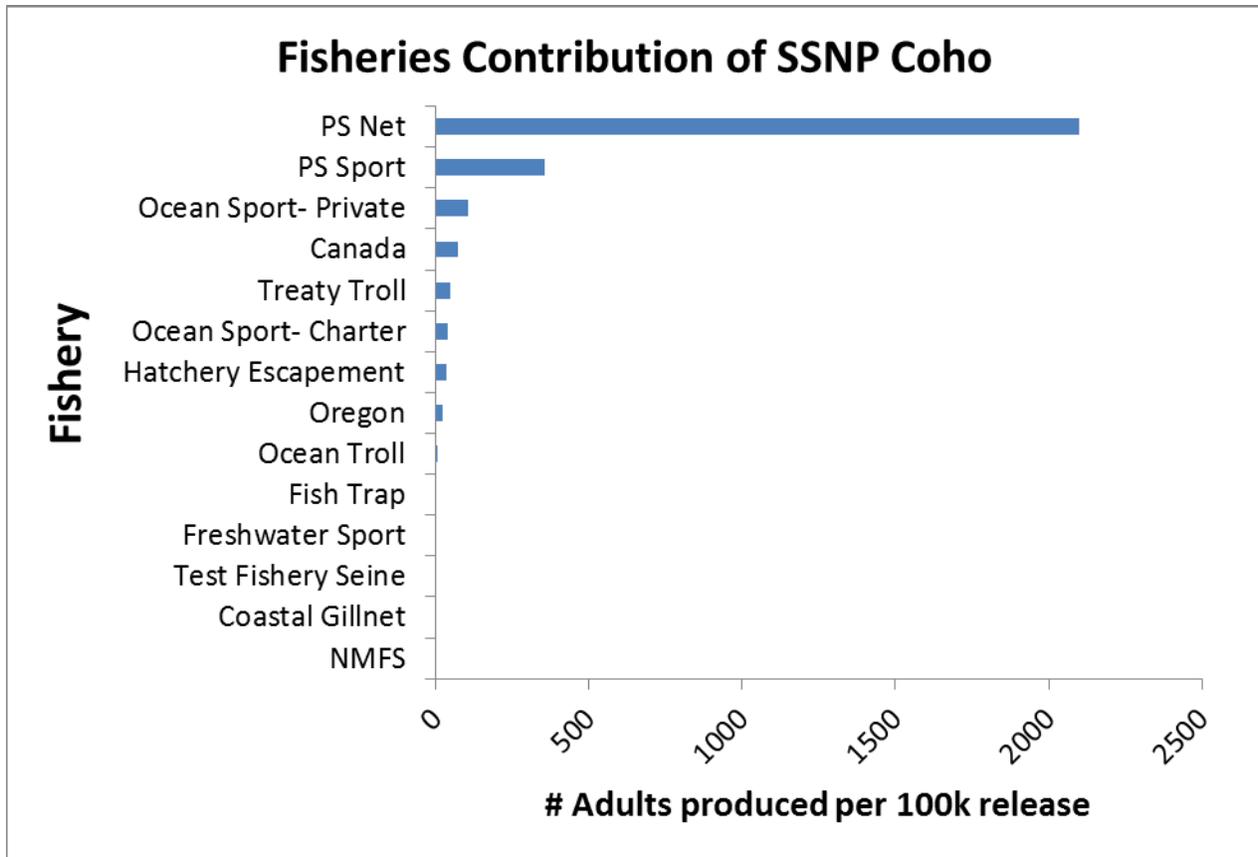


Figure 3. Fisheries contribution of South Sound NP Coho.

Table 2 Recreational Catch of SSNP Coho by Marine Area and WRIA for South Sound Net Pen Coho.

Catch Area	Fishery	# Tags	# Fish	% Sport Contribution
MA 05	45- PS Sport	4.36	62	0.46%
MA 10	45- PS Sport	9.75	139	1.03%
BC	40- Ocean Sport	39.46	561	4.18%
OR A2	40- Ocean Sport	25.51	363	2.70%
OR A3	40- Ocean Sport	13.67	195	1.45%
OR A4	40- Ocean Sport	18.32	261	1.94%
OR A5	40- Ocean Sport	3.94	56	0.42%
MA 01	41- Ocean Sport- Charter	27.42	390	2.91%
MA 02	41- Ocean Sport- Charter	54.62	777	5.79%
MA 03	41- Ocean Sport- Charter	8.28	118	0.88%
MA 04	41- Ocean Sport- Charter	13.61	194	1.44%
MA 01	42- Ocean Sport- Private	65.95	938	6.99%

MA 02	42- Ocean Sport- Private	25.58	364	2.71%
MA 03	42- Ocean Sport- Private	17.81	253	1.89%
MA 04	42- Ocean Sport- Private	83.14	1,183	8.81%
MA 05	45- PS Sport	235.07	3,345	24.92%
MA 06	45- PS Sport	14.28	203	1.51%
MA 08	45- PS Sport	35.47	505	3.76%
MA 09	45- PS Sport	49.35	702	5.23%
MA 10	45- PS Sport	69.97	996	7.42%
MA 11	45- PS Sport	75.6	1,076	8.01%
MA 13	45- PS Sport	52.2	743	5.53%
		943	13,423	100%

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**Prepared by the
Hatchery Scientific Review Group**

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