HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Bonneville Hatchery Coho Salmon Program**
Species or Hatchery Stock:	**Coho Stock 14 (Tanner Creek)**
Agency/Operator:	**Oregon Department of Fish & Wildlife**
Watershed and Region:	**Lower Columbia River Basin**
Date Submitted: **Updated Draft Submitted:**	**September 28, 2005** **May 6, 2016**
Date Last Updated:	**May 5, 2016**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of Program.

Bonneville Hatchery Coho Salmon program.

1.2) Population (or stock) and species.

Bonneville Hatchery Coho Salmon program utilizes the lower Columbia River Coho Salmon *Oncorhynchus kisutch*. Hatchery stock 14 is used in this program. Coho Salmon in the lower Columbia River are classified as a distinct Evolutionarily Significant Unit (ESU), and are listed as threatened under the federal Endangered Species Act (ESA). This hatchery Coho population (stock 14) is included as part of the Lower Columbia River Coho ESU (Federal Register Notice 2005). Lower Columbia Coho are also listed as endangered under the State of Oregon's Endangered Species List, Oregon Administrative Rule (OAR) 635-100-0080 through 635-100-0135.

1.3) Responsible organization and individual.

Lead Contact:

Name (and title):	Scott Patterson, Fish Propagation Program Manager
Organization:	Oregon Department of Fish and Wildlife
Address:	4034 Fairview Industrial Drive SE, Salem, OR 97302
Telephone:	(503) 947-6218
Fax:	(503) 947-6202
Email:	Scott.D.Patterson@state.or.us

On-site Lead Contacts:

Name (and title):	John North, Columbia River Fisheries Management Manager
Agency or Tribe:	Oregon Department of Fish and Wildlife
Address:	17330 SE Evelyn St, Clackamas, OR 97015
Telephone:	(971) 673-6029
Fax:	(971) 673-6070
Email:	John.A.North@state.or.us

Name (and title):	Greg Davis, Bonneville Hatchery Manager
Organization:	Oregon Department of Fish and Wildlife
Address:	70543 NE Herman Loop, Cascade Locks, OR 97014
Telephone:	541-374-8393
Fax:	541-374-8090
Email:	Greg.L.Davis@stae.or.us

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Other agencies, e.g., NOAA Fisheries, USACE, and BPA are involved through program funding.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources:
NOAA: Funds 55% of all Bonneville programs, and 100% of the Cascade and Oxbow programs, through the Mitchell Act.
USACE: Funds 45% of all Bonneville programs, owns land and hatchery facilities.
BPA: Funds some coded wire tagging.

Operational Information:
Bonneville Hatchery:

Full time equivalent staff:	16 FTE	
Annual operating cost:	$1,700,000	(~$412,500 for Coho Salmon program only)

Cascade Hatchery:

Full time equivalent staff:	5 FTE
Annual operating cost:	$900,000*

* Funding information provided is total annual operating cost, and is not specific to the Coho program.

1.5) Location(s) of hatchery and associated facilities.

1) Bonneville Hatchery is at RM 0.25 on Tanner Creek in the lower Columbia River watershed, Multnomah County, Oregon.
Coho Program Functions include:
Primary broodstock source
Broodstock collection
Adult holding
Spawning
Juvenile rearing
Smolts release site

2) Cascade Hatchery is at RM 0.5 on Eagle Creek in the lower Columbia River watershed, Multnomah County, Oregon.
Coho Program Functions include:
Incubation
Juvenile rearing

1.6) Type of program.

Isolated harvest and broodstock maintenance program (including broodstock for SAFE Coho Salmon program).

1.7) Purpose (Goal) of program.

The primary goal of Bonneville Hatchery Coho Salmon program is to mitigate the losses of Coho Salmon harvests in the sport and commercial fisheries due to habitat and passage loss/degradation along the Columbia River Basin. The program fish shall contribute to the Ocean and Columbia River commercial, recreational, and tribal fisheries. The program will be maintained by an on-site release of 300,000 to a maximum of 1,000,000 Coho Salmon smolts annually (depending on funding) into Tanner Creek for adult production for harvests and a hatchery return of at least 6,000 adults for broodstock purpose for this program as well as broodstock for the Selective Area Fisheries Evaluation (SAFE) Coho Salmon program (Figure 1). The average smolt to adult survival goal is 2.5%.

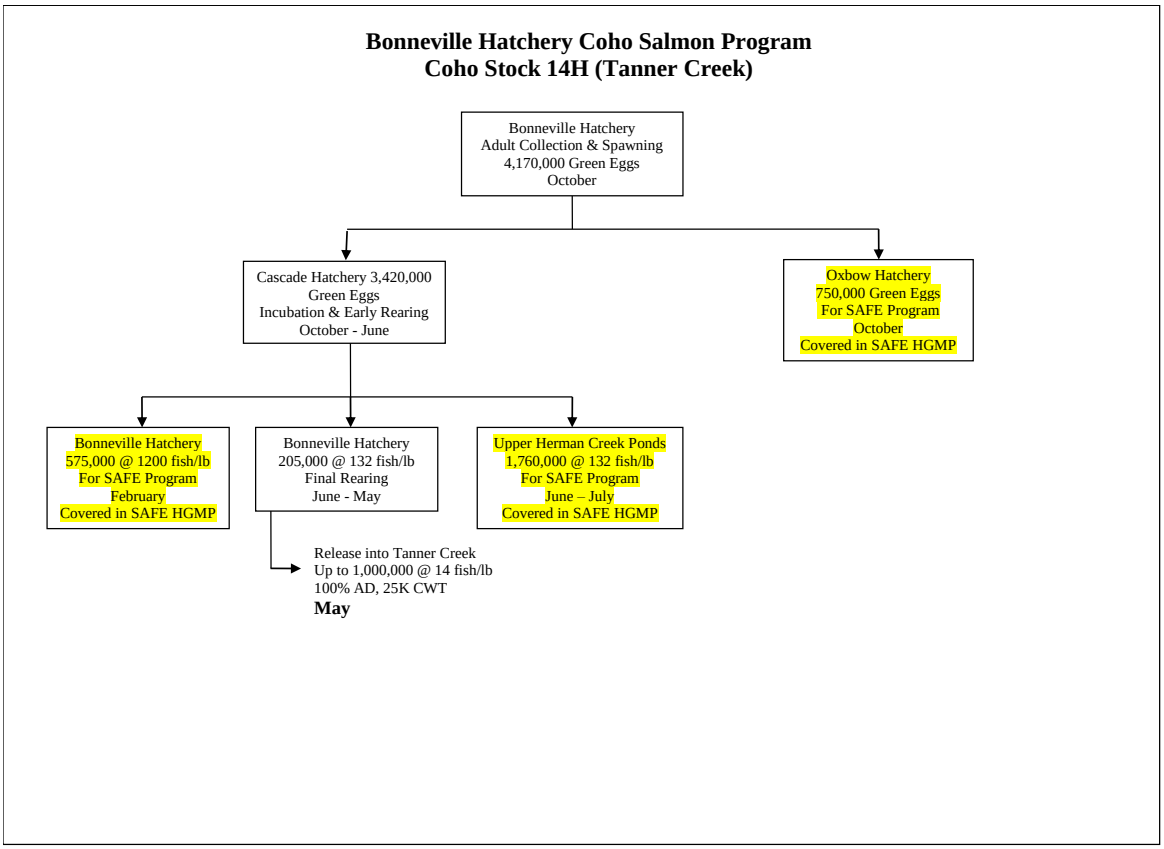


Figure 1. A flow chart of Bonneville Hatchery Coho Salmon program.

1.8) Justification for the program.

The Bonneville Hatchery Coho Salmon program mitigates for the loss of wild Coho harvest in sport, commercial, and tribal fisheries due to habitat and passage loss or degradation in the Columbia River Basin. This hatchery program will supplement Coho Salmon to meet harvest goals in the fisheries (as defined by location, time and gear) that are intended to benefit from the program. Fisheries which target lower Columbia River hatchery-produced Coho Salmon are managed in a way that harvest impacts to ESA listed natural salmon and steelhead do not exceed the limit authorized by the National

Marine Fisheries Service (NMFS). Indian and non-Indian fisheries targeting Columbia River hatchery Coho are managed by quotas, time, area, and gear types to assure that federal and state ESA harvest limits are not exceeded.

Fishing effort for Bonneville Hatchery Coho Salmon primarily occurs prior to the arrival of most late returning stock of wild Coho and wild Chum Salmon in the local fishing areas. Management of Coho harvest in ocean and freshwater fisheries is designed to maximize harvest of hatchery Coho and minimize impacts to wild listed Coho. The program fish are mass marked (100%) with adipose fin-clip for easy identification that will maximize harvests in target fisheries areas. Maximizing harvest of hatchery-fish both improves program performance (providing fish for harvest) and reduces the number of hatchery Coho that may escape to potentially spawn in lower Columbia River tributaries. Also, a proportion of released smolts are marked with ad-clip and CWT, to evaluate program performance, determine harvest contribution to different areas/fisheries, smolt to adult survival, stray rates etc.

Specific release strategies are implemented to minimize potential biological and ecological effects to wild juveniles including: size at release, timing of release, and release location. These strategies will to some extent separate temporally and spatially the hatchery and wild Coho populations and minimize the adverse interaction effects. Any wild Coho adults collected at the hatchery will be loaded in tank for release above the Bonneville Dam for upstream migration. Also, direct release of smolts from the hatchery will trigger most of the non-harvested adult fish to return to the hatchery, and that will minimize the straying of hatchery fish to natural spawning grounds.

1.9) Performance Standards.

See Section 1.10

1.10) List of program "Performance Indicators", designated by "benefits" and "risks".

1.10.1) "Performance Indicators" addressing benefits.

BENEFITS **Performance Standards**	**Performance Indicators**	**Monitoring & Evaluation**
Maintain Bonneville Hatchery Coho broodstock.	Number of males and females spawned. (Min. of 3,052 Females and 3,012 Males). Broodstock collection represents run. Meets fish health standards.	Annually record number of females, males and jack retained as broodstock and spawned. Track timing of run and fish retained for broodstock, and sex ratios. Record broodstock mortality, and results of fish health checks.

BENEFITS Performance Standards	Performance Indicators	Monitoring & Evaluation
Provide hatchery Coho to meet harvest mitigation goals.	Number of juvenile fish released for the program. Number of program fish adults harvested in target fisheries.	Pre-release sampling and data reporting. Fish buyer monitoring, and angler creel surveys of ocean and freshwater fisheries. Analysis of recoveries of CWT marked fish.
Provide for identification and selective harvest of hatchery fish.	All hatchery Coho smolts will be adipose fin-clipped prior to release.	Pre-release mark quality checks used to monitor mark quality and maintain a minimum of 95% mark rate on released fish.
Release groups are sufficiently marked and tagged to track survival and distribution.	Each production release includes at one or more representative groups of at least 25,000 Ad+CWT fish.	Pre-release mark quality checks. Release reporting in ODFW and PSMFC databases.
Adaptive management to improve program performance.	Projects are identified, reviewed, and implemented to increase survival of program fish and contribution to fisheries.	Monitoring of program in early rearing stages to improve survival, such as rearing, feeding, diseases, and releases.
Program hatcheries will be operated in compliance with established fish health guidelines.	Number of broodstock sampled and pathogens observed. Rearing survival rates, egg to fry, and fry to smolt. Number of juveniles sampled and pathogens observed during rearing and immediately prior to release.	Juvenile fish health is monitored on at least a monthly basis.
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	Stream enrichment program use of hatchery carcasses complies with existing management guidelines.	The existing MOA calls for documenting project activities, and establishes monitoring and evaluation of the program.

1.10.2) "Performance Indicators" addressing risks.

RISKS Performance Standards	Performance Indicators	Monitoring & Evaluation
Fisheries conducted to harvest hatchery produced Coho are consistent with conservation requirements.	Fishery impacts to ESA listed salmon and steelhead do not exceed federal and state ESA limits.	In-season monitoring of catch by species is conducted in the ocean, and catch and stock composition in the Columbia River. Post-season analysis of fisheries estimate impacts to listed fish based on sampling of the landed catch (sport and commercial) for species, hatchery marks, and CWTs.
Juvenile hatchery releases minimize interactions with wild fish species.	Release timing, location, condition of juveniles, and emigration patterns.	Observe effects of rearing and release strategies on outmigration, adult production, and hatchery returns.

RISKS Performance Standards	Performance Indicators	Monitoring & Evaluation
Minimize disease risk to wild fish.	Program complies with the ODFW Fish Health Management Policy for fish health inspection, transfer, and disease preventions.	Juvenile fish health is monitored on at least a monthly basis at the hatchery.
Straying of hatchery fish to lower Columbia watersheds.	Recovery of program fish in watersheds other than Tanner Creek.	CWT recoveries throughout the Columbia Basin are recorded and summarized annually in order to estimate the number of straying of program fish.
Natural spawning of program fish is accounted for to enable enumeration of wild Coho spawning.	Ability to estimate the number of hatchery and wild Coho naturally spawning in lower Columbia River tributaries.	Estimates of hatchery Coho spawning naturally through spawning ground survey. Program fish are mass marked with adipose fin-clip and a portion are CWT tagged to verify origin.
Hatchery operations comply with the federal Clean Water Act.	Facilities are being operated under the NPDES permits' terms and conditions issued by the Oregon Department of Environmental Quality (DEQ).	Required effluent water quality data are monitored per NPDES permit requirements, and data are reported quarterly to DEQ.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The proposed annual broodstock collection goal is 3,000 females, 3,000 males, and 10 jacks, including broodstock needs for the SAFE Coho Salmon program. This proposed broodstock collection numbers are higher than the past collections because of the recent increased broodstock requirement for the SAFE program. The actual number of males and females spawned in the past are presented in Table 7.4.2 (Section 7.4.2).

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

The Bonneville Hatchery Coho Salmon program will release up to a maximum of 1,000,000 yearling smolts annually into Tanner Creek depending on funding availability.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The purpose of this hatchery program is to provide Coho Salmon for harvest in the Ocean and lower Columbia River sport and commercial fisheries. The program performance is measured by smolt-to-adult survival rates, harvest contribution, and adult returns to the hatchery. The total hatchery returns of this stock are provided in Table 1.12a. The average survival for brood years 2001-2011 has been 2.62%. Smolt-to-adult survival rates are provided in Table 1.12b and Table 10.4.1. See Section 3.3 for harvest

information.

Table 1.12a. Total returns of adult Coho Salmon to Bonneville Hatchery, 1992-2015.

Return Year	Hatchery Returns (# of fish)
1992	13,085
1993	8,764
1994	27,410
1995	4,850
1996	14,883
1997	14,960
1998	6,061
1999	4,512
2000	18,116
2001	45,294
2002	27,539
2003	36,122
2004	24,148
2005	26,737
2006	42,002
2007	34,366
2008	51,196
2009	56,649
2010	24,484
2011	18,674
2012	13,284
2013	10,032
2014	21,963
2015	6,698

Source: ODFW HMS database.

Table 1.12b. Smolt to adult survival rates and total adult production of Bonneville Hatchery Coho released at Tanner Creek, brood years 1990-2013.

Brood Year	No. Released	Average Survival (%)	Adult Production
1990	2,176,665	1.24	26,991
1991	1,111,764	2.36	26,238
1992	1,037,468	0.63	6,536
1993	1,279,197	0.91	11,641
1994	1,034,597	1.17	12,076
1995	1,115,249	0.71	7,918
1996	991,036	0.82	8,126
1997	1,316,431	1.75	23,038
1998	1,176,082	5.33	62,685
1999	1,249,655	2.79	34,865
2000	1,198,209	5.76	69,017
2001	1,243,499	2.96	36,789
2002	1,150,283	1.48	16,998
2003	1,189,382	3.72	44,284
2004	1,183,948	4.08	48,262
2005	1,252,793	2.36	29,537
2006	1,212,294	4.03	48,915
2007	1,227,480	2.02	24,791
2008	739,115	2.79	20,618
2009	722,034	2.11	15,249
2010	687,325	1.26	8,647
2011	358,175	18.06	64,731
2012	521,326	1.67	7,060
2013	353,525	-	-

Source: Regional Mark Information System (RMIS) database.

1.13) First year of operation for this program.

Program began in 1938.

1.14) Expected duration of program.

The program is on-going with no planned termination.

1.15) Watersheds targeted by program.

Releases are made into Tanner Creek, an Oregon tributary of the Columbia River located less than one mile downstream of Bonneville Dam. Post-release rearing, migration, and harvest occurs in the Pacific Ocean, lower Columbia River estuary, main-stem Columbia River, and tributaries.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1) Brief Overview of Key Issues.

Issue 1. Impacts of the Bonneville Hatchery Coho Salmon program on wild Coho.

Bonneville Hatchery Coho can potentially impact wild Coho populations by straying into tributaries and spawning with wild fish. Progeny of natural spawning hatchery fish may also compete with wild juvenile Coho for space and food while rearing in streams. In addition, fisheries targeting hatchery Coho may impact wild Coho through catch and release mortalities.

1.16.2) Potential Alternatives to the Current Program.

Issue 1. Impacts of the Bonneville Hatchery Coho Salmon program on wild Coho.

Alternative 1: Maintain current Bonneville Coho Salmon program. The current program provides harvest opportunities of Columbia River Coho Salmon that are not presently sustainable through natural production. Fishery impacts to wild Coho are minimized through selective harvests of hatchery fish due to mass marking with ad-clip, and by implementing fishery timing and regulations. Mandatory use of barbless hooks in the Ocean and Columbia River sport fisheries helps to minimize release mortality of wild fish when captured. A component of released fish are coded-wire tag marked to enable identification and proportionate contribution to fisheries, hatchery returns and on the spawning grounds. Coded-wire tag recovery data help determine the harvest contribution rates to specific fisheries, and aid program evaluation. Straying of hatchery fish into streams utilized by spawning wild Coho Salmon is monitored through spawning surveys and adult traps. Visual inspection for hatchery marks, scale sampling and analyses, and recovery and evaluation of coded wire tags and data provide the information needed to differentiate hatchery fish from wild fish. Because of these monitoring capabilities, the program can be adjusted as necessary to ensure that impacts to wild Coho are minimized.

Alternative 2: Replace the Bonneville Coho Salmon program with efforts to restore wild Coho populations. Since there are many reasons for the decline of wild Coho Salmon populations in the Columbia River Basin (e.g. hydropower development, habitat degradation, past overfishing, etc.), efforts to restore wild populations would be complex, expensive, and likely take a long time to achieve desired results. Although these efforts are important, program goals to mitigate for lost fish production would not be realized in

the near future.

Issue 2. Current lower Columbia River program is 100% mass marking of hatchery Coho Salmon.

Alternative 1: Maintain current mass marking program at Bonneville Hatchery. The current mass marking program clips the adipose fins on 100% of the Coho released from Bonneville Hatchery. The purpose of mass marking is to enable and maximize harvest of Coho Salmon in mark-selective fisheries and to facilitate identification of hatchery fish on spawning grounds. When wild and hatchery Coho Salmon are caught in mark-selective fisheries, they can be differentiated by the mass mark; hatchery fish can then be retained while wild fish are returned to the river and released. Mass marking also allows hatchery Coho to be identified upon their return to escapement areas, which provides fishery managers the ability to determine if significant interaction between hatchery and wild Coho is occurring on spawning grounds. Finally, mass marking provides for the identification of wild fish harvested in Columbia River commercial fisheries, thereby allowing fishery managers to evaluate fishery strategies intended to minimize handling of wild Coho. Continuation of the current mass marking program will allow Bonneville Hatchery to continue to accomplish its goal of providing fish for harvest while limiting impacts to listed stocks.

Alternative 2: Reduce marking rate for Coho Salmon smolts released from Bonneville Hatchery. Reduction of mark rates of Coho smolts released at Bonneville Hatchery would reduce the production cost while the program faces funding difficulties. But this action will ultimately reduce the harvest rate of hatchery produced fish due to lack of marking, and would increase the number of un-harvested hatchery fish straying to natural spawning grounds. Additionally, reducing the current marking strategy would reduce fishery manager's ability to detect hatchery fish in natural spawning areas and commercial fishery landings. Reducing mark rates is effective in areas where supplementation programs are being developed to help rebuild depressed wild stocks; however, Coho smolts releases from Bonneville Hatchery are not used for supplementation purposes. Reducing the mark rate of Bonneville Coho smolts may reduce costs for the program, but the loss of harvest efficiency and monitoring capabilities would offset these savings and complicate fisheries management and wild Coho Salmon monitoring.

1.16.3) Potential reforms and Investments.

Reform/Investment 1: Maintain current mass marking program for Coho Salmon smolts released from Bonneville Hatchery. Cost of the mass marking program for Coho smolts at Bonneville Hatchery is approximately $31,000-$37,000 per year.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-listed salmonid species and non-salmonid species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

The HGMP for Bonneville Hatchery Coho Salmon program was submitted to NMFS of 9/28/2005 for ESA authorization/coverage. This is an updated version of the previously submitted HGMP.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid populations (s) affected by the program.</u>

All Columbia River anadromous salmonids that successfully return to spawn must migrate through the lower Columbia River and estuary twice during their life cycle. Thus, the Bonneville Hatchery Coho Salmon program has the potential to affect the 13 listed Evolutionary Significant Units (ESUs) of the Columbia River Basin. However, it is more probable that the program could affect those ESA-listed natural salmonid populations that occur nearest the sub-basin where the program fish are collected and released, including:

The Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*) ESU was federally listed as threatened under the Endangered Species Act, effective May 24, 1999.

The Columbia River Chum Salmon (*Oncorhynchus keta*) ESU was federally listed as threatened, effective May 24, 1999.

The Lower Columbia River steelhead (*Oncorhynchus mykiss*) ESU was federally listed as threatened under the ESA.

The Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*) ESU was federally listed as threatened, effective June 26, 2005 and updated April 14, 2014.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

The Bonneville Hatchery Coho are also part of the LCR Coho Salmon ESU and thus are listed under the ESA. The Bonneville Coho Salmon program primarily uses hatchery-origin adults that return to Bonneville Hatchery in its broodstock program. No natural origin fish are taken into broodstock. In times of shortfalls, additional broodstock have been transferred from other Coho salmon hatcheries in the lower Columbia, including the Big Creek and Sandy hatcheries. Hatchery and natural origin Coho Salmon at the Bonneville Hatchery trap can be identified based upon adipose fin clip marks; only

adipose fin-clipped Coho are collected for broodstock. Therefore, the natural listed Coho Salmon of the Lower Columbia River Coho ESU, is not likely to be directly affected by the Bonneville Hatchery Coho Salmon program.

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River Coho Salmon are present in numerous Oregon tributaries to the lower Columbia. Evidence suggests that most Coho observed in these sub-basins are hatchery fish, but wild Coho Salmon are present in many of them to varying degrees (Brown et al. 2003). Lower Columbia River hatchery Coho Salmon are categorized as either Type S or Type N, based on their general ocean distribution either south or north of the Columbia River. Managers also refer to Type S as early stock Coho and Type N as late stock. Early stock of Coho Salmon in the lower Columbia generally enter the Columbia River beginning in August, with peak spawn timing generally in late October. And, late stock Coho Salmon in the lower Columbia generally enter the Columbia River beginning in September, with peak spawn timing generally in late November and December. Depending on spawn timing and water temperature, Coho fry from naturally spawning parents begin emerging in the spring and rear for a year in freshwater; emigration begins the following spring.

The fall component of the Lower Columbia River Chinook ESU is comprised of two groups: 'tules' and 'brights'. Native fall Chinook Salmon in Oregon tributaries of the lower Columbia River are almost all tule fall Chinook, with the exception of bright fall Chinook in the Sandy River. The Sandy River bright fall Chinook Salmon are one of two naturally produced bright fall Chinook populations in the lower Columbia. The other is produced in the North Fork of the Lewis River in Washington. Tule fall Chinook Salmon arrive at the mouth of the Columbia River beginning in August, with peak migration generally in September; bright fall Chinook return timing is typically later than that for tules. Tule fall Chinook are sexually mature upon river entry and spawn soon after arrival to the spawning grounds, while bright fall Chinook are sexually immature and may hold in freshwater for months prior to spawning. Populations in the lower Columbia have short migrations, which are more characteristic of coastal populations than upper Columbia populations. Depending on spawn timing and water temperature, tule fall Chinook juveniles in the lower Columbia River generally emerge beginning in March-April and follow an ocean-type life history, emigrating in late spring/early summer as sub-yearlings. Meanwhile, bright fall Chinook juveniles in the lower Columbia River generally emerge from March-June and emigrate in early/late summer. Ocean distribution of lower Columbia fall Chinook extends from the southern coast of Oregon to Southeast Alaska, with bright fall Chinook salmon more northerly distributed (TFC 1999).

Chum salmon in the lower Columbia arrive at the mouth of the Columbia River beginning in mid-late October, with peak migration generally in November. Chum salmon are sexually mature upon river entry and spawn soon after arrival to the spawning grounds. Depending on spawn timing and water temperature, chum fry begin emerging

in early spring (March) and emigrate shortly after emergence; peak emigration is usually late April. Current chum salmon ocean distribution is not well documented but is expected to extend along the coast from Washington to Alaska. The closest chum populations to the Bonneville Hatchery occur in the main-stem Columbia River and tributaries on the Washington side of the Columbia River immediately downstream of Bonneville Hatchery. Natural spawning chum also occur in the main-stem Columbia on the Oregon side of the river near Multnomah Falls.

Steelhead are rainbow trout that migrate to and from the ocean. Lower Columbia River steelhead include summer and winter runs. Summer steelhead return from the ocean between May and November and generally spawn between January and June. Winter steelhead return to freshwater between November and April and generally spawn sometime during the months of March to June. Some adult steelhead return to the ocean after spawning and may survive a second freshwater migration to spawn twice during the life cycle. Juvenile steelhead typically rear one to three years in freshwater before emigrating to the ocean during spring. Within this ESU there are few resident forms (i.e. rainbow trout); however, it is known that resident fish can produce steelhead and steelhead can produce rainbow. The extent to which this takes place and the mechanisms that govern this are probably the result of some combination of genetic and ecological factors that are not well understood at this time.

Listed populations that may be incidentally affected by the Bonneville Coho Salmon program include species utilizing habitat in Columbia River tributaries near Bonneville Dam (both upstream and downstream), as well as the Columbia River and estuary downstream of Bonneville Dam. All NMFS ESA-listed salmonids use the lower Columbia River as a migratory route, although effects of the Bonneville Coho Salmon program are expected to be minimal. Potential for impacts associated with the Bonneville Coho Salmon program are more likely to occur in populations of threatened Chinook, Coho, steelhead, and Chum Salmon that spawn in the vicinity of Bonneville Dam.

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (see definitions in "Attachment 1").

The Willamette/Lower Columbia Technical Review Team (WLC-TRT) have not calculated critical and viable population thresholds for the Oregon lower Columbia fall Chinook, Chum, or Coho populations in the vicinity of the Bonneville Hatchery Coho Salmon program. However, the TRT has established "default value" minimum population viability criteria of 1,400 for Chinook and 1,100 for chum for use as a general value for lower Columbia fall chinook and chum populations. A default minimum viable population criteria has not been identified by the TRT for Coho, although the Lower Columbia Recovery Board (LCFRB) has assumed a value of 600 for Washington lower Columbia Coho populations, which is the same criteria identified by the TRT for lower Columbia steelhead.

The WLC-TRT has performed a preliminary assessment of the current viability status of salmon and steelhead populations in the lower Columbia and Willamette ESUs. This assessment estimates the extinction risk by evaluating four population attributes: 1) abundance and productivity; 2) diversity; 3) spatial structure; and 4) habitat. The populations were ranked from 0-4, with category 0 representing a 0-40% chance of persistence in the next 100 years and category 4 representing a 99% chance of persistence in the next 100 years. A population was considered viable with a category 3, or higher, score. The status assessment includes fall Chinook, Coho, steelhead, and Chum populations occurring in the vicinity of Bonneville Hatchery. The persistence probability scores from this preliminary WLC-TRT evaluation process are reflected as a range (Figure 2). The scores for fall chinook are generally low ranging from 1-2, for Chum very low at less than 1, and for Coho low from 1 to 2.

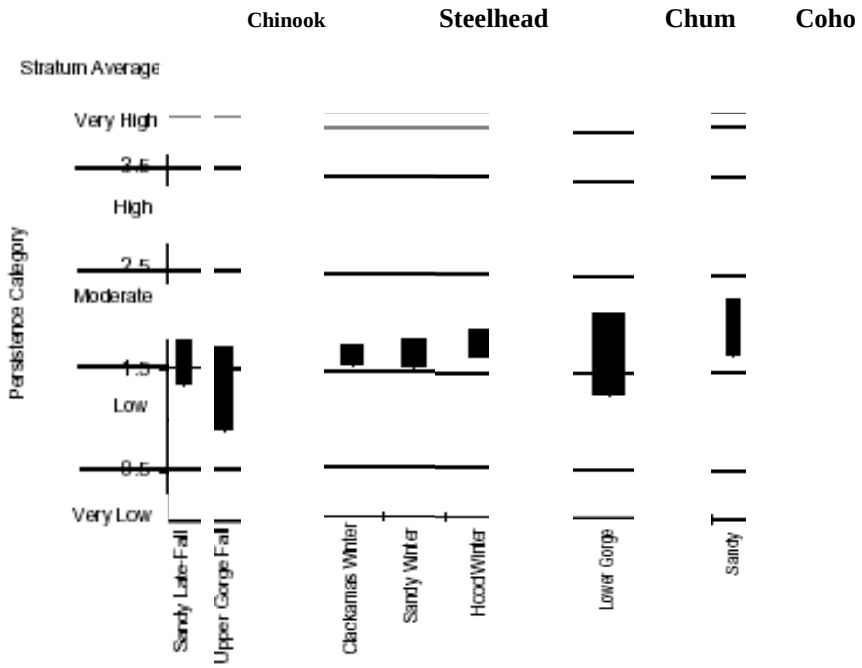


Figure 2. Current viability status of fall Chinook, steelhead, Chum and Coho Salmon populations in the Sandy River, the upper and lower Columbia River Gorge, the Hood River, and the Clackamas River. Figure adapted from McElhany et al. 2004.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

These data are not available.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. (Include estimates of juvenile habitat seeding relative to capacity or natural fish

densities, if available).

Spawning ground surveys for Coho Salmon are conducted in the vicinity of Bonneville Hatchery in November and December. Table 2.2.2a lists the estimated Coho Salmon abundance for the Gorge Stratum and the Sandy River for run years 2002-2014. The Lower Gorge population includes tributaries from Eagle Creek upstream of Bonneville Dam to Young Creek, 17 miles downstream of Bonneville Dam. Estimates of Wild Coho in the Lower Gorge section ranged from 920 in 2010 to a low of 96 in 2012. The Hood River population is included in the LCR Coho ESU (Sounhein et al, 2015). The maximum and minimum abundance estimates for naturally produced Coho in the Hood River were 1,235 and 0 for run years 2005 and 2009 respectively.

Sandy River wild Coho Salmon estimated abundance has ranged from a low of 325 fish in 2002 to a high of 5,403 in 2014. Between 1999 and 2006, only non-clipped, presumably wild fish were passed above Marmot Dam. The removal of Marmot Dam in 2007 opened access for migrating Coho to about 100 miles of the Sandy River that had been restricted since the construction of Marmot Dam in 1913.

Table 2.2.2a. Recent abundance estimates for hatchery and wild coho in the Lower Columbia Coho ESU in the vicinity of Bonneville Dam, 2002-2014. Hatchery numbers do not include returns to hatcheries.

Run Year	Lower Gorge		Hood River		Sandy River[a]	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild[b]
2002	67	338	223	120	515	325
2003	n.a.	n.a.	n.a.	n.a.	0	1,173
2004	n.a.	n.a.	n.a.	n.a.	127	1,029
2005	1,512	263	1,043	1,235	0	717
2006	538	226	342	341	n.a.	822
2007	261	126	138	120	66	687
2008	191	223	28	19	0	1,277
2009	192	468	0	0	174	1,493
2010	65	920	1,298	223	128	667
2011	255	216	511	232	319	3,300
2012	124	96	590	169	33	1,129
2013	9	152	710	889	89	507
2014	377	362	132	42	169	5,403

[a] Marmot Dam was removed in 2007. Coho in Cedar Creek adjacent to Sandy Hatchery are not included in the hatchery number.
[b] 2002-2006 include unmarked Coho Salmon passed above Marmot Dam and spawning ground survey estimate.
n.a. = not available or not sampled
Source http://odfw.forestry.oregonstate.edu/spawn/pdf%20files/coho/AnnualEstLC2002-2014.pdf

- Provide the most recent 12 year (e.g. 2002-2014) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The proportion of hatchery-origin fish on natural spawning grounds in the Lower Gorge and Hood River strata for run years 2002-2014 has averaged 44% and 53% respectively (Table 2.2.2b). The majority of Bonneville Hatchery Coho coded-wire tag recoveries have been recovered from tributaries downstream of Bonneville Dam in close proximity to Bonneville Hatchery.

Table 2.2.2b. Coho abundance estimates and proportions of direct hatchery-origin and listed natural-origin fish for spawning ground survey sections in the Gorge Stratum, run years 2002-2014.

	Lower Gorge			Hood River		
Run Year	Wild	Hatchery	pHOS	Wild	Hatchery	pHOS
2002	338	67	17%	147	223	60%
2003	n.a.	n.a.	n.a.	41	n.a.	n.a.
2004	n.a.	n.a.	n.a.	126	n.a.	n.a.
2005	263	1512	85%	1262	1043	45%
2006	226	538	70%	373	342	48%
2007	126	261	67%	170	138	45%
2008	223	191	46%	69	28	29%
2009	468	192	29%	65	0	0%
2010	920	65	7%	223	1298	85%
2011	216	255	54%	232	511	69%
2012	96	124	56%	169	590	78%
2013	152	9	6%	889	710	44%
2014	362	377	51%	42	132	76%
avg	*308*	*326*	*44%*	*293*	*456*	*53%*

Source: http://odfw.forestry.oregonstate.edu/spawn/pdf%20files/coho/AnnualEstLC2002-2014.pdf

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u> *(see "Attachment 1" for definition of "take").*

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Direct take of lower Columbia River Chinook, Columbia River Chum, lower Columbia

River steelhead, or Columbia River Coho is unlikely through activities associated with adult broodstock collection for the Bonneville Coho Salmon program. Any incidental take is expected to be minimized as a result of the broodstock collection methods described in Sections 6 and 7. The numbers of natural fish captured and released unharmed during brood collection at Bonneville Hatchery for return years 2011-2015 are in Table 2.2.3a**.** Annual estimated take levels for each population are included in Table 2.2.3b. Broodstock are collected through volitional return of adults to the fish trap at the Bonneville Hatchery, which is located on Tanner Creek. Because the run timing of Bonneville hatchery Coho overlaps that of wild lower Columbia Coho, some wild Coho may enter the hatchery trap and be handled during sorting procedures. However, only adipose fin-clipped Coho are retained for broodstock and all unmarked Coho are transported and released into the Columbia River above Bonneville Dam. Therefore, impacts to wild Coho from broodstock collection activities are minimal. Additionally, any hatchery adult Coho collected in excess of annual broodstock needs are used for one of the following purposes: sold to a fish buyer, donated to a food bank, processed into fish feed or fertilizer, or buried. No excess hatchery adults are returned to Tanner Creek and allowed to spawn naturally.

Incidental take of juvenile lower Columbia River chinook, Columbia River chum, lower Columbia River steelhead, or Columbia River Coho is not expected to occur through activities associated with rearing, acclimation, and release at the Bonneville Hatchery. There may be competition between hatchery released Coho Salmon and naturally-produced salmonids in the Columbia River downstream of Bonneville Dam, but these effects have not been quantified. Disease, predation, and habitat carrying capacity issues are additional sources of potential impacts to listed juvenile salmon and steelhead in the main-stem Columbia River and Pacific Ocean.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

Table 2.2.3a. Listed natural fish captured and released unharmed during brood collection of Coho, Tule, and upriver bright fall Chinook Salmon at Bonneville Hatchery, 2011-2015.

Species	2011	2012	2013	2014	2015
Coho Salmon	1,384	619	1,280	710	289
Chum Salmon	0	0	4	12	46
Tule Chinook	0	704	967	935	1,507
URB Chinook	0	0	1,128	701	624
Pink Salmon	0	0	2	0	4
Sockeye Salmon	0	0	1	0	3
Steelhead	12	49	90	108	92

Source: ODFW's Hatchery Management System (HMS) database and Bonneville Hatchery records.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Projected annual take estimates expected to be similar to data presented in Table 2.2.3. No lethal take of listed natural fish is expected.

Table 2.2.3b. Estimated annual take of lower Columbia River listed salmonid ESUs during broodstock collection for Bonneville Hatchery Coho Salmon program (including broodstock collection for SAFE Coho Salmon program).

Action	Lower Columbia Chinook (Tule)		Upper Columbia Chinook (URB)		Columbia Chum		Lower Columbia Coho		Summer Steelhead		Pink Salmon		Sockeye	
	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take	Life stage[b]	Estimated Annual Take
Observe or harass	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Collect for transport	A	1200	A	600	A	20	A	300	A	100	A	2	A	1
Capture, handle, and release	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Capture, handle, tag mark / tissue sample, and release	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Capture and remove (e.g., broodstock)	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Intentional lethal take	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Unintentional lethal take	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0
Other take (specify)	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0	A, J	0

b A = Adult, J = Juvenile.

-Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

All of the Bonneville Hatchery Coho Salmon smolts released on-station are marked with an adipose fin clip, thus allowing for easy distinction between wild and hatchery fish. Only marked Coho are retained for broodstock. Any unmarked Coho Salmon entering the trap are loaded into a tanker truck and transported above Bonneville Dam and released. It is important to note that many of the unmarked Coho handled at the Bonneville Hatchery trap are probably unmarked hatchery fish originating from areas upstream of Bonneville Dam. However, in the future, if significantly higher numbers of listed natural fish (Chinook, Chum, Coho, steelhead, Pink Salmon and Sockeye Salmon) enter the hatchery-adult-returning ponds the listed fish may be returned to the mouth of Tanner Creek to give them opportunity to continue their upstream migration in the Columbia River. Other alternative passage and handling methods may have to be developed based on the numbers of listed natural fish returning to hatchery ponds.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan. Explain any proposed deviations from the plan or policies.

The Bonneville Coho Salmon program operates in accordance with the ODFW Fish Hatchery Management Policy (ODFW 2003), ODFW Fish Health Management Policy, Northwest Power and Conservation Council Annual Production Review Report (NPPC document 99-15), the Lower Columbia Salmon and Steelhead Recovery and Sub-basin Plan (LCFRB 2004), the Lower Columbia River and Estuary Bi-State Sub-basin Plan (LCREP 2004), and the US v. Oregon Fall Management Agreement (2004). The Fish Hatchery Management Policy (FHMP) requires that Hatchery Program Management Plans (HPMP) be developed for each hatchery program. HGMP may serve as HPMPs if consistent with guidance provided in the FHMP.

The Oregon Fish and Wildlife Commission (OFWC) adopted the Native Fish Conservation Policy (NFCP) in 2002. Conservation plans will provide guidance for hatchery programs for species within the associated SMU.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Mitchell Act
Oregon Division of State Lands submerged land lease(s)
ACOE – John Day Mitigation Plan
US v. Oregon (Interim Management Agreement)- supply Coho Salmon eggs to upriver

tribal programs, whenever needed.
Biological Opinion
Oregon Department of Fish and Wildlife's Endangered Species Management Plan for Lower Columbia Coho Salmon

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (2000-2012), if available.

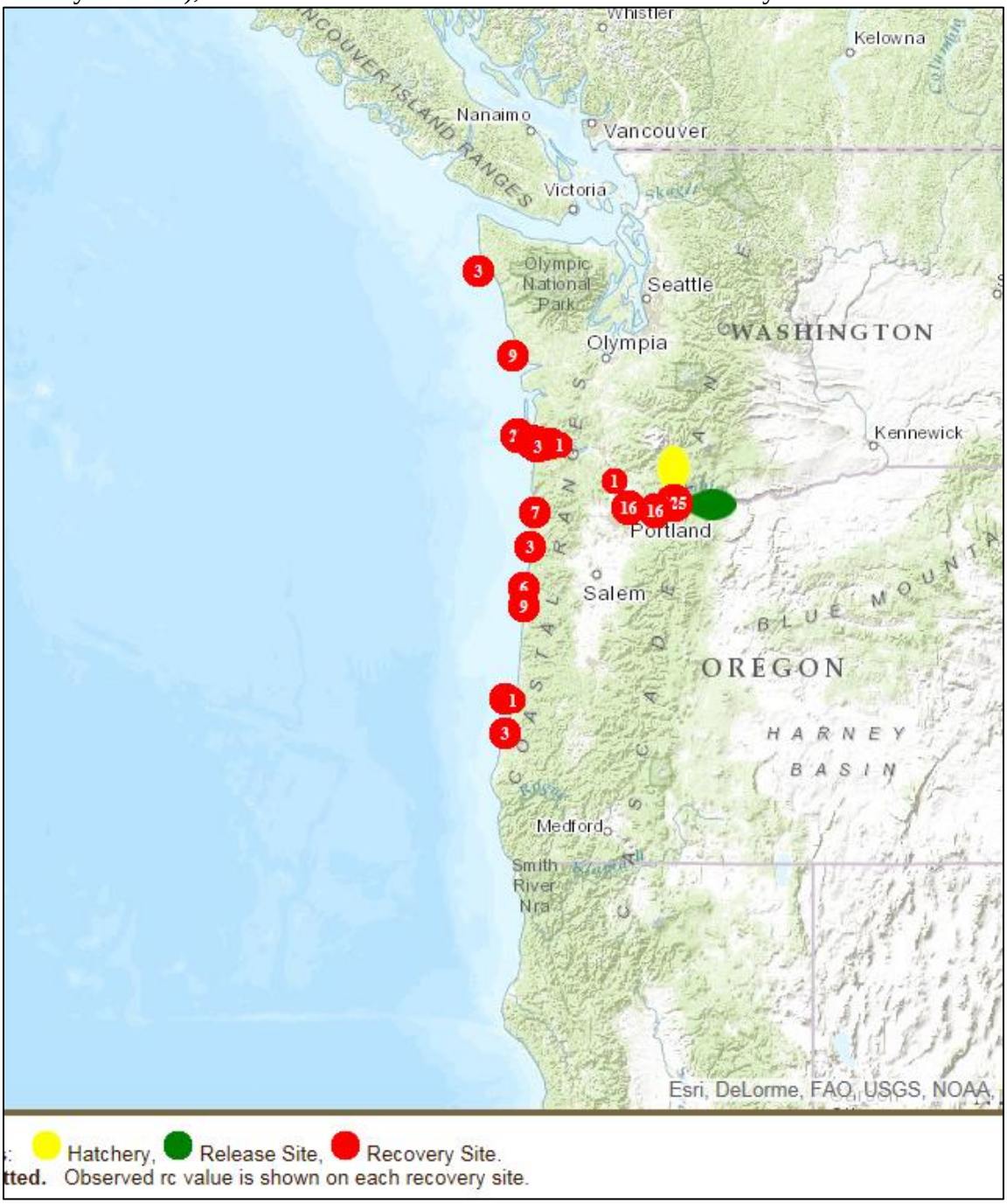
This program is managed to supplement decreased harvest in ocean and Columbia River commercial and sport fisheries resulting from lost salmon production as a result of habitat loss or degradation in the Columbia River Basin. Recoveries of coded-wire tagged Bonneville Coho Salmon indicate that contribution to fisheries is greatest for Oregon Ocean and freshwater recreational fisheries, followed by Washington and California (Table 3.3.1a).

Table 3.3.1a. Harvest distribution of coded wire tagged Bonneville Hatchery Coho released at Tanner Creek, 2000-2012 brood years.

	Washington	Oregon	California	Totals
Commercial Fishery				
Ocean	1.3%	2.3%	0.00%	3.6%
Freshwater	0.00%	16.6%	0.00%	16.6%
Recreational Fishery				
Ocean	20.7%	29.3%	0.4%	50.4%
Freshwater	12.5%	16.9%	0.00%	29.4%
Totals by State	34.8%	65.1%	0.4%	100.0%

The distribution and relative contribution of adults based on CWT recoveries of fish from one of the Tanner Creek Coho Salmon smolts releases is shown in **Figure** . The recoveries originated from a release in May of 2013 (tag code 090638). The red dots indicate the locations of individual CWT recoveries and the numbers within the red dots are the actual number of CWT's recovered from that location. Only locations with reported geographical coordinates are included in the figure. Adult Coho were caught in ocean fisheries ranging from Coos Bay on the southern Oregon coast to the Northern coast of Washington state. In the Columbia River, the majority of sport recoveries occurred in the Buoy 10 fishery at its mouth, whereas the majority of the Columbia River commercial fishery recoveries occurred in the zone 4 and 5 net fisheries between Portland and Bonneville Dam.

Figure 3. Locations of CWT Recoveries for Tag Code 090638 (Tanner Creek Coho-brood year 2011), released into Tanner Creek at Bonneville Hatchery.



Source: Regional Mark Information System Database [online database]. Continuously since 1977. Portland (OR): Regional Mark Processing Center, Pacific States Marine Fisheries Commission. 04/19/2016:<http://www.rmpc.org>

CWT Recovery data from the 2002-2013 return years indicate that, on average, 16.7% of the total estimated CWT recoveries of Tanner Creek Coho Salmon are recovered in ocean and freshwater fisheries (Table 3.3.1b). The remaining CWTs are recovered at the hatchery and on the spawning grounds (83.2% and 0.15% of the total, respectively).

Table 3.3.1b. Percentage of CWT recoveries by run year to fisheries, hatchery and spawning grounds for Bonneville Coho released at Tanner Creek, run years 2002-2013.

Run Year	Fishery	Hatchery	Spawning Ground	Total
2002	25.1%	72.0%	2.9%	100.0%
2003	44.6%	55.0%	0.5%	100.0%
2004	30.0%	69.0%	0.9%	100.0%
2005	15.4%	84.4%	0.2%	100.0%
2006	10.0%	89.8%	0.2%	100.0%
2007	32.1%	67.8%	0.1%	100.0%
2008	11.2%	88.7%	0.1%	100.0%
2009	30.2%	69.6%	0.2%	100.0%
2010	17.9%	82.0%	0.1%	100.0%
2011	9.4%	90.6%	0.0%	100.0%
2012	11.4%	88.6%	0.0%	100.0%
2013	7.9%	91.9%	0.1%	100.0%
Median	16.7%	83.2%	0.15%	

Bonneville Coho are harvested in fall Columbia River commercial and recreational fisheries. Since 1990, Bonneville Hatchery-origin Coho Salmon have comprised between 5% and 36% of the total annual early stock Coho hatchery returns and lower Columbia River dam counts. Based on coded-wire tag recovery information, the estimated harvest of Bonneville Coho in lower Columbia fisheries for the 2001-2015 run years has ranged from 8,801 to 59,241 fish annually (Table 3.3.1c).

Table 3.3.1c. Estimated contribution of Bonneville Coho Salmon to freshwater fisheries, hatchery and spawning grounds, run years 2001-2015. Estimates based on CWT recovery data.

Run Year	Commercial	Recreational	Hatchery	Spawning Grounds	Total Freshwater Return
2001	4,880	10,990	43,020	351	59,241
2002	3,696	628	24,966	976	30,266
2003	3,017	9,774	34,746	307	47,843
2004	541	2,208	22,388	261	25,397
2005	935	417	14,878	29	16,259
2006	1,131	558	38,024	75	39,788
2007	735	2,423	30,539	44	33,741
2008	1,808	1,041	28,855	27	31,731
2009	1,944	4,268	35,639	119	41,970
2010	1,463	1,516	21,518	18	24,515

2011	1,344	673	19,427	0	21,443
2012	320	786	12,661	0	13,768
2013	381	192	8,215	14	8,801
2014[1]	2,450	2,209	-	17	-
2015[1]	157	2,636	3,160	-	-

[1] Recovery data incomplete

Data from RMIS regional database and CWTF-ODFW coded-wire tag database

Lower Columbia Coho Salmon were listed as a threatened species by NOAA Fisheries on June 28th, 2005 and a final determination was made August 26, 2005. The listing status was reviewed and updated April 14, 2014. The State of Oregon listed wild Coho destined for Oregon tributaries of the lower Columbia River as an endangered species under Oregon state law in July 1999. The ODFW has completed a management plan for state-listed wild Coho Salmon (Chilcote 2003). The management plan includes separate abundance-based harvest matrices for ocean and freshwater fisheries and was adopted at the July 20, 2001 OFWC meeting. The harvest matrices provide separate maximum allowable fishery mortality rates for ocean and freshwater fisheries based on parental escapement relative to full seeding and marine survival as indexed by the return rate of jacks per hatchery smolts released. For 2005, the combined ocean and freshwater fishery mortality rate should not exceed 21.4% of the pre-fishery ocean abundance and the freshwater fishing mortality rate should not exceed 6.5% of the run entering the Columbia River. Fisheries will be managed to limit impacts to state-listed Coho through the use of area closures or mesh size restrictions as described in the ”Coho Protection Measures” section of this document.

In order to facilitate consultations with the National Oceanographic and Atmospheric Administration (NOAA) Fisheries for past main-stem treaty Indian and non-Indian fisheries, the *U.S. v Oregon* TAC has prepared biological assessments for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The TAC has completed Biological Assessments (BAs) of impacts to all ESA-listed salmonid stocks (including steelhead) for all main-stem Columbia River fisheries including Select Area fisheries since January 1992 and for Snake River Basin fisheries since January 1993. A Biological Assessment concerning Columbia River treaty Indian and non-Indian fisheries as described in the recently adopted “2005-2007 Interim Management Agreement for upriver Chinook, Sockeye, steelhead, Coho, and White Sturgeon” was submitted to the NOAA Fisheries during the spring of 2005 (TAC 2005), and a Biological Opinion was issued on May 9th, 2005.

3.4) Relationship to habitat protection and recovery strategies.

There is no known natural salmonid production in the lower reach of Tanner Creek, which serves as the hatchery’s water source. Thus, no habitat protection or recovery strategies have been developed or require for Tanner Creek.

Habitat protection and recovery strategies were developed in the draft Lower Columbia

River and Estuary Bi-State Sub-basin Plan (LCREP 2004); the Bonneville Coho Salmon program is consistent with these habitat protection and recovery strategies.

3.5) Ecological interactions.

(1) Species that could negatively impact the program include:

- Avian predators, such as great blue herons, Caspian terns, cormorants, and gulls,
- Mammalian predators such as river otters, harbor seals, or sea lions,
- Introduced fish species such as American Shad, Walleye, Smallmouth Bass, and Channel Catfish,
- Northern Pikeminnow,
- Out-of-basin hatchery salmonid releases,
- Known or unknown aquatic non-indigenous animals and plants.

The majority of the above species can be characterized as predators of juvenile salmonids, which may negatively affect Bonneville Coho Salmon juvenile survival after release. In recent years, Caspian terns (*Sterna caspia*) have colonized the Columbia River estuary; the colony currently represents the largest in North America. Estimates of annual Caspian tern predation on salmonid smolts have been as high as about 25 million (Roby et al. 1998). Caspian tern predation is highest on large smolts, such as steelhead or Coho that spend 1-2 years rearing in freshwater. Predation is lower on ocean-type salmonids such as fall Chinook and Chum Salmon that emigrate as sub-yearlings. Northern Pikeminnow (*Ptychocheilus oregonensis*) have been estimated to annually consume millions of juvenile salmonids in the lower Columbia River (Ward et al. 1995). Most Northern Pikeminnow predation is thought to occur downstream of dams. Pikeminnow abundance in the Columbia River estuary is likely low; therefore, Pikeminnow effects are expected to be highest near the mouth of Tanner Creek and diminish with distance downstream. Walleye (*Sander vitreus*), Smallmouth Bass (*Micropterus dolomeiui*), and Channel Catfish (*Ictalurus punctatus*) have been estimated to consume substantial numbers of emigrating juvenile salmonids (Zimmerman 1999). Effects of these species are thought to be highest around dams and throughout impounded reaches of the Columbia River (Zimmerman and Parker 1995). Like Pikeminnow, the abundance of walleye, smallmouth bass and channel catfish in the estuary is thought to be low; so, their predation effects should be highest near the Bonneville Dam and progressively decreased with distance downstream.

River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food (NMFS 1999). These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed.

American Shad (*Alosa sapidissima*) and large out-of-basin hatchery salmonid releases

represent potential competitors of juvenile Bonneville Coho and may decrease juvenile survival through density dependent competition effects. In the lower Columbia River and estuary, juvenile American shad were described as year-round residents in all areas of the estuary (Bottom et al. 1984). Multiple studies have found overlap in both habitat use and diet items in juvenile American shad and both sub-yearling and yearling salmonids (McCabe et al. 1983, Bottom et al. 1984), suggesting competition for food and space. Additionally, other hatchery fish may be a source of competition for Bonneville Coho salmon. The potential exists for large-scale hatchery releases of fry and fingerling ocean-type Chinook Salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Food availability may be negatively affected by the temporal and spatial overlap of juvenile salmonids from different locations; competition for prey may develop when large releases of hatchery salmonids enter the estuary (Bisbal and McConnaha 1998), although this issue remains unresolved (Williams et al. 1998).

Aquatic non-indigenous species introductions in the lower Columbia River represent permanent alterations of the biological integrity of the ecosystem for numerous reasons: impacts of introduced species are unpredictable, introduced species alter food web dynamics, and introduced species are a conduit for diseases and parasites (Waldeck et al. 2003). Significant changes in estuary faunal and floral communities have occurred through species introductions, but, for the most part, the effects of these species introductions have not been assessed. Several nonnative invertebrate species have expanded their populations dramatically since introduction, particularly the Asian bivalve, *Corbicula fluminea*. Additionally, ecosystem effects of non-indigenous aquatic plants are a concern for many resource managers. Of particular interest in the Columbia River estuary and lower main-stem are four plants considered noxious weeds: purple loosestrife (*Lythrum salicaria*), Eurasian water milfoil (*Myriophyllum spicatum*), parrot feather (*Myriophyllum aquaticum*), and Brazilian elodea (*Egeria densa*). Effects of these non-indigenous species on Bonneville Coho are unknown.

(2) Species that could be negatively impacted by the program include:

- Lower Columbia River Chinook Salmon,
- Lower Columbia River Chum Salmon,
- Lower Columbia River steelhead,
- Lower Columbia River Coho Salmon,
- Out-of-basin wild salmonids using the Columbia River estuary.

Wild juvenile salmonids using the Columbia River estuary may be affected by releases of Bonneville Coho Salmon. However, the hatchery Coho are released as yearling smolts that are expected to promptly out-migrate through the lower Columbia River and estuary with a minimum of ecological interaction with other species. The influence of these hatchery juveniles on predator behavior in the lower Columbia is unknown. Some researchers purport that releases of hatchery juveniles in general attract predators, thereby increasing predation on wild juvenile salmonids (Bayer 1986, Collis et al. 1995). Others suggest that releases of hatchery fish may overwhelm predators, thereby providing a

competitive advantage to wild juvenile salmonids that have better predator avoidance capability than hatchery fish (Petersen and De Angelis 1992).

As adults, Bonneville Coho Salmon return at a time of year when adult chum and winter steelhead are not usually present but overlap the run timing of lower Columbia River fall Chinook, Coho, and summer steelhead. Indigenous populations of wild fall Chinook, Chum, steelhead, and Coho Salmon do not use Tanner Creek for spawning or juvenile rearing, and assumed that never were used before; therefore, ecological interactions with wild adult salmonids are restricted to the main-stem Columbia River migration corridor and are assumed to be minimal. Genetic interactions with wild Coho Salmon could occur if Bonneville Coho stray into Columbia River tributaries and spawn with wild fish. However, recoveries of coded-wire tagged Bonneville Coho during spawning ground surveys have been relatively infrequent comprising 0.15% of the total coded-wire tag recoveries (Table 3.3.1b).

(3) There are no species that are known to positively impact the program. Stream enrichment in Tanner Creek would provide little benefit to the program because hatchery fish released in Tanner Creek reach the main-stem Columbia River shortly after release. There is little, if any, extended juvenile rearing in Tanner Creek.

(4) There are no species that are known to be positively impacted through the program. There is no known natural production in lower Tanner Creek and hatchery fish in excess of broodstock needs are not returned to the stream to serve as a nutrient or food base. Hatchery production has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climatic cycles.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Bonneville Hatchery

Bonneville Hatchery operates on a mixture of well water supply (13,000 gpm) and Tanner Creek surface water. The water meets or exceeds the recommended IHOT water quality guidelines for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. The water supply is protected by flow alarms at the intake(s), at the head box, and there are pond level alarms in the holding ponds. Water supply is protected by backup power generation. There are no limitations imposed by the water supply.

Cascade Hatchery

The water source for Cascade hatchery is a mixture of untreated water from Eagle Creek (600 gpm) and spring water (15-20 gpm). The water source is gravity fed. The water

source meets or exceeds IHOT guidelines for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. The water supply is protected by flow alarms at the head box. There are no limitations imposed by the water supply.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Both Bonneville and Cascade hatcheries are operated under the NPDES permits issued by the Oregon Department of Environmental Quality (DEQ), and in full compliance with the requirements. The intake screens at the Bonneville Hatchery are in compliance with NOAA Fisheries screening criteria. Intake screens at Cascade Hatchery do not meet NOAA Fisheries screening criteria. Screens will be replaced when funding becomes available.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Bonneville Hatchery:

Broodstock at Bonneville Hatchery is collected by volitional returns to an adult-capture pond.

Table 5.1. Description of pond facilities for coho broodstock collection at Bonneville Hatchery.

Hatchery	# of Ponds	Pond type	Volume (ft^3)	Length (ft)	Width (ft)	Depth (ft)	Flow (gpm)
Bonneville	2	Concrete	32,785	123.23	38	6.0	5,000
Bonneville	1	Concrete	14,502	83	27.3	6.5	3,500
Bonneville	1	Concrete	11,288	61.5-82	13.5-27.3	6.5	3,500

5.2) Fish transportation equipment (description of pen, tank, truck, or container used).

The fish transportation facilities used at Bonneville Hatchery are described in Table 5.2, which are used to transport listed natural fish for hauling to upstream above Bonneville Dam. Integrated Hatchery Operations Team (IHOT) guidelines for transportation are followed.

Table 5.2. Fish transportation facilities used at Bonneville Hatchery.

Equipment type	Capacity (gallons)	Supplemental Oxygen (y/n)	Normal transit time	Chemicals used
Tank Truck	1,000	Y	Varied	None
Tank (portable)	200	Y	Short distances	None

5.3) Broodstock holding and spawning facilities.

Broodstock holding facilities are the same as described in Section 5.1 and Table 5.1. Spawning takes place in a covered spawning facility. The IHOT adult holding guidelines are followed for adult holding, flows, density, water quality, alarm systems and predator control measures to provide the necessary security for the broodstock. Coho salmon are spawned at Bonneville Hatchery and fertilized green eggs are shipped to Cascade Hatchery for incubation.

5.4) Incubation facilities.

Incubation of all Coho Salmon eggs is done at Cascade Hatchery. Cascade Hatchery incubation facilities used in the Coho program are described in Table 5.4. At Cascade Hatchery, temperature is checked daily from a thermograph and has a range of 32°-52° F to the eye stage. Dissolved oxygen is not monitored, but remains between 10-7 ppm. Average Coho Salmon egg size is 111 eggs/oz. at the green egg stage and 90 eggs/oz. at the eyed egg stage.

Table 5.4. Incubation facilities at Cascade Hatchery.

Incubator Type	Units (#)	Flow (gpm)	Volume (ft^3)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Vertical stacks (Heath)	44	5.0	NA	10,000 eggs/tray 15 trays/stack	8,250 eggs/tray 15 trays/stack

5.5) Rearing facilities.

After incubation and early rearing at Cascade Hatchery Coho Salmon fry (132 fpp) are shipped back to Bonneville Hatchery for rearing until release into Tanner Creek. Rearing density at Cascade Hatchery is 1.09 $lb/ft^3$and at Bonneville Hatchery is 0.80 lb/ft^3. See Table 5.5 below for rearing facilities at Cascade and Bonneville hatcheries.

Table 5.5. Rearing facilities at Bonneville and Cascade Hatcheries.

Hatchery	Number of ponds	Pond type	Volume (cu. ft)	Length (ft)	Width (ft)	Depth (ft)	Flow (gpm)	Max flow index
Bonneville	28	concrete	3,780	75	16.8	3	650	NA
	32	concrete	4,800	80	20	3	700	NA
	4	FG circular		64	NA	9	3	100
Cascade	30	concrete	3,200	80	16	2.5	250-400	NA

5.6) Acclimation/release facilities.

Coho salmon smolts are released on-site from rearing ponds into Tanner Creek, and no additional acclimation is necessary for this Bonneville Hatchery Coho Salmon program as Tanner Creek water is the source for final rearing.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No incidents of this nature have occurred in the past 25 years.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Although Bonneville Hatchery Coho Salmon (Tanner Creek stock 14) are a part of the lower Columbia River listed Coho Salmon ESU, no listed natural Coho are used or reared under this program. Incubation and rearing facilities both Cascade and Bonneville hatcheries are sited at enough higher elevations and consequently risks of catastrophic fish loss from flooding is less. Both facilities are staffed 24 hours a day to assure the safety and security of rearing fish due to water loss or equipment failure, and staff are notified by alarms of any emergency situations.

Both hatcheries (Bonneville and Cascade) have gravity feed water supplies. Bonneville has well water from the aquifer under the Columbia. The wells are powered from two different sources directly off Bonneville Dam. There is also a recirculation system for 28 ponds. Cascade has some spring water available for incubation, a recirculation pump for the rearing ponds, and a pump located in Eagle Creek as an emergency backup which can be powered by municipal power or diesel generator. Incubating eggs are initially disinfected and treated with formalin as needed to prevent fungal infections. Fish health is inspected once a month and treated, if needed. Mortalities are removed daily and not allowed to enter the water of the state to prevent transmission of diseases to the watershed.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source.

Broodstock for both Bonneville Hatchery Coho Salmon program and SAFE Coho Salmon program are collected from adult Coho returns to Bonneville Hatchery. As back-up source of broodstock for this program, Coho stocks of Sandy Hatchery (Cedar Creek), Big Creek Hatchery (Big Creek), Klaskanine Hatchery, and Eagle Creek National Fish Hatchery shall be used, if needed.

6.2) Supporting Information.

6.2.1) History.

This hatchery program dates back to 1938. Historically, Coho Salmon were collected at Eagle Creek, Herman Creek and Tanner Creek on the lower Columbia River. These stocks were maintained as three separate broodstocks although gene transfusion among these stocks may have had occurred at very higher rates. And eventually these stocks were combined together into a single broodstock. In addition to that, fish were incorporated into this broodstock from several other locations within the Columbia Basin, including Big Creek and Sandy hatcheries.

6.2.2) Annual size.

The annual size of the Bonneville Hatchery Coho broodstock (including SAFE Coho Salmon program) is 6,000 adults. No listed natural fish are taken as broodstock for this program.

6.2.3) Past and proposed level of natural fish in the broodstock.

Listed natural Coho Salmon are not taken for broodstock under this program.

6.2.4) Genetic or ecological differences.

The Bonneville Hatchery Coho Salmon stock is comprised of a mixed gene pool as it originated from different sources (see Section 6.2.1), and eventually became a domesticated stock at Bonneville Hatchery. It is assumed to have genotypic, phenotypic and behavioral differences from the ancestral and current wild Coho stocks in the area. If present, these differences are assumed to be because of domestication, artificial selection, stock transfer and gene infusion.

6.2.5) Reasons for choosing.

This broodstock was chosen because it originated substantially from the local streams and became well adapted to the local environment, and has characteristics, primarily the ocean distributions and return timing which are desirable for Columbia River fisheries.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Broodstock selection targets only hatchery-origin Coho Salmon. Any listed natural salmonids that are incidentally captured in the adult trap are released above Bonneville Dam.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Returning adults and a few jacks shall be collected for broodstock.

7.2) Collection or sampling design.

All hatchery-origin adults that enter volitionally into the trap/pond at Bonneville Hatchery are collected. Adults are selected randomly from the available marked hatchery fish for the broodstock. All unmarked Coho Salmon are released into the Columbia River upstream of Bonneville Dam.

7.3) Identity.

Hatchery-origin Coho produced below Bonneville Dam are 100% marked. Only marked Coho are used for broodstock. Wild Coho are rare in Tanner Creek. However, it should be noted that in some years, substantial numbers of unmarked hatchery Coho believed to be originating from areas upstream of Bonneville Dam can enter Tanner Creek and the hatchery trap/pond. Because they cannot be easily differentiated from naturally produced Coho, they are transported above the Bonneville Dam and released unharmed.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Assuming 1:1 sex ratio, the current annual brood stock collection goal is 3,000 females, 3,000 males (for both Bonneville and SAFE programs). The proposed broodstock collection goal is significantly higher than the past collection levels because of proposed increases in Coho Salmon smolts releases from SAFE net pens.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available:

Actual annual broodstock collection levels of the past for Bonneville Hatchery Coho

Salmon program are shown in Table 7.4.2. On some occasions, collection levels are below goals due to mortality (up to 25% annual mortality).

Table 7.4.2. Coho Salmon broodstock collection levels at Bonneville Hatchery, 2004 - 2015.

	Adults		
Brood Year	Females	Males	Eggs
2004	1,890	1,890	13,123,950
2005	2,040	2,038	12,611,661
2006	2,070	2,095	14,248,497
2007	2,085	2,085	12,678,544
2008	1,347	1,347	9,956,555
2009	1,350	1,350	8,888,065
2010	746	743	5,394,401
2011	852	852	5,335,372
2012	1,290	1,290	6,923,313
2013	1,170	1,174	7,779,982
2014	1,320	1,320	7,912,335
2015	1,421	1,421	6,422,977

Source: ODFW HMS database.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

All hatchery fish that enter the hatchery trap are collected and are either selected for the broodstock or are disposed of. Fish in excess of what is needed for broodstock are sold through competitive bid process, to generate revenue for hatchery operations. Some will be donated to Oregon Food Bank to feed the needy Oregonians with quality protein. Fish that are below the standard/quality for human consumption will be used for stream enrichment or hauled to Bio-Oregon, Inc. for processing into fish feed or fertilizer. All hatchery Coho carcasses used for nutrient enrichment of spawning streams are marked to prevent confusion with naturally spawned fish. Specific criteria and guidelines for operation of the stream enrichment program are identified in an MOU between ODFW and DEQ. See Section 7.8 for disposition of carcasses.

7.6) Fish transportation and holding methods.

The fish transportation facilities used at Bonneville Hatchery are described in Table 5.2. The IHOT guidelines for transportation are followed in this program. Broodstock holding facilities are described in Table 5.1. Broodstock are both collected and spawned at the hatchery, so transportation of broodstock is minimized. Adults return to holding ponds volitionally and are utilized throughout the spawning run as needed.

7.7) Describe fish health maintenance and sanitation procedures applied.

ODFE Fish Health Management Policy, Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection Committee (PNFHPC) guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses. Broodstock holding facilities are cleaned weekly and mortalities removed daily. Fish health is inspected by ODFW fish health specialist and holding adults are treated as needed.

7.8) Disposition of carcasses.

The carcasses which should be disposed of are treated as per IHOT guidelines and disposed of at a landfill.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

No listed natural Coho Salmon are taken for broodstock for this program, and only hatchery-origin Coho Salmon are collected for broodstock. Any listed fish that are incidentally captured are transported upstream daily. Safeguards are in place, including separate facilities, sanitation procedures, and treated water supplies to protect any other listed species that may occur on the hatchery site.

SECTION 8. MATING

8.1) Selection method.

Only hatchery-origin fish are selected for broodstock and mating. Ripe males and females available on a given day are randomly selected for mating.

8.2) Males.

The preferred or target sex ratio for this program is 1:1 (female to male). No backup of males is expected. No jacks are incorporated into the broodstock.

8.3) Fertilization.

The current and preferred protocol is to spawn a single female with a single male for fertilization.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not used in this program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

No listed natural Coho Salmon are used for spawning. Therefore, it is unlikely that the mating scheme will have any direct adverse genetic or ecological impacts on listed natural fish. However, to maintain within-hatchery population genetic diversity enough broodstock shall be used for spawning using 1:1 female to male spawning ratio, and adults used for broodstock shall be randomly selected throughout the entire run. Ripe males and females on specific spawning days shall be randomly mated without any bias for size or other physical characteristics or traits.

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

The numbers of eggs taken in the past and egg to fry survival of program fish from 2004-2015 brood years are provided in Table 9.1.1.

Table 9.1.1. Bonneville Hatchery Coho Salmon egg take, and egg to ponded fry survival from brood year 2004-2015 (egg to fry survival is average for eggs incubated at Cascade Hatchery since incubation to both the eyed stage and ponding take place at Cascade Hatchery).

Brood Year	Egg Take	Egg to ponded fry survival	Brood Year	Egg Take	Egg to ponded fry survival
2004	13,123,950	90%	2010	5,394,401	91%
2005	12,611,661	86%	2011	5,335,372	95%
2006	14,248,497	81%	2012	6,923,313	95%
2007	12,678,544	91%	2013	7,779,982	94%
2008	9,956,555	93%	2014	7,912,335	92%
2009	8,888,065	93%	2015	6,422,977	86%

9.1.2) Cause for, and disposition of surplus egg takes.

If eggs are found to be in excess of production goals, it would be first determined if any other hatcheries have egg deficits. If not, excess eggs are destroyed (frozen) and disposed of or given to the Oregon Coast Aquarium or local zoos to feed the animals. Eggs may be selectively culled, if determined to be potentially infected with Bacterial Kidney Disease (BKD) based on ELISA results from samples taken on females at spawning.

9.1.3) Loading densities applied during incubation.

Incubation of eggs for Bonneville Hatchery Coho Salmon program takes place at Cascade Hatchery. The IHOT species-specific incubation recommendations are followed for water quality, flows and temperature and loading densities. Cascade Hatchery receives 3,420,000 green eggs from Bonneville Hatchery for incubation. Rearing densities are 10,000 eggs per tray to the green egg stage, and then 8,000 to the eyed egg stage. Average egg sizes are 111 eggs/oz. as green and 90 eggs/oz. at the eyed stage. Flow in the incubating trays is maintained at 5 gpm.

9.1.4) Incubation conditions.

The IHOT species-specific incubation recommendations are followed for water quality, flows and temperature. Rearing densities are 10,000 eggs per tray to the green egg stage, and then 8,000 to the eyed egg stage. Water flow through the incubators is 5 gpm. Temperatures range from 32-52°F. Incubating eggs are treated with formalin per prescription of fish health specialist to prevent fungal growth. Eggs are monitored when needed to determine fertilization efficiency and embryonic development. Eggs are incubated under similar conditions so that embryonic growth is similar to all incubating eggs for a common ponding date. At ponding, families within spawning groups are mixed randomly so that any unintentional rearing differences affect all families equally.

9.1.5) Ponding.

The procedures used for determining when fry are ponded include visual inspection of the amount of yolk remaining, and a specified number of accumulated temperature units. At Cascade Hatchery, ponding is forced at about 1,300 CTU. Coho fry from all family groups are mixed together during ponding. See Section 5.5 for details regarding rearing facilities.

9.1.6) Fish health maintenance and monitoring.

Disinfection procedures are implemented during incubation, preventing pathogen transmission between stocks of fish. Also, incubating eggs are treated with formalin as needed to protect the eggs from fungal infections. Eggs are monitored to determine fertilization efficiency and embryonic development. Following eyed-up stage, eggs are inventoried, and dead or undeveloped eggs are removed and disposed of as described in the disease control guidelines. Dead or culled eggs are discarded in a manner that prevents transmission of pathogens to the receiving watershed. ODFW Fish Health Management Policy, IHOT, and Pacific Northwest Fish Health Protection Committee guidelines are followed for inspections and fish health maintenance.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Although hatchery Coho stock-14 is part of the lower Columbia River ESU, no listed

natural Coho Salmon eggs are incubated under this program. Safeguards are in place to protect the incubating hatchery-origin Coho Salmon eggs. Disinfection procedures are implemented during incubation that prevents pathogen transmission between stocks of fish on site. Eggs are treated with formalin whenever needed to prevent fungal growth. Dead or culled eggs are discarded in a manner that prevents transmission of pathogens to the receiving watershed. Flows and loading densities during incubation are maintained as per IHOT recommendations. Water flows/levels are equipped with alarm system to instantly notify responsible staff in any accidental water system failure.

9.2) Rearing.

9.2.1) Provide survival rate data (average program performance) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (2002-2014), or for years dependable data are available.

Table 9.2.1. Coho Salmon fry-to-fingerling survival rates at Cascade Hatchery; and fingerling to smolt survival rates at Bonneville Hatchery, 2003-2014.

Brood Year	Cascade Hatchery	Bonneville Hatchery
2003	99.0%	99.7%
2004	98.5%	94.6%
2005	97.7%	98.9%
2006	96.8%	98.6%
2007	98.3%	96.6%
2008	98.6%	89.4%
2009	99.2%	98.8%
2010	98.1%	95.5%
2011	98.8%	99.1%
2012	98.7%	99.0%
2013	98.2%	99.8%
2014	99.1%	98.7%

Source: ODFW HMS database.

9.2.2) Density and loading criteria (goals and actual levels).

The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria. The IHOT standards are followed for: water quality, alarm systems, predator control measures, and loading density.

Table 9.2.2. Actual loading density and loading goal for Bonneville Hatchery Coho Salmon program at the rearing hatcheries.

Hatchery	Actual Loading Density	Goal
Bonneville	0.80 lbs/ft^3	1.10 lbs/ft^3
Cascade	1.09 lbs/ft^3	1.10 lbs/ft^3

Source: ODFW HMS database.

9.2.3) Fish rearing conditions.

Rearing facilities at Cascade and Bonneville hatcheries are described in Section 5.5. Water temperature is monitored via a thermograph gauging all water coming into the hatchery. The water source is well water which provides water of a consistent 49-51°F. Dissolved Oxygen (D.O.) is only monitored when rearing densities are high, at which time it is monitored with a portable D.O. meter. Ponds are cleaned weekly or bi-weekly depending on the time of year. Early in the rearing phase, the ponds are cleaned weekly. Later in the phase, ponds may be cleaned bi-weekly. Mortalities are picked daily, and fish are inspected monthly by ODFW pathologists. Flow in the rearing ponds is 700gpm. Flow in the Canadian troughs it is 60 gpm. Flow in the circular ponds is 100 gpm.

The IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria.

9.2.4) Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Feeding rates are regulated so that fish size is within 10% of program goal each year. Operator conducts periodic feed quality analysis. Feed is stored under proper conditions as described by IHOT guidelines. The available data on fish growth information is provided in Table 9.2.4.

Table 9.2.4. Fish growth information (fish per pound) for Bonneville Hatchery coho salmon program.

Rearing Period	Weight (fpp) Bonneville	Weight (fpp) Cascade
Mar		905
Apr		442
May		208
Jun	128	123
Jul	74	74

Aug	48	47
Sep	33	32
Oct	25	23
Nov	22	
Dec	21	
Jan	19	
Feb	17	
Mar	16	
Apr	15	

Source: ODFW HMS database.

9.2.5) Indicate monthly fish growth rate and energy reserve data (average program performance), if available.

Monthly growth data is provided in Table 9.2.4. Energy reserved data are not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (average program performance).

Daily feeding rates are regulated so that fish size is within 10% of program goal each year. Feeding operator conducts periodic feed quality/quantity analysis to evaluate growth performance and determine feeding schedule/rate. Feed is stored under proper conditions as described by IHOT guidelines. The correct amount and type of food is provided to achieve the desired growth rate for the species and life stages being reared. Feeding protocols are provided in Table 9.2.6.

Table 9.2.6. Feeding protocols for Coho Salmon fry (stock 14) at Bonneville and Cascade hatcheries.

Rearing period	Facility	Food type	Application schedule (no. feedings/day)	Feeding rate (% B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion
Mar - Apri	Cascade	BioVita Starter #0	10	1.8	0.04	0.65
Apr - May	Cascade	BioVita Starter #1	4	1.8	0.04	0.77
May - Jul	Cascade	BioVita Starter #2	2	1.8	0.06	0.82
Jun - Jul	Bonneville	BioVita Starter #2 BioClark's Fry 1.2	4	1.5	0.05	0.90
Jul - Aug	Bonneville	BioClark's Fry 1.5	4	1.3	0.05	0.93
Aug - Dec	Bonneville	BioClark's Fry 2.0	4	0.7	0.03	0.94
Dec - May	Bonneville	BioClark's Fry 2.5	2	0.3	0.02	0.94

Source: ODFW HMS database and hatchery staff contact.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

The ODFW Fish Health Management Policy and IHOT fish health guidelines are followed to prevent disease transmission between lots of fish on site or transmission or amplification to or within the watershed. Vaccines are not used, whenever possible, to minimize the use of antimicrobial compounds. The juvenile rearing density and loading guidelines used at the facilities are based on standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria. At Bonneville Hatchery ponds are cleaned weekly or bi-weekly depending on waste accumulation and the time of year. Early in the rearing phase, the ponds are cleaned weekly. Later in the phase, ponds may be cleaned bi-weekly. Mortalities are picked daily, and fish are inspected by ODFW pathologists monthly. At Cascade Hatchery, rearing ponds are cleaned weekly, and mortalities are picked daily. Fish are treated per prescriptions of fish health specialists at both facilities, if needed.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

The smolt development indices are determined by visual inspection, length of rearing, fish of size, coloration, and behavior of fish. No gill ATPase enzyme activity is measured.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Natural rearing method is practiced in this program.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

No listed natural Coho Salmon are used for propagation under this program, and only hatchery-origin Coho are reared. So, it's unlikely to have any adverse genetic effects to listed natural fish due to this program. To minimize ecological effects, fish health monitoring and maintenance are strictly followed (see Section 9.2.7). Enough flow is maintained within each raceway at Bonneville Hatchery until release. Fish are reared to full smolt stage for quick outmigration through the lower Columbia River main corridor soon after release.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2. "Location" is watershed planted (e.g. "Elwha River").)***

Table 10.1. Proposed fish release levels of Bonneville Hatchery coho salmon program.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	0			
Unfed Fry	0			
Fry	0			
Fingerling	0			
Yearling smolts	1,000,000*	14 fpp	May	Tanner Creek

*Release numbers may vary from 300,000 to 1,000,000 smolts annually depending on funding availability.

10.2) Specific location(s) of proposed release(s) (for the on-station releases).

Stream, river, or watercourse: Tanner Creek, a tributary to the lower Columbia River.
Release point: Tanner Creek (latitude 45.6334 N and longitude 121.9568) or RM 140.9 from the mouth of the Columbia River.
Major watershed: Columbia River/Estuary
Basin or region: Columbia River Basin

10.3) Actual numbers and sizes of fish released by age class through the program.

The actual numbers of Bonneville Coho Salmon smolts released into Tanner Creek since 2004 are presented in the three tables below, including release dates and sizes.

Table 10.3. Number released and average size of Coho Salmon smolts released from Bonneville Hatchery (on-station only).

Release Year	No. Released	Avg size (fpp)
2004	1,150,280	12.8
2005	1,189,382	13.4
2006	1,183,948	13.5
2007	1,252,793	13.5
2008	1,212,294	15.1
2009	1,227,480	13.8
2010	739,115	13.7
2011	722,034	13.2
2012	687,325	14.9
2013	358,175	15.9

2014	521,326	14.7
2015	353,525	14.7

Source: ODFW HMS database.

10.4) Actual dates of release and description of release protocols.

Table 10.4. Starting and ending dates for releases of Coho Salmon smolts from Bonneville Hatchery (on-station only).

Brood Year	Start Date	End Date
2004	30-Apr	27-May
2005	29-Apr	19-May
2006	28-Apr	12-May
2007	13-Apr	10-May
2008	1-May	15-May
2009	28-Apr	15-May
2010	8-May	8-May
2011	8-May	8-May
2012	2-May	8-May
2013	6-May	6-May
2014	30-Apr	30-Apr
2015	7-May	7-May

Source: ODFW HMS database.

Since the 2013 release year, all smolts were forced released from Bonneville Hatchery into Tanner Creek. Detailed information on releases and their associated recoveries and smolt-to-adult return estimates are provided in Table 10.4.1.

Table 10.4.1. Release data for Bonneville Coho Salmon smolts released at Tanner Creek, estimated number of recoveries, and SAR percentages, brood years 2000-2012.Tag codes and recovery data in **BOLD** are releases that were not adipose fin-clipped.

RELEASE DATA						Estimated Number of CWT Recoveries				SAR (%)			
						FISHERY				FISHERY			
Brood Year	Release Month	Avg Wt (g)	Tag Code	# CWT Tagged	Total Released	Ocean	River	Escapement	Total	Ocean	River	Escapement	Total
2000	04	34.4	093345	26,933	398,943	462	366	1,041	1,869	1.7	1.4	3.9	6.9
	05	31.1	093014	25,439	799,266	266	235	649	1,150	1.0	0.9	2.6	4.5
2001	04	35.7	093459	24,438	400,591	196	121	705	1,022	0.8	0.5	2.9	4.2
	06	34.7	091931	26,337	841,800	110	24	351	485	0.4	0.1	1.3	1.8
2002	04	33.1	093731	27,028	395,878	31	23	353	407	0.1	0.1	1.3	1.5
	06	34.6	093726	50,822	754,402	61	69	614	743	0.1	0.1	1.2	1.5
2003	04	35.2	094052	25,179	398,357	82	74	1,216	1,372	0.3	0.3	4.8	5.5
	05	34.6	093943	27,583	791,025	35	18	541	594	0.1	0.1	2.0	2.2
2004	04	33.4	094245	26,346	477,006	210	59	748	1,017	0.8	0.2	2.8	3.9
	05	33.7	092042	27,357	706,942	300	78	800	1,178	1.1	0.3	2.9	4.3
2005	04	33.0	094449	26,031	497,353	25	113	828	966	0.1	0.4	3.2	3.7
	05	33.6	094454	55,147	755,440	32	55	862	949	0.1	0.1	1.6	1.7
2006	04	28.2	094630	54,542	717,664	286	171	1,121	1,578	0.5	0.3	2.1	2.9
	05	32.1	094626	26,737	494,630	295	214	1,196	1,705	1.1	0.8	4.5	6.4
2007	04	33.7	094656	27,111	488,847	17	40	282	339	0.1	0.1	1.0	1.3
	05	32.3	094658	27,329	738,633	53	84	624	761	0.2	0.3	2.3	2.8

RELEASE DATA						Estimated Number of CWT Recoveries				SAR (%)			
						FISHERY				FISHERY			
Brood Year	Release Month	Avg Wt (g)	Tag Code	# CWT Tagged	Total Released	Ocean	River	Escapement	Total	Ocean	River	Escapement	Total
2008	05	33.0	094531	28,726	739,116	7	76	718	801	0.0	0.3	2.5	2.8
2009	05	34.3	090266	59,529	365,350	69	142	971	1,181	0.1	0.2	1.6	2.0
	05	34.3	**090267**	**53,271**	357,984	**7**	**45**	**1,144**	**1,197**	**0.0**	**0.1**	**2.1**	**2.2**
2010	05	30.3	090473	48,113	343,662	34	56	517	607	0.1	0.1	1.1	1.3
	05	30.3	090474	48,113	343,663	3	23	592	618	0.0	0.0	1.2	1.3
2011[1,2]	05	28.5	090564	52,012	88,685	287	606	NA	1,035	0.6	1.2	NA	NA
	05	28.5	090565	52,976	89,742	289	660	NA	1,086	0.5	1.2	NA	NA
	05	28.5	**090637**	**52,657**	90,128	**54**	**866**	NA	**1,097**	**0.1**	**1.6**	NA	NA
	05	28.5	090638	52,569	89,914	254	605	NA	990	0.5	1.2	NA	NA
2012[2]	04	30.9	090646	56,505	421,677	163	374	424	962	0.3	0.7	0.8	1.7

[1]Hatchery return data not yet available for Bonneville Hatchery CWT recoveries for 2014 return year.
[2]Recovery data incomplete for 2011 and 2012 brood years.

10.5) Fish transportation procedures, if applicable.

Not applicable, fish are released on-site.

10.6) Acclimation procedures (methods applied and length of time).

Early rearing of this Coho Salmon program occurs at Cascade Hatchery, up to 132 fpp. And final over winter rearing occurs at Bonneville Hatchery to smolt stage (14 fpp) prior to onsite release into Tanner Creek.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Coho released on-station from Bonneville Hatchery are 100% marked with adipose fin clips, and a portion (25K) is marked with Ad-CWT.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Any culling in this program occurs when the fish are at the eyed egg stage. These surplus eggs are either supplemented to other programs (e.g. SAFE Coho Salmon program) or destroyed.

10.9) Fish health certification procedures applied pre-release.

Per ODFW Fish Health Management Policy, fish health status is inspected within 3 weeks prior to release, and only certified fish are released.

10.10) Emergency release procedures in response to flooding or water system failure.

Bonneville and Cascade hatcheries are located at high elevations and are not prone to flooding. If water supply from Tanner Creek diminishes, managers will consult with other hatcheries for available rearing space.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Ecological interactions with other species are minimized by releasing smolts into, and collecting adults from, Tanner Creek so that range overlap with any listed species occurs only in the main-stem of the Columbia River. Coho salmon are released as full term smolts when they are expected to promptly out-migrate to the Ocean and thus minimizing adverse ecological effects to listed natural fish migrating through the Columbia River corridor.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Many policies within the hatchery program are already in place to minimize and avoid risks to ESA listed species. Thus, much of the monitoring and evaluation of the Bonneville Hatchery program is incorporated into routine ODFW operations within the Hatchery, Fish Pathology, and Fisheries Management programs. See Section 1.10 for a listing of monitoring and evaluation efforts associated with each of the performance indicators for the Bonneville Hatchery Coho Salmon program.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Funding and staffing are adequately provided to allow implementation of the monitoring and evaluation program.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

The monitoring and evaluation program is not anticipated to require any additional risk aversion measures, besides those already discussed in early sections of this report.

SECTION 12. RESEARCH

12.1) Objective or purpose.

No research is currently being undertaken on Bonneville Hatchery coho salmon program. And thus the following sections under research are not applicable.

12.2) Cooperating and funding agencies. N/A

12.3) Principle investigator or project supervisor and staff. N/A

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2. N/A

12.5) Techniques: include capture methods, drugs, samples collected, tags applied. N/A

12.6) Dates or time periods in which research activity occurs. N/A

12.7) Expected type and effects of take and potential for injury or mortality. N/A

12.8) Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1). See Section 2, Table 2.2.3 for the numbers of take of listed natural fish due to Bonneville Hatchery Coho Salmon program.

12.9) Alternative methods to achieve project objects. N/A

12.10) List species similar or related to the threatened species; provide number and causes of mortality related to this research project. N/A

12.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities. N/A

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name and Title of Applicant: Scott Patterson, Fish Propagation Program Manager, ODFW

Signature: _____Date: _____

ATTACHMENT 1. DEFINITION OF TERMS REFERENCED IN THE HGMP TEMPLATE.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as "supplementation".

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific

natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with natural origin recruit (NOR).

Natural origin recruit (NOR) - See natural fish.

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

ATTACHMENT 2. AGE CLASS DESIGNATIONS BY FISH SIZE AND SPECIES FOR SALMONIDS RELEASED FROM HATCHERY FACILITIES.

		SIZE CRITERIA
SPECIES/AGE CLASS	Number of fish/pound	Grams/fish
Chinook Yearling	<=20	>=23
Chinook (Zero) Fingerling	>20 to 150	3 to <23
Chinook Fry	>150 to 900	0.5 to <3
Chinook Unfed Fry	>900	<0.5
Coho Yearling 1/	<20	>=23
Coho Fingerling	>20 to 200	2.3 to <23
Coho Fry	>200 to 900	0.5 to <2.3
Coho Unfed Fry	>900	<0.5
Chum Fed Fry	<=1000	>=0.45
Chum Unfed Fry	>1000	<0.45
Sockeye Yearling 2/	<=20	>=23
Sockeye Fingerling	>20 to 800	0.6 to <23
Sockeye Fall Releases	<150	>2.9
Sockeye Fry	> 800 to 1500	0.3 to <0.6
Sockeye Unfed Fry	>1500	<0.3
Pink Fed Fry	<=1000	>=0.45
Pink Unfed Fry	>1000	<0.45
Steelhead Smolt	<=10	>=45
Steelhead Yearling	<=20	>=23
Steelhead Fingerling	>20 to 150	3 to <23
Steelhead Fry	>150	<3
Cutthroat Trout Yearling	<=20	>=23
Cutthroat Trout Fingerling	>20 to 150	3 to <23
Cutthroat Trout Fry	>150	<3
Trout Legals	<=10	>=45
Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.

2/ Sockeye yearlings defined as meeting size criteria and 1 year old.