HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Nehalem Hatchery Winter Steelhead Program**
Species or Hatchery Stock:	**Winter Steelhead (*Oncorhynchus mykiss*) (Stock 32)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**North Coast Watershed District West Region**
Date Submitted: First Update Submitted: Second Update Submitted: Third Update Submitted:	**September 26, 2005 September 8, 2008 October 30, 2014 July 8, 2016**
Date Last Updated:	**February 8, 2017**

SECTION 1
GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Nehalem Hatchery Winter Steelhead Program (stock 32). The program is targeted to release winter steelhead in the North Fork Nehalem River and the Necanicum River.

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

Winter Steelhead (*Oncorhynchus mykiss*) of stock 32 will be propagated under this program. Nehalem River winter steelhead are part of the Oregon Coast Evolutionary Significant Unit (ESU). In 1998, NOAA Fisheries determined that this ESU was not warranted for listing under the Federal Endangered Species Act (Busby et al. 1996). However, due to concerns over specific risk factors, the ESU was designated as a Species of Concern in 2004 (Federal Register Notice 69FR19975, 4/15/04). Oregon coastal wild steelhead populations are also considered a "Vulnerable" species under the State of Oregon's Sensitive Species Rule (OAR 635-100-040).

1.3) Responsible organization and individuals.

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

Nehalem Hatchery is supported by 100% "State other" funds (licenses).
The operational budget for Nehalem Hatchery for the 2005-2007 biennium was $648,278 [3.5 full time equivalent (FTE) employees].
Note: Beginning with the 2008-09 return year stock 32 winter steelhead production will represent approximately 31.8% of the production at Nehalem Hatchery. Based on this percentage, overall cost for this program is estimated to be $206,111 ($103,056 annually) for the production of 130,000 smolts.

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

Nehalem Hatchery is located in the North Fork Nehalem River watershed, approximately 12 miles east of the town of Nehalem on Highway 53. The hatchery facility is located on the North Fork Nehalem River at River Mile (RM) 10.3. The hatchery site is 26.2 acres in size, at an elevation of 160 feet above sea level, at latitude 45^{o} 39' 41'' N and longitude 123^{o} 50' 20'' W. Fish propagation activities for this hatchery steelhead program (adult collection, spawning, egg incubation, and juvenile rearing) occur primarily at Nehalem Hatchery, but adult collection could occur at upstream traps as needed to meet production. The North Fork Nehalem River is assigned the ODFW waterbody code 0100310000.

1.6) Type of program.

Harvest Augmentation – To increase freshwater sport harvest opportunities for adult winter steelhead by releasing artificially propagated steelhead smolts.
Salmon Trout Enhancement Program (STEP) – The use of stream side, or classroom, incubators and rearing facilities to provide educational opportunities for students.

1.7) Purpose (Goal) of program.

The primary purpose of this program is to release approximately 130,000 hatchery winter steelhead smolts in the North Fork Nehalem River (90,000) and the Necanicum River (40,000) with a goal to provide hatchery steelhead adults for recreational harvest in those basins.
An additional purpose of this program is to educate school students about salmonid fish biology and their special habitat requirements through STEP activities.

1.8) Justification for the program.

Winter steelhead fisheries in the North Fork Nehalem River and Necanicum River are managed conservatively to reduce impacts to naturally produced steelhead populations. Harvest of unmarked, naturally-produced winter steelhead is currently prohibited. This program is therefore designed to support a recreational and consumptive fishery in the North Fork Nehalem River and the Necanicum River. The program produces full-term smolts for release into the identified systems. Smolts are mass marked to allow selective harvest of hatchery adults.
This program releases yearling smolts to encourage rapid migration to the ocean, which should minimize residualism and ecological interactions with wild juvenile steelhead and other wild fish

juveniles. Releases occur in locations that are low in the watershed and separate from primary naturally-produced steelhead juvenile rearing areas to further minimize these types of interactions. Standard fish health inspections are done for both adult and juvenile steelhead in this program, to minimize potential disease concerns. The hatchery reared steelhead are mass marked to allow positive identification of hatchery fish throughout their life cycle. The basins where this program releases hatchery steelhead are currently managed for selective harvest of marked (hatchery) steelhead adults, with the requirement that all unmarked steelhead caught must be released unharmed.

Stock 32 is based predominately on the local native steelhead population (see Section 6.2 for details). However, it is a long-term hatchery stock that does not incorporate naturally produced fish in the broodstock. Therefore, the hatchery and natural populations are managed as isolated populations. Hatchery fish are managed to balance fishery opportunity, while minimizing straying of hatchery fish to natural spawning areas; ODFW's Coastal Multi-Species Conservation and Management Plan (CMP) defines allowable portions of naturally spawning hatchery fish (pHOS).

Another important aspect of this program is to educate school students through STEP activities about biology of salmonids, their critical life stages and special habitat requirements. It is assumed that the small number of unfed fry that will be released from STEP classroom incubators will have very negligible impacts to the native species in the respective basins.

1.9 and 1.10) List of program "Performance Standards" and "Performance Indicators" designated by "benefits" or "risks".

Indicator 1 – Harvest

Standard 1.1: Provide hatchery-produced winter steelhead for recreational harvest in such a way that impacts to naturally produced steelhead and coho populations are minimized during the winter steelhead sport fishery. **(Benefit)**

Indicator: Number of hatchery winter steelhead caught and number of angler days generated associated with this program. **(Benefit)**

Indicator: Estimated number or rate of naturally produced coho and naturally produced steelhead caught and released during winter steelhead fisheries. **(Risk)**

Standard 1.2: All hatchery juvenile steelhead will be externally marked. **(Benefit)**

Indicator: Mark rate by mark type for each release group. **(Benefit)**

Indicator: Pre-release quality checks indicate a minimum 95% retention of identifiable marks. **(Benefit)**

Indicator 2 – Life History Characteristics

Standard 2.1: Winter steelhead broodstock will be collected in a manner that approximates the distribution in timing, age, and size of stock 32 hatchery fish returning to Nehalem Hatchery. Jacks (one salt males) will be used in the brood when available. **(Benefit)**

Indicator: Temporal distribution of stock 32 adult winter steelhead returns and adults collected for broodstock. **(Risk - unknown)**

Indicator: Age distribution of stock 32 adult winter steelhead returns and broodstock spawned. **(Benefit)**
Indicator: Size at age distribution of stock 32 adult winter steelhead returns and broodstock spawned. **(Risk - unknown)**

Standard 2.2: Releases of stock 32 winter steelhead smolts will minimize impacts to naturally produced salmonids through control of hatchery release numbers and timing, which should minimize spatial and temporal overlap with natural populations. **(Risk)**
Indicator: Number of stock 32 winter steelhead smolts released. **(Risk)**
Indicator: Dates of stock 32 winter steelhead smolt releases. **(Risk)**
Indicator: Location of stock 32 winter steelhead smolt releases. **(Risk)**

Standard 2.3: All stock 32 winter steelhead smolts will be released as yearlings. **(Risk - unknown)**
Indicator: Beginning and ending dates of stock 32 winter steelhead smolt releases. **(Risk - unknown)**
Indicator: Size and length frequency of stock 32 winter steelhead smolts released. **(Risk - unknown)**

Standard 2.4: Stock 32 winter steelhead fry and/or fingerlings in excess of production needs will be released at times and locations that reduce impacts to naturally rearing salmonids. Any surplus fry or fingerlings may be released into standing water bodies, or may be destroyed. **(Benefit)**
Indicator: Location, number, and timing of stock 32 winter steelhead fry and fingerling releases. **(Benefit)**

<u>Indicator 3 – Genetic Characteristics</u>

Standard 3.1: Hatchery-produced adult winter steelhead spawning naturally in the North Fork Nehalem River and Necanicum River basins are consistent with the criteria defined in the CMP, **(Benefit)**
Indicator: Estimated abundance of naturally produced winter steelhead spawning naturally in the respective populations. **(Benefit)**
Indicator: Estimated abundance of naturally spawning winter steelhead in the respective populations that are of hatchery origin based on scales, marks or tags. **(Benefit)**

Standard 3.2: Only stock 32 winter steelhead, or adult returns from smolts released for this program, will be used as broodstock. **(Risk - unknown)**
Indicator: Location of broodstock collection. **(Risk - unknown)**
Indicator: Fin clips on fish collected for brood. **(Benefit)**

Standard 3.3: Stock 32 winter steelhead broodstock will be spawned following appropriate mating and spawning protocols to maintain genetic diversity of the population. **(Benefit)**
Indicator: Estimated number and ratio of males and females spawned. **(Benefit)**

Indicator: Matings will follow procedures as outlined and appropriate for the stock size, in the Hatchery Management Policy, Integrated Hatchery Operations Team (IHOT) fish health document, or as directed by ODFW staff. **(Benefit)**

Indicator 4 – Operation of Artificial Production Program

Standard 4.1: The Nehalem Hatchery winter steelhead program will be operated in compliance with the ODFW Hatchery Management Policy, Fish Health Management Policy, and IHOT fish health guidelines (IHOT 1994). See Attachment A. **(Benefit)**
Indicator: Number of broodstock sampled and pathogens detected. **(Benefit)**
Indicator: Rearing survival rates, egg to fry and fry to smolt. Results of fish health examinations. **(Benefit)**
Indicator: Detect fish health status of juveniles prior to release, and release only certified fish. **(Benefit)**
Indicator: Release of full-term smolts at the target size of 6 fish per pound. **(Benefit)**

Standard 4.2: Nehalem Hatchery effluent will comply with the conditions and water quality limitations identified in the current NPDES permit. **(Benefit)**
Indicator: Water samples collected and results reported. **(Benefit)**
Indicator: Results are within permit requirements. **(Benefit)**

Standard 4.3: Nehalem Hatchery water withdrawals will comply with NOAA Fisheries juvenile screening criteria. **(Benefit)**
Indicator: Screens inspected and are either in, or are brought into compliance. **(Benefit)**

Standard 4.4: Nehalem Hatchery stock 32 steelhead carcass placements for stream nutrient enrichment comply with guidelines for loading densities. **(Benefit)**
Indicator: Number and location of steelhead carcasses distributed. **(Benefit)**
Indicator: Examine carcass health and use only pathogen free carcasses. **(Benefit)**

Standard 4.5: Naturally produced steelhead, Chinook, coho, chum, and cutthroat that enter the Nehalem Hatchery adult trap are handled and released in a manner that minimizes stress, injury, mortality, and delay in migration. **(Risk)**
Indicator: Number of unmarked adult steelhead, Chinook, coho, chum, and cutthroat collected and released alive from the Nehalem Hatchery trap. **(Risk - unknown)**
Indicator: Number of unmarked adult steelhead, Chinook, coho, chum, and cutthroat mortalities at Nehalem Hatchery during operation of the hatchery adult trap. **(Risk)**
Indicator: Dates of trap operation and frequency of handling steelhead, Chinook, coho, chum, and cutthroat. **(Benefit)**

Standard 4.6: Releases of stock 32 winter steelhead smolts will limit predation impacts to naturally produced salmonids through control of hatchery release numbers and by minimizing spatial and temporal overlap of wild salmonid juveniles. **(Risk - unknown)**
Indicator: Location, dates, and sizes of stock 32 winter steelhead smolt releases. **(Risk - unknown)**

Indicator 5 - Socio-Economic Effectiveness

Standard 5.1: Estimated harvest benefits will equal or exceed hatchery production costs for stock 32 winter steelhead, based on the benefit-cost model in ODFW (1999), or an updated version of that model. **(Benefit)**

Indicator: Annual budget expenditures. **(Benefit)**

Indicator: Estimated harvest benefits. **(Benefit)**

1.11) Expected size of program.

The expected size of the program is 130,000 full term smolts for release annually. The smolts are scheduled for release as follows:
North Fork Nehalem River: 90,000 smolts
Necanicum River: 40,000 smolts
A small number of fry (≤4,000) may be released from STEP classroom incubators annually.

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

The program requires a minimum of 100 females and 100 males to meet broodstock needs. Additional adults may be collected if required to cover shortages resulting from, but not limited to, fecundity variation, early egg mortality, positive disease test, etc.

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

Table 1-1. **Proposed Annual Release Levels.**

Life Stage	Release Location	Annual Release Level
Eyed Eggs	N/A	N/A
STEP-Unfed Fry[1]	Nehalem River and/or Necanicum River, or tributaries	4,000 (STEP Classroom Incubator)
Fry	Standing Water	Excess to production, varies[2]
Fingerling	Standing Water	Excess to production, varies[2]
Yearling	North Fork Nehalem River	90,000
Yearling	Necanicum River	40,000

Data source: District files

[1] Releases of unfed fry from classroom incubators varies depending on the number of schools that may choose to become involved. Due to this variation, it is difficult to predict a "proposed" release level. For the last 12 years, few releases have occurred. However, interest in this program has been expressed by local educators. Release sites are typically in systems close to the participating school. Note: STEP releases prior to the 1992 brood year included extensive releases from in-stream hatchboxes. Data on those releases is available upon request.

[2] This program does not produce fry or fingerlings for release as a program goal for stock 32 winter steelhead. In any given year there may be surplus fry or fingerlings (typically from above average fry and fingerling survival). These will be released to standing water bodies.

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

Estimates of adult winter steelhead production from the Nehalem stock 32 hatchery winter steelhead program for the 1990-2001 brood years are presented in Tables 1-2 to 1-3. The

estimated number of adult hatchery winter steelhead produced was derived from a variety of data sources. The "Freshwater Sport" column is based on harvest card estimates of catch in the various basins. The harvest card estimates of catch were attributed to hatchery and wild fish and age classes based on average results from scales collected during the 1983-84 through 1991-92 fishery seasons. Since 1992 these areas have been managed for selective harvest of hatchery steelhead, based on the presence of a fin clip. The "Hatchery Return" column depicts the actual count of adult winter steelhead returns at Nehalem Hatchery, with the adult age composition based on the average of the 1983-84 to 1991-92 fishery scale data. Estimates of the number of hatchery winter steelhead (includes both 32 and 99 stocks) that escaped to natural spawning areas in the upper North Fork Nehalem River are available from 1998-99 through 2007-08 return years. Estimates ranged from 136 to 1,567 hatchery adults (Wiley, ODFW Research, unpublished data). Since the estimate of naturally spawning hatchery winter steelhead is only available since the 1998-99 return, and no age data is available, it is not included in Table 1-2 for ease of comparison with earlier years. No estimates of hatchery winter steelhead that strayed to other natural spawning areas (Necanicum River, mainstem Nehalem River basin) are available A minimum smolt-to-adult survival is calculated as the sum of the prior 3 columns divided by the "Smolt Release" columns. Stock 99 winter steelhead will no longer be used for broodstock as of the 2008-09 return-year.

Table 1-2. **Estimated adult winter steelhead produced by Nehalem Hatchery winter steelhead smolts (Stocks 32 and 99 combined) released in the Nehalem Basin, 1990 to 2001 Brood Years. n.a. = not available. Data in italics is incomplete, because it is missing 3-salt returns.**

Brood Year	Smolt Release	2-Salt Return Year	Estimated Adult Hatchery STW (2-salt + 3-salt)			
			Freshwater Sport [1]	Hatchery Return [2]	Spawning grounds	Smolt to Adult Survival
1990	147,198	1992-93	2,999	706	n.a.	2.52%
1991	158,856	1993-94	1,099	441	n.a.	0.97%
1992	139,227	1994-95	1,527	1,062	n.a.	1.86%
1993	151,887	1995-96	1,352	1,150	n.a.	1.65%
1994	95,135	1996-97	1,308	1,032	n.a.	2.46%
1995	98,286	1997-98	961	746	n.a.	1.74%
1996	92,747	1998-99	1,233	1,233	n.a.[3]	2.66%
1997	94,909	1999-00	1,466	1,040	n.a.[3]	2.64%
1998	87,215	2000-01	1,238	1,158	n.a.[3]	2.75%
1999	99,725	2001-02	2,280	2,484	n.a.[3]	4.78%
2000	98,195	2002-03	753	1,213	n.a.[3]	2.00%
2001	98,911	2003-04	*648*	1,791	n.a.[3]	2.47%

Data Source: HMIS, District files.

[1] Nehalem basin catch, based on harvest card returns. Hatchery/wild and age composition estimated, based on average of the 1983-84 to 1991-92 scale data.

[2] Used average age composition from fishery scales to assign age to Nehalem hatchery returns.

[3] Estimates of naturally spawning hatchery winter steelhead (32 and 99 stocks combined) are available for the upper North Fork Nehalem River. However, data is not available for all years, and no age data is available to assign brood years; therefore it is not included in this table.

Table 1-3. **Estimated Adult Winter Steelhead Produced by the Nehalem Hatchery Stock 32 Winter Steelhead Smolts Released in the Necanicum River, 1990 to 2001 Brood Years. n.a. = not available. Data in *italics* is incomplete, because it is missing 3-salt returns.**

Brood Year	Necanicum River Stock 32 Smolt Release	2-Salt Return Year	Estimated Adult Hatchery STW (2-salt + 3-salt)			
			Freshwater Sport *	Hatchery Return	Spawning grounds	Smolt to Adult Survival
1990	39,635	1992-93	1,334	n.a.	n.a.	3.37%
1991	50,061	1993-94	626	n.a.	n.a.	1.25%
1992	39,991	1994-95	639	n.a.	n.a.	1.60%
1993	40,388	1995-96	697	n.a.	n.a.	1.73%
1994	39,721	1996-97	721	n.a.	n.a.	1.82%
1995	41,786	1997-98	409	n.a.	n.a.	0.98%
1996	45,092	1998-99	417	n.a.	n.a.	0.92%
1997	40,005	1999-00	511	n.a.	n.a.	1.28%
1998	39,043	2000-01	621	n.a.	n.a.	1.59%
1999	39,991	2001-02	934	n.a.	n.a.	2.34%
2000	40,062	2002-03	403	n.a.	n.a.	1.01%
2001	39,992	2003-04	*288*	n.a.	n.a.	*0.72%*

Data Source: HMIS, District files

* Necanicum River catch, based on harvest card returns. Hatchery/natural and age composition based on average of Necanicum River 1983-84 to 1991-92 scale data.

1.13) Date program started (years in operation), or is expected to start.

Nehalem Hatchery replaced a prior hatchery located at Foley Creek (tributary of the Lower Nehalem River) which operated from 1926 to 1965. Available records indicate that steelhead production was relatively minor at that facility. The current facility became operational in 1966. The stock 32 winter steelhead program began in 1977 with steelhead taken from the North Fork of the Nehalem River.

The STEP program has been in place since 1981. Participation by local schools varies from year to year.

1.14) Expected duration of program.

The Nehalem Hatchery stock 32 winter steelhead program is an ongoing annual program. The hatchery winter steelhead program is expected to continue into the future.

The STEP program is ongoing, and eggs will be made available for classroom incubators if requested by program participants.

1.15) Watersheds targeted by program.

North Fork Nehalem River, a tributary of the lower Nehalem River.

Necanicum River, a tributary of the Pacific Ocean on the north Oregon coast.

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.

a) Recycling adult steelhead - Recycling adult steelhead through the sport fishery provides for increased angling opportunity and some level of harvest on hatchery fish. Recycled hatchery steelhead may interact with naturally produced fish if they are not caught or do not return to the hatchery after being recycled. The recycling program is very popular with anglers.
b) Straying of hatchery steelhead to natural spawning areas- Adult hatchery steelhead which are not caught and do not return to the hatchery interact with naturally produced steelhead populations on the spawning grounds. The ODFW's CMP criteria identify an allowable proportion of naturally spawning hatchery steelhead. The current conservative management approach seeks to minimize straying of hatchery steelhead to natural spawning areas where possible.

1.16.2) Potential Alternatives to the Current Program.

Alternative 1 - Reduce program size.
Description and Implications: This alternative would reduce the number of smolts released. The winter steelhead sport fishery in the North Fork Nehalem River and Necanicum River could be affected if the reduction resulted in fewer adults available to anglers. Any impacts of hatchery steelhead on native species would potentially be reduced also. Hatchery operating costs would decrease or applied to other programs.

Alternative 2 - Increase program size.
Description and Implications: This alternative would increase the number of smolts released. The winter steelhead sport fishery in the North Fork Nehalem River and/or the Necanicum River may be enhanced if the increase resulted in more adults available to anglers. Any impacts from stock 32 hatchery steelhead on listed species would potentially increase. Hatchery operating costs would increase to some extent. Increased adult returns would increase the workload of hatchery personnel to handle the additional fish.

Alternative 3 - Eliminate program.
Description and Implications: This alternative would eliminate the program. The popular consumptive winter steelhead sport fishery in the North Fork Nehalem would be eliminated in both rivers. Any impacts of stock 32 hatchery steelhead on listed species would be reduced or eliminated. Hatchery operating costs associated with the program would be eliminated. Allowing harvest of unmarked, naturally produced winter steelhead could be considered to provide consumptive fishery opportunity.

Alternative 4 - Eliminate recycling of adult steelhead.
Description and Implications: This alternative would eliminate this portion of the program. The consumptive winter steelhead sport fishery in the North Fork Nehalem River (no recycling occurs in the Necanicum River) would be reduced to some degree, depending on the number of adults recycled and their contribution. Any additional interactions of recycled hatchery steelhead with naturally produced fish would be eliminated. Adult hatchery fish could be transported to

standing waters to provide angling opportunity. Adult hatchery fish could be donated to local food bank programs or used for stream enrichment.

Alternative 5 - Incorporate unmarked fish into brood.
Description and Implications: Use of unmarked, naturally produced adults in the brood may enhance the gene pool of Nehalem Hatchery stock 32 winter steelhead. During the 1998-99 to 2007-08 run years, estimated abundance of naturally produced fish in the upper North Fork Nehalem River has ranged from 228 to 869 adults (Solazzi et al, 2003; Wiley, ODFW Research, unpublished data). Sufficient numbers of naturally produced fish may be available to meet genetic needs without excessive impact to natural populations; however, a recent evaluation of the potential use of wild broodstock in the North Fork Nehalem recommended that it be revisited during the development of the coastal winter steelhead conservation plan (NCWD, *unpublished report*).

Alternative 6 – Incorporate acclimation or tributary sites into the release strategy.
Description and Implications: This option would establish acclimation sites or utilize tributary releases on the North Fork Nehalem River and/or the Necanicum River. Fisheries could be enhanced if hatchery fish tend to linger near acclimation sites and are more susceptible to being caught. Homing to the hatchery trap on the North Fork Nehalem may be diminished. Impacts to natural populations would need to be assessed.

Alternative 7 – Eliminate the current stock 32 and begin a new program utilizing naturally produced adult winter steelhead from the North Fork Nehalem River.
Description and Implications: Use of unmarked, naturally produced adults as the source of brood would create a hatchery product more similar to North Fork Nehalem River winter steelhead. Stock 32 winter steelhead has been influenced to some degree by Big Creek (stock 13) winter steelhead. Although there was likely some use of North Fork Nehalem naturally produced steelhead in the brood prior to mass marking, none have been used in the last 13 years. During the 1998-99 to 2007-08 run years, estimated abundance of naturally produced fish in the upper North Fork Nehalem River has ranged from 228 to 869 adults (Solazzi et al. 2003; Wiley, ODFW Research, unpublished data). Sufficient numbers of naturally produced fish may or may not be available to utilize fish for a new program without excessive impact to the natural steelhead population. Utilization of naturally produced adults for brood would likely spread out the return of hatchery fish later into the spring, and would require operation of the hatchery trap longer than is currently done. A review of this alternative has recently been completed (NCWD 2008, *unpublished report*) and it was decided that it be revisited during the development of the coastal winter steelhead conservation plan.

Alternative 8 – Increase smolt production and expand release locations to include the mainstem Nehalem River and/or tributaries.
Description and Implications: This option would increase the number of smolts produced and expand the range hatchery steelhead releases to include the mainstem Nehalem River and/or tributaries (for example Cook Creek, Rock Creek). This alternative could include the development of a new broodstock source or the use of the existing stock 32. Expanding the range of releases could enhance sport angling opportunity and/or reduce angler crowding in current release streams. Expanding the range of releases could increase impacts to naturally

producing salmonid populations by increasing the interactions with hatchery winter steelhead. The level of increase in production and numbers of fish released and the location(s) of releases would have to be determined. Alternatively, production could remain the same, with releases spread into more basins.

Alternative 9 – Install a barrier (*i.e*. weir) at Nehalem Hatchery to allow removal of hatchery winter steelhead and limit their presence in the upper North Fork Nehalem River basin.
Description and Implications: A barrier facility would allow for the separation of hatchery and wild fish at the hatchery. Only naturally produced adults would be allowed upstream of the hatchery. This would necessitate handling of all fish migrating upstream past the hatchery. Workload associated with sorting hatchery winter steelhead from naturally produced fish in the hatchery trap would increase. Impacts to naturally produced fish from handling would increase. Any impacts to naturally produced salmonid populations from passing hatchery winter steelhead to the upper North Fork Nehalem River would be reduced or eliminated. Substantial cost would be associated with construction and maintenance of the barrier. The hatchery winter steelhead sport fishery would be confined to the North Fork Nehalem downstream from the hatchery. Adult traps in the upper North Fork Nehelam operated as part of the Life-Cycle Monitoring Project, currently capture some hatchery adults. These fish are either recycled to the fishery or they are used for stream enrichment.

Alternative 10 – Terminate Necanicum River releases.
Description and Implications: This alternative would eliminate hatchery winter steelhead releases in the Necanicum River basin. This would reduce or eliminate the consumptive winter steelhead fishery in the Necanicum River basin. Allowing harvest of unmarked, naturally produced winter steelhead could be considered to provide consumptive fishery opportunity. Any impacts from stock 32 hatchery winter steelhead on naturally produced fish would be eliminated. Hatchery operating costs would be reduced.

Alternative 11 – Develop a tributary release (with or without a recapture) facility in the Necanicum River basin.
Description and Implications: This alternative would provide a mechanism to separate hatchery fish from some natural spawning areas and/or trap and recycle or remove hatchery winter steelhead from the Necanicum River basin. Substantial cost could be involved to build and staff a trap facility. An adequate site would need to be located, and access secured. The number of naturally spawning hatchery winter steelhead in the Necanicum River basin could be reduced, or hatchery fish "black holed" to isolate from other spawning reaches. Any impacts from hatchery winter steelhead on naturally produced fish could be reduced. Additional fishery opportunity could result from recycling adult winter steelhead downstream and/or to lakes. Additional carcasses could be made available for donation to food banks or stream enrichment activities.

Alternative 12 – Expand fishery by shifting the timing of broodstock collection and egg take to promote return of hatchery adults over a broader time range.
Description and Implications: The program currently attempts to balance the number of fish collected from the first, middle, and end of the run to ensure a representative sample of the entire run. Because of the highly heritable nature of winter steelhead run-timing, it may be possible to protract the fishery by collecting a higher percentage of eggs at the beginning and end of the run.

This could eliminate the current problem of most fish returning over a very short time period, and provide anglers an opportunity to harvest fish over a longer time frame. Extending the return period later in the season could increase interaction among hatchery and wild fish on the spawning grounds
Note: The alternatives listed are draft. They are presented here as a forum for further discussion. This list is not exhaustive, other ideas are welcome. The alternatives listed may not represent final decisions by ODFW.

1.16.3) Potential Reforms and Investments.

a) Modify intake screening – Nehalem Hatchery intake screening does not currently meet NOAA Fisheries screening criteria. Modification of the intake will require increasing the size of the screen area and purchase of additional screens and framing. No cost estimate is currently available.

b) Construct recapture facility in Necanicum basin- Using a tributary release strategy could result in the need for a remote recapture facility. Location and cost would need to be determined, but could result in substantial capital costs up front, and long term investments in staff time to operate. No cost estimate is available at this time.
Note: The reforms and investments listed are draft. They are presented here as a forum for further discussion. This list is not exhaustive, other ideas are welcome. The reforms and investments listed may not represent final decisions by ODFW.

SECTION 2
PROGRAM EFFECTS ON ESA - LISTED SALMONID POPULATIONS

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

The HGMP for this hatchery program was submitted to NMFS on 06/26/2005 for approval and ESA coverage. This is an updated version of the previously submitted HGMP and consistent with the ODFW's Coastal Multi-Species Conservation and management Plan 2014.

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

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Oregon coastal Coho Salmon currently are listed under the ESA as *Threatened*. The program has no intent to directly take any ESA-listed Coho Salmon, but incidental and/or indirect take occur due to this program. Oregon coastal Coho Salmon inhabit the North Fork Nehalem River and Necanicum River basins and may be indirectly affected by the stock 32 winter steelhead program due to competitive interactions for food and space.

Necanicum Complex
The Necanicum Complex consists of Coho Salmon inhabiting the Necanicum River and a few small direct oceans tributaries to its south (Nickelson 2001). There is an estimated 70 miles of spawning habitat available to the coho salmon of this complex.

Nehalem Complex
The Nehalem Complex consists of Coho Salmon inhabiting the Nehalem Basin, one small direct ocean tributary to the north and a few to the south (Nickelson 2001). There is an estimated 470 miles of spawning habitat available to the coho salmon of this complex.

Coho Salmon Life History
Adult coho salmon migrate into fresh water in the fall to spawn. Spawning of wild Coho Salmon usually occurs from mid-November through February. Adult spawning Coho Salmon are typically 3 years old and are often accompanied by 2-year-old jacks (precocious males) from the next brood. Spawning occurs primarily in small tributaries located throughout coastal basins. The parents normally exhibit strong homing to their natal stream. The female digs a nest (redd) in the gravel and lays her eggs, which are immediately fertilized by accompanying adult males or jacks. The eggs are covered by digging and displacing gravel from the upstream edge of the nest. Each female lays about 2,500 eggs. The adults die soon after spawning. Sex ratios of spawning adults tend to average around 50:50 at most locations (Table 2-1). However, Moring and Lantz (1975) observed 77% males in three small Alsea River tributaries over a period of 14 years. They concluded that males tend to move around a lot and visit multiple streams. The eggs hatch in about 35 to 50 days, depending upon water temperature (warm temperature speeds hatching). The alevins remain in the gravel 2 or 3 weeks until the yolk is absorbed and then emerge as fry to actively feed in the spring. Most juvenile

coho salmon spend one summer and one winter in fresh water. The following spring, approximately one year after emergence, they undergo physiological changes that allow them to survive in seawater. They then migrate to the ocean as silvery smolts about 10 to 12 centimeters (cm) in length.

Table 2-1. **Observations of Coho Salmon Sex Ratio at Adult Traps.**

Population Complex	Percent Males	Percent Females	Location	Run Years	Data Source
Nehalem	52%	48%	North Fork trap	1998-1999	Life Cycle Monitoring
Siletz	50%	50%	Mill Creek trap	1997-1999	Life Cycle Monitoring
Yaquina	51%	49%	Mill Creek trap	1997-1999	Life Cycle Monitoring
Alsea	77%	23%	Drift Creek tributaries	1959-1972	Moring & Lantz (1975)
Alsea	50%	50%	Cascade Creek trap	1997-1999	Life Cycle Monitoring
Umpqua	55%	45%	Smith River trap	1999	Life Cycle Monitoring
Coos	63%	37%	South Coos River, Winchester Creek, and Fall Creek	1999	Oregon Plan Monitoring

The smolts undergo rapid growth in the ocean, reaching about 40 to 50 cm by fall. Little is known of the ocean migrations of coho salmon from Oregon coastal streams. However, based on what is known, it appears migrations are mostly limited to coastal waters. Initial ocean migration appears to be to the north of their natal stream (Fisher and Pearcy 1985; Hartt and Dell 1986). After the first summer in the ocean, a small proportion of the males attain sexual maturity and return to spawn as jacks. Migration patterns during the fall and winter are unknown. Those fish remaining at sea grow little during winter but feed voraciously during the next spring and summer, growing to about 60 to 80 cm in length. During this second summer in the ocean, a substantial percentage of these maturing adults are caught in ocean troll and sport fisheries, usually to the south of their natal stream (Lewis 2000). The survivors return to their home streams or neighboring streams where they spawn and die to complete the life cycle.

Habitat Use and Freshwater Distribution

Spawning and rearing of juvenile coho salmon generally take place in small low gradient (generally less than 3%) tributary streams, although rearing may also take place in lakes where available. Coho salmon require clean gravel for spawning and cool water temperatures (53° to 58°F preferred, 68°F maximum) for rearing (Reiser and Bjornn 1979). Fry emerge from February to early June (Moring and Lantz 1975) and occupy backwater pools and the stream margins (Mundie 1969; Lister and Genoe 1970; Nickelson et al. 1992a).

During summer, coho prefer pools in small streams; whereas during winter, they prefer off-channel alcoves, beaver ponds, and dam pools with complex cover (Nickelson et al. 1992a, 1992b). Habitat complexity, primarily in the form of large and small wood is an important element of productive coho salmon streams (Nickelson et al. 1992b; Rodgers et al. 1993). Little is known about residence time or habitat use of estuaries during seaward migration. It is usually assumed that coho salmon spend only a short time in the estuary before entering the ocean. However, recent research finding is that rearing in the upper ends of tidal reaches can be extensive.

The distribution of coho salmon within a basin is primarily determined by two factors: marine survival, and the distribution of freshwater habitat of different levels of quality. When marine survival has been very poor as in recent years, coho will be found in only the highest quality habitats. Coastwide, these habitats comprise about 22% of the habitat (Nickelson 1998). When marine survival increases, as could occur with a changing climate regime, coho will redistribute into freshwater habitats of lower quality. Thus Coho Salmon population dynamics function with a classic "source-sink" relationship among stream reaches.

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

This steelhead hatchery program has no intent to directly take any ESA-listed Coho Salmon. Oregon coast steelhead populations are considered a "*Species of Concern*" and may also be affected by this program.

- Identify NMFS ESA-listed population(s) that will be <u>incidentally</u> affected by the program.

Incidental take of listed Coho Salmon may occur due to steelhead brood collection. Also, the listed Coho Salmon may be indirectly affected through competitive interactions for food and space between hatchery fish and listed coho within the program areas (Nehalem and Necaninum rivers). Water withdrawal due to hatchery operations may have indirect impacts on coho population in the Nehalem River.

2.2.2) Status of 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.

Necanicum Complex

The Necanicum Complex consists of Coho Salmon inhabiting the Necanicum River and a few small direct oceans tributaries to its south. There is an estimated 70 miles of spawning habitat available to the Coho Salmon of this complex. The critical population level for the Necanicum Complex is 300 adult spawners (Nickelson, 2001), and the spawner abundance was always above the critical threshols during 2003-2015.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of data.

The abundance of Coho Salmon spawners of the Necanicum Complex has ranged from about 400 to about 5,700 and has averaged about 2,050 since 2003 (Figure 2-1 and Table 2-2). Spawner abundance did not fall below the critical threshold of 300 fish during that period.

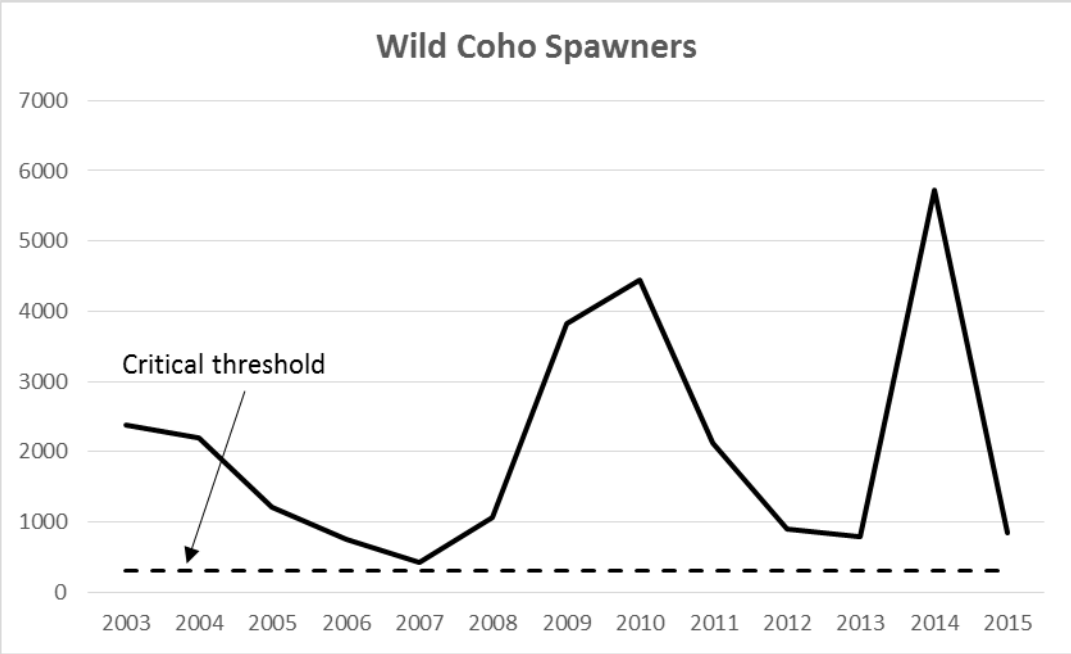

Figure 2-1. Trend in adult wild coho spawner abundance relative to the critical population level for the Necanicum Complex, 2003-2015.

Table 2-2. Population Parameters of Coho Salmon showing recruit per spawner for the Necanicum Complex, 2003-2015.

Year	Wild Spawners	Hatchery Spawners	Percent Hatchery Spawners	Pre-harvest Wild Population	Recruits Per Spawner
2003	2,377	158	6%	2,584	7.2
2004	2,198	141	6%	2,381	0.5
2005	1,218	34	3%	1,274	0.6
2006	750	93	11%	812	0.3
2007	431	33	7%	489	0.2
2008	1,055	128	11%	1,075	0.9
2009	3,827	42	1%	4,102	5.5
2010	4,445	0	0%	4,654	10.8
2011	2,120	39	2%	2,253	2.1
2012	902	0	0%	1,104	0.3
2013	798	0	0%	931	0.2
2014	5,727	98	2%	6,690	3.2
2015	847	0	0%	1,057	1.2
Avg.	**2053**	**59**	**3.7%**	**2,262**	**2.5**

Smolt production in Necanicum complex was estimated for the 1997 through 1999 broods. Estimated smolt abundance ranged from 15,000 to 55,000 for the Necanicum Complex (Table 2-3).

Table 2-3. **Estimates of Abundance of Juvenile Life Stages Based on Spawner Abundance.**

Population Complex	1997 Brood (millions)				1998 Brood (millions)				1999 Brood (millions)			
	Eggs	Fry	Parr	Smolts	Eggs	Fry	Parr	Smolts	Eggs	Fry	Parr	Smolts
Necanicum	0.316	0.206	0.045	0.015	1.183	0.769	0.232	0.055	0.885	0.575	0.113	0.031
Source: Nickelson (2001).												

- Provide the most 12 year progeny-to-parent ratios, survival data by life stge, or other measures of productivity for the listed population. Indicate the source of data.

Recruits per wild spawner in Necanicum complex have been highly variable, with seven of the last thirteen broods falling to one or below (Table 2-2 above and Figure 2-2 below).

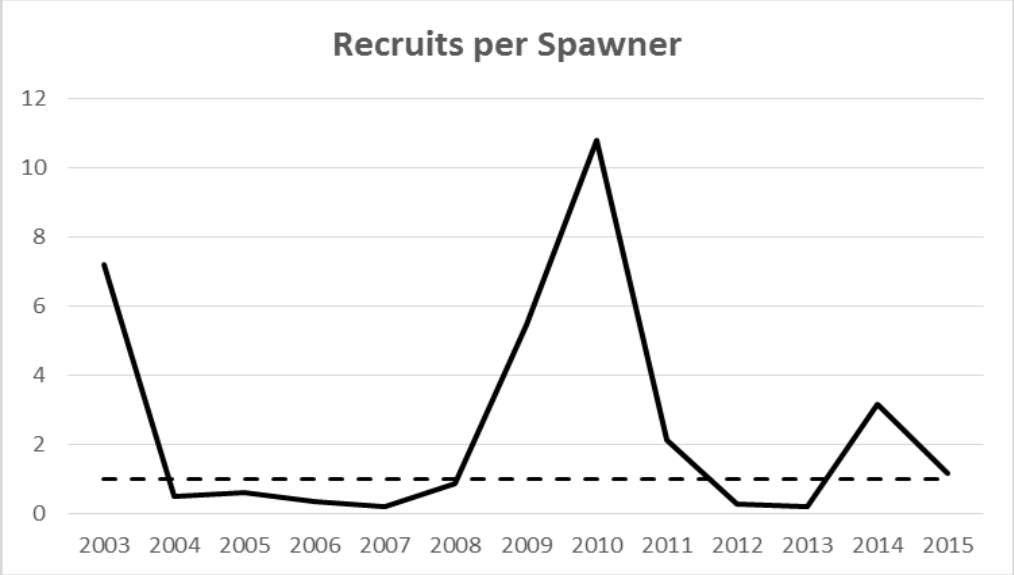

Figure 2-2. Trends in Recruits per Spawner for Necanicum Complex Wild Coho Salmon, 2003-2015.

- Provide the most recent 12 year estimates of annual proportions of direct hatchery-origin fish and listed natural-origin fish on natural spawning grounds, if available.

Hatchery fish have been observed on the spawning grounds. Hatchery spawners have comprised from 0-11% of observed spawners since 2003 (Table 2-2). No data is available for progeny of naturally spawning hatchery coho rearing in the wild.

Nehalem Complex

-Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

The Nehalem Complex consists of Coho Salmon inhabiting the Nehalem Basin, and small direct ocean tributaries to the north and south. There is an estimated 470 miles of spawning habitat available to the coho salmon of this complex. The critical population level for the Nehalem complex is 1,900 adult spawners. The habitat of this complex has the potential to support a viable population because high quality habitat is estimated to be present in 110 miles of stream, well above the 15-mile threshold (Nickelson 2001).

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of data.

The population of wild Coho Salmon spawners of the Nehalem Complex has ranged from about 3,000 to about 32,500 and has averaged about 16,539 since 2003 (Figure 2-3 and Table 2-4). In none of those years did spawner abundance fall below the critical threshold of 1,900 fish.

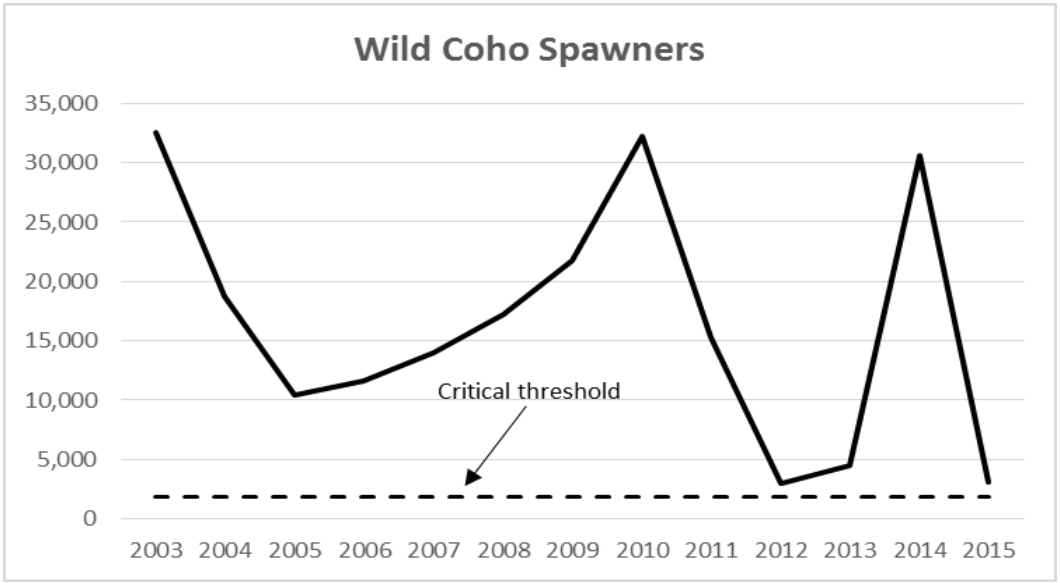

Figure 2-3. Trend in adult wild Coho Salmon spawner abundance relative to the critical population level for the Nehalem Complex, 2003-2015.

Table 2-4. Population Parameters of Coho Salmon showing recruit per spawner for the Nehalem Complex, 2003-2015.

Year	Wild Spawners	Hatchery Spawners	Percent Hatchery Spawners	Pre-harvest Wild Population	Recruits Per Spawner
2003	32,517	284	1%	35,345	2.4
2004	18,736	89	0%	20,299	0.9
2005	10,451	0	0%	10,932	0.6
2006	11,614	1202	9%	12,569	0.4
2007	14,033	425	3%	15,910	0.8
2008	17,205	0	0%	17,538	1.7
2009	21,753	1740	7%	23,315	2.0
2010	32,215	837	3%	33,733	2.4
2011	15,322	64	0%	16,283	0.9
2012	2,963	0	0%	3,627	0.2
2013	4,539	0	0%	5,296	0.2
2014	30,577	764	2%	35,721	2.3
2015	3,079	0	0%	3,844	1.3
Avg.	**16,539**	**416**	**2%**	**18,032**	**1.2**

Results of past surveys in the North Fork Nehalem suggested little natural production of Coho Salmon was taking place in that subbasin, which was heavily influenced by hatchery fish. However, since the North Fork above Waterhouse Falls became a Life-Cycle Monitoring Site in 1998 (Solazzi et al. 2000) and all of the hatchery fish are now marked, we have found that significant natural production is occurring. Wild adult spawning population estimates are presented in (Table 2-5). From 2002-2007, most hatchery fish captured in the Waterhouse Falls trap were removed from the system, except for a small percentage that were passed for research purposes (*i.e.* Life Cycle Monitoring Project). Since 2007, all hatchery coho trapped have been removed from the system. As a result, the proportion of hatchery fish in the spawning population above the falls, based on the ratio of hatchery to wild fish trapped, has been substantially reduced (from an average of 31% down to an average of 14%). Another factor in the reduced number of hatchery fish on the spawning grounds is the reduction in smolt releases from Nehalem Hatchery from 800,000 to 100,000.

Estimated wild smolt production in the North Fork has been 19,000-37,000 during the 2007-2013 brood years (Table 2-6). Estimates of smolt production for the entire Nehalem Complex for the 1997-1999 broods range from about 200,000 to about 400,000 (Table 2-6).

Table 2-5. **Summary of Life-Cycle Monitoring for the North Fork Nehalem River, 2007-2015.**

Brood Year	Estimated Egg Deposition	Smolts Produced	Returning Adults			Freshwater Survival	Marine Survival
			Males	Females	Total		
2007	1,459,170	29,044	2,431	2,595	5,026	2.0%	17.9%
2008	4,176,504	27,106	1,437	1,269	2,706	0.6%	9.4%
2009	2,898,252	20,553	205	184	389	0.7%	1.8%
2010	9,083,940	37,852	686	596	1,282	0.4%	3.2%
2011	3,797,696	30,035	3,527	3,163	6,690	0.8%	21.1%

2012	492,536	19,228	466	317	783	3.9%	3.3%
2013	1,895,418	30,778	N/A	N/A	N/A	1.6%	N/A
2014	11,878,440	N/A	N/A	N/A	N/A	N/A	N/A
2015	953,418	N/A	N/A	N/A	N/A	N/A	N/A
Source: ODFW Life Cycle Monitoring files.							

Table 2-6. **Estimates of Abundance of Juvenile Life Stages Based on Spawner Abundance.**

Population Complex	1997 Brood (millions)				1998 Brood (millions)				1999 Brood (millions)			
	Eggs	Fry	Parr	Smolts	Eggs	Fry	Parr	Smolts	Eggs	Fry	Parr	Smolts
Nehalem	1.466	0.953	0.587	0.198	1.488	0.967	0.595	0.201	4.350	2.828	1.151	0.389
Source: Nickelson (2001).												

- Provide the most 12 year progeny-to-parent ratios, survival data by life stge, or other measures of productivity for the listed population. Indicate the source of data.

Recruits per wild spawner have been highly variable, with seven of the last thirteen broods falling below one (Table 2-4 above and Figure 2-4 below).

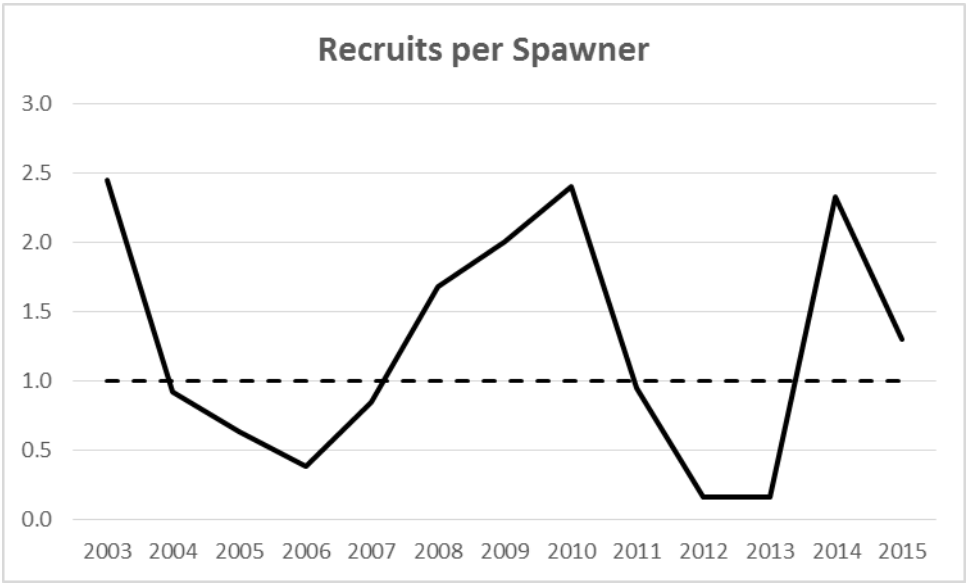

Figure 2-4. Trends in Recruits per Spawner for Nehalem Complex Wild Coho, 2003-2015.

- Provide the most recent 12 year estimates of annual proportions of direct hatchery-origin fish and listed natural-origin fish on natural spawning grounds, if available.

Hatchery strays have not been comprised of a significant portion of the spawning population in recent years. Less than 10% of the Coho Salmon sampled on spawning ground surveys have been of hatchery origin, with an average of 2% since 2003 (Table 2-4 above). The majority of hatchery spawners tend to be in the North Fork Nehalem. No data is available for progeny of naturally spawning hatchery coho rearing in the wild.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels 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.

Hatchery adult trapping - Adult steelhead are trapped at Nehalem Hatchery from November through February or early March annually. The hatchery trap is usually shut down at the end of February (sometimes early March) at the end of the hatchery steelhead return.

Naturally produced Coho Salmon may be handled if they enter the trapping facility. Unmarked Coho Salmon (and unmarked steelhead, Chinook Salmon, and Cutthroat Trout) trapped are passed above the hatchery facility. Handling mortality may occur during this process, although no mortalities have been observed.

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

Data on past take is shown for return years 1998-99 to 2007-08 and is provided in Table 2-7. The 1998-99 run-year was the first year that returning hatchery coho adults were mass marked and could be differentiated from naturally produced coho. Note: Nehalem Hatchery traps multiple stocks of fish during the trapping period. The unmarked coho trap figures presented (Table 2-7) are not cumulative take but are total take for the trapping season (all stocks combined).

Table 2-7. **Number of unmarked coho salmon collected at Nehalem Hatchery.**

Return Year	Unmarked Coho[1]
1998-99	119
1999-00	44
2000-01	147
2001-02	206
2002-03	176
2003-04	228
2004-05	70
2005-06	173
2006-07	191
2007-08	27

Data Source: HIMS; hatchery files.
[1] includes jacks.
Note: The unmarked coho trap figures are not cumulative take but are total take for the trapping season. Collection occurs during trapping of coho and winter steelhead. The number of unmarked coho handled represents a season total, and is not additive to numbers presented in other HGMP's.

- 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).
See Table 2-8 below.

Table 2-8. **Estimated Listed Salmonid Take Levels by Hatchery Activities.**

Listed Species Affected:	**Coho Salmon**	**ESU/Population:**	**Oregon Coast Coho ESU**	**Activity:**	**StW Trapping**
Location of Hatchery Activity:	**Nehalem Hatchery and Necanicum River Research Activities**	**Dates of Activity:**	**Nov. 15 – March 15**	**Hatchery Program Operator:**	**ODFW**

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)			20	
Collect for transport b)				
Capture, handle, and release c)		0-100	0-600*	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			0-110	
Intentional lethal take f)				
Unintentional lethal take g)		<10	<10**	
Other Take (specify) h)				

a) Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b) Take associated with weir or trapping operations where listed fish are captured and transported for release.
c) Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d) Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e) Listed fish removed from the wild and collected for use as broodstock.
f) Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g) Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h) Other takes not identified above as a category.

*** Unmarked, naturally produced coho adults trapped not used for brood are passed upstream of the hatchery facility. Wild coho are passed upstream of the research trap in the Necanicum basin.**
**** No direct mortalities have been observed during trap and pass operations.**
Note: The take figures are not cumulative take but are total take for the trapping season. Collection occurs during trapping of coho and winter steelhead. The number of unmarked coho handled represents a season total, and is not additive to numbers presented in other HGMP's.

- 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.

The Nehalem Hatchery trap facility and handling procedures will be modified immediately if take of naturally produced coho is exceeding, or is projected to exceed, levels specified in this HGMP, and appears to be related to operation of the facility. This may include, but is not limited to, additional staff training or review of proper procedures, trap modifications, cessation of trapping, modified operation by hatchery personnel, etc.

SECTION 3

RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

- **Native Fish Conservation Policy** - The Oregon Fish and Wildlife Commission has approved the Native Fish Conservation Policy (NFCP). The NFCP requires the development of a conservation plan for each native stock within the species management unit (SMU), which was completed in 2014 and is described below.

- **Fish Hatchery Management Policy (FHMP)** – This policy provides guidance for the responsible use of hatchery-produced fish. It outlines the best management practices for hatchery programs to ensure conservation and management of both naturally produced native fish and hatchery produced fish **i**n Oregon. The FHMP calls for the development of Hatchery Program Management Plans (HPMPs) to outline the hatchery practices that will be followed for each hatchery program. A HPMP may be a Hatchery and Genetic Management Plan (HGMP) or an aspect of conservation plan developed under the Native NFCP.

- **Coastal Multi-Species Conservation and Management Plan** – This plan addresses conservation and management of anadromous salmonids (salmon, steelhead and trout) on the Oregon coast from Cape Blanco to Seaside. The CMP is unique from other conservation plans in that it addresses both conservation and utilization of six distinct groups of fish species, none of which are listed under the ESA. In addition to meeting requirements of the Native Fish Conservation Policy, the CMP provides long-term management direction for species which are relatively healthy, with the intent to help ensure the continued existence of wild fish and the fisheries which wild and hatchery fish support.

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

Oregon Plan for Salmon and Watersheds, Governors Executive Order EO 99-01: The Oregon Plan for Salmon and Watersheds is a prescriptive set of measures for recovering threatened and endangered salmon and steelhead, and meeting federal water quality standards, established by Executive Order of the Governor. The Oregon Plan includes measures linked to the hatchery production of winter steelhead in the Nehalem and Necanicum watersheds, including nutrient enrichment, acclimation and other separations of hatchery and natural production, and monitoring of hatchery and naturally produced runs.

NPDES Permit: The Nehalem hatchery is operated under the NPDES 300-J general permit to maintain environmental standards of hatchery effluents.

3.3) Relationship to harvest objectives.

Nehalem stock 32 hatchery winter steelhead are mass marked as a means of integration of hatchery and harvest management. Mass marking will allow for selective harvest of hatchery fish while requiring release of all wild fish. Mass marking will also allow for better monitoring and control of impacts of the hatchery program on wild steelhead populations. Incidental take of naturally produced Nehalem and Necanicum basin coho in harvests is limited by the ESA Section 4(d) rule. The 4(d) rule requires development of Fishery Management and Evaluation Plans (FMEP). Such plans are under development and will be guided by the Pacific Coast Salmon Plan, specifically Amendment 13 (Pacific Fisheries Management Council [PFMC] 1999). Under recent conditions of marine survival and abundance, the allowable impact has ranged from 8-30% of the total pre-harvest Oregon Coast ESU natural coho abundance. Take could increase if conditions improve (PFMC 1999). This standard is adopted as adequate for controlling incidental harvest impacts in this plan, pending completion of FMEP's. All further address of harvest impacts will occur under the FMEP's. Estimated harvest impacts (ocean and freshwater combined) on naturally produced coho for the period 1994 through 1999 averaged 9.2% and ranged from 6.8% to 12.4% (PFMC 1999).
The winter steelhead artificial production program is designed to minimize biological impacts to naturally produced fish species. Likewise, fish culture practices are designed and carried out to rear full-term smolts to limit impacts to naturally rearing fish species.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1990-2001), if available.
Freshwater sport fisheries in the North Fork Nehalem River and the Necanicum River benefit from this program. Sport fisheries are selective for hatchery steelhead, thus this program supports the only consumptive harvest opportunity for winter steelhead in these basins. Recent harvest data is presented in Tables 1-2 to 1-3.

3.4) Relationship to habitat protection and recovery strategies.

This harvest augmentation program is not directly related to habitat protection or recovery. It is designed to provide hatchery winter steelhead for harvest in freshwater fisheries, while other actions are taken to protect and restore habitat. Management of the hatchery program will focus on attaining harvest objectives using methods that minimize impacts to naturally produced fish and their habitats.
Major factors affecting natural production in the North Fork Nehalem River and the Necanicum River are unknown. However, it is suspected that ocean survival may be the largest contributing factor. In general, habitat condition in these basins is slowly improving. A significant portion of the upper Nehalem Basin was severely impacted from a series of forest fires in the mid-1930's, collectively known as the "Tillamook Burn". These fires impacted fish habitat through loss of shade, increased sedimentation, and loss of stream complexity. The basin is recovering to a forested condition with shade and sedimentation impacts greatly reduced. Dominant land use in the basins in which this program operates is industrial forestland and agriculture. Recent changes to regulations governing these activities should improve water quality and reduce sedimentation in streams. Unfavorable natural events (flooding) are common in the basins and can have detrimental effects on egg depositions and juvenile rearing. However, these events also provide some long term benefits in the form of gravel and large woody debris recruitment.

Habitat restoration projects over the past 25 years on state and private lands, have begun to address in-stream complexity concerns. Fish passage structures believed to impede migrations (primarily culverts) are being evaluated on most county, state, and privately owned lands. Major highways and county road systems have been inventoried and priority ranked. Some sites have been addressed and others are in various planning stages; however, all are subject to funding availability. Oregon fish passage laws require fish passage to be addressed at all impediments to passage. As such, fish passage in these basins is likely to continue to improve over time.

3.5) Ecological interactions.

(1) Species that could negatively impact program

Competition for food between stock 32 hatchery winter steelhead smolts and other salmonids (naturally produced and hatchery) in release streams, estuaries, and near shore ocean environment may negatively impact this program. Avian and marine mammal predation may negatively impact this program also.

(2) Species that could be negatively impacted by program

Competition for food and/or predation by stock 32 winter steelhead smolts and naturally produced salmonid juveniles in release streams, estuaries, and near shore ocean environment may negatively impact naturally rearing salmonids. Large concentrations of hatchery reared fish may attract predators, which may cause increased predation on naturally produced salmonid juveniles. Handling of naturally produced adult coho and steelhead during hatchery broodstock collection may negatively impact those populations. Angling pressure on

hatchery steelhead may cause incidental mortality of naturally produced steelhead and Coho Salmon.

(3) Species that could positively impact program

Increased abundance of naturally produced adult salmonids, primarily Chinook and coho salmon, and their eventual death after spawning, will increase stream nutrient levels and biomass productivity which may positively impact the program. Use of hatchery salmon or steelhead carcasses for stream enrichment activities will further enhance this nutrient base and positively influence the steelhead program.

(4) Species that could be positively impacted by program

Hatchery winter steelhead carcasses are used in stream enrichment activities. The nutrients provided by these carcasses will benefit salmonid and non-salmonid fishes in the streams where the carcasses are placed.

General Information

Interactions between migrating hatchery winter steelhead smolts and naturally produced coho salmon are likely to be minimal. Steelhead are reared to smolt size and expected to migrate upon, or soon after release. Smolt releases occur at or downstream of the hatchery facility (North Fork Nehalem) or in mainstem river or selected tributary location(s) (Necanicum River). Target release size is 6 fish per pound with release timing of late March to mid-April. All hatchery release groups are sampled and disease tested by ODFW fish health staff and cleared before release. It is possible that some smolts may residualize after release, but it is anticipated that interactions with naturally rearing salmonids are minimal based upon their species-specific rearing and life history characteristics. Furthermore, unfed fry and fingerlings from hatchery production are released into locations (standing water) that are unlikely to overlap with rearing fry/fingerling of listed species.

ODFW conducts steelhead spawning surveys across north coast basins annually. Surveys are designed to sample across the north coast strata, and are not applicable to the population scale. Therefore, no population specific estimate of the proportion of hatchery steelhead spawning naturally is available. Observations of hatchery steelhead (based on adipose fin-clips observed on live fish and carcasses) during spawning surveys has averaged about 11% since 2003. However, steelhead hatchery releases were modified in 2015 with the implementation of the Coastal Multi-Species Management Plan. Thus, in the future the proportion of hatchery fish may differ from the previous surveys. No data will be available for several years until returns include all year classes from these modified hatchery releases. Origin (summer or winter) of live hatchery steelhead observed cannot be determined (and few carcasses are recovered), so no data is available specific to the composition of summer vs. winter hatchery steelhead that are spawning naturally.

STEP Program

ODFW has had a Salmon and Trout Enhancement Program in place and operational since 1981. A portion of the program (STEP hatchbox program) is the incubation of eggs and release of unfed fry by public participants. Egg requests are handled as part of annual

hatchery production operations. Early stage eyed eggs are given to volunteers for incubation in classroom incubators. Direct stream releases are made when fish are in the late "button-up" stage. Typically, releases are directed into locations that are close to participating schools.

Habitat Above Hatchery Facilities

NORTH FORK NEHALEM RIVER

The North Fork Nehalem River and some tributaries met several of the benchmarks for general quality salmonid habitat when ODFW Aquatic Habitat Inventory surveys were conducted in the mid 1990's (Johnson and Maser, 1999). There are approximately 40 miles of anadromous (primarily Chinook, coho, steelhead, and cutthroat) fish habitat available upstream of Nehalem Hatchery (Dalton, ODFW Research, personal communication). Although relative pool area and frequency met the benchmark goals, habitat complexity was lacking in many areas. In-stream large wood volume was at or above benchmark values in many reaches; however the number of key pieces was low. Spawning gravel abundance is generally sufficient, but the presence of fine sediments in surveyed reaches generally exceeded benchmark values.

The majority of the North Fork Nehalem basin above the hatchery is located in industrial forestland. Younger age forest habitat dominates the landscape. Riparian areas generally did not meet the desired benchmark values.

ODFW has worked cooperatively with the major landowner(s) in the basin on habitat enhancement projects and will continue to conduct habitat enhancement projects in conjunction with timber management operations.

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.

Nehalem Hatchery has a water right for 0.22 cubic feet per second (cfs) of pathogen-free spring water for incubation and early rearing. The spring is located approximately 900 feet from the incubation facility, and water is delivered by gravity flow through an underground pipeline. There are no fish living within the spring water system. Availability of spring water is limited by winter and spring rainfall. North Fork Nehalem River water can be pumped for incubation and early rearing during times of insufficient spring water supply.

Rearing ponds are supplied with North Fork Nehalem River water by pumping (hatchery water right is 22.3 cfs). Water temperatures, in degrees Fahrenheit, are usually in the 40- to 50-degree range during winter and 50- to 65-degree range in summer. River water contains a variety of pathogens and becomes turbid several times annually making it not well suited for incubation and early rearing. River water availability can be limited by low flows, usually from July through September. Naturally produced coho are present in this water source. The facility is in compliance with water rights, water withdrawals, and annual water uses reporting to Oregon Water Resource Department.

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.

Nehalem Hatchery currently operates and discharges effluents under a NPDES 0300J permit as required by the DEQ. The hatchery is in compliance with the requirements of the permit. The hatchery takes water samples during each quarter of the year. The samples are collected during the month of heaviest production in each quarter. Settleable solids (SS) and total suspended solids (TSS) are sampled for normal operations and cleaning operations. Individual samples, evenly spread over the day, are taken and combined to form a composite sample. Contents from the composite sample are used to measure SS and TSS. The Nehalem Hatchery does not have a pollution abatement settling pond. To comply with the permit limits, it uses a vacuum to remove solids from pond bottom and minimizes discharge of solid wastes to receiving stream. Chemically treated waste waters are sufficiently diluted as per label instructions for safe disposal. The facility is in compliance with the NPDES permit's monitoring and reporting requirements, to maintain the effluent water quality standards.

Intake screening for the main hatchery water supply from the North Fork Nehalem River at Nehalem Hatchery currently does not comply with NOAA criteria. This problem has been identified through the ODFW Fish Screening and Passage Program. To date, no funding is available to modify the facilities to meet NOAA criteria. Long term plans include upgrading the screens when funding has been secured. Intake screening on the spring water source used for incubation does not meet NOAA criteria either. However there are no fish present in the spring system.

SECTION 5
FACILITIES

Adult collection, spawning, egg incubation, juvenile rearing, and release facilities associated with the Nehalem Hatchery winter steelhead program are currently located at Nehalem Hatchery. A recapture facility may be developed in the Necanicum River in the future. Returning adult hatchery steelhead are also collected at two trapping sites on the North Fork Nehalem River as part of an Oregon Plan for Salmon and Watersheds (OPSW) life-cycle monitoring program. The adult hatchery steelhead at the trap site may be tagged and passed upstream as part of this research, tagged and recycled downstream, transported back to the hatchery for processing, or used for stream enrichment. Since these traps are not part of the hatchery program, they are not included in the details below [see Solazzi et al. (2003) for further information on these adult traps]. The existing hatchery facilities are described below.

5.1) Broodstock collection facilities (or methods).

The Nehalem Hatchery trap is located in the North Fork Nehalem River watershed approximately 12 miles east of Nehalem off Highway 53 (RM 10.3). The adult trap is located at the hatchery and is supplied with outflow water from the raceways as an attractant. The hatchery relies on fish voluntarily swimming up a fish ladder, through a v-notched weir, and into the adult trap. An old weir footing spans the North Fork Nehalem River at the entrance to the fish ladder, however the weir is no longer in place. The footing is not a barrier to upstream or downstream migration. No description of a recapture facility in the Necanicum basin is available at this time as that concept/strategy is still under development.

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

Broodstock are collected and held in the Nehalem Hatchery trapping/holding facility. All off-station transfers are done with the use of a large liberation truck or a portable liberation tank (see description below).

The transfer of juvenile fish on station (from one pond to another) is usually done with a liberation truck. Juvenile fish are dip-netted and hand weighed to determine the average number of fish per pound. Juveniles are then weighed, via water displacement, and counted as they are loaded on a liberation truck. The fish are then released from the truck into another raceway through liberation hoses. Occasionally, fish may be transferred from one pond to another through an irrigation type pipe when being moved to an adjacent pond.

Carcasses for stream enrichment are transported in plastic totes in the back of full size pickup trucks or on a trailer. Haul time varies depending on the location, but is usually less than 2 hours.

Adult fish are transported in liberation trucks similar to those used for juveniles (described in Section 10.5), or in a portable liberation tank carried in a full-size pickup truck. Liberation trucks are typically 1,000-2,500 gallon capacity units, either mounted on a large flatbed truck, or a tanker style truck. The liberation trucks are usually equipped with oxygen diffusing systems, water re-circulation pumps, and dissolved oxygen meters. The portable liberation tank is carried in the back of a pickup truck, has a

capacity of 300 gallons of water, and is equipped with an oxygen diffusion system and circulation pump.

Larger numbers of trapped naturally-produced adult fish to be passed upstream of the hatchery are transported in a portable liberation tank to a release pipe about 200 feet upstream of the hatchery weir. Smaller numbers of fish are hand carried in a soft net and released above the pump intake structure near the trap.

Adult fish passed upstream of the hatchery are transported a short distance and returned to the river at the upstream end of the hatchery grounds. Adult fish recycled downstream are transported less than 10 miles, with a haul time generally less than 20 minutes. Adult fish recycled to lakes are transported various distances, depending on the lake chosen. Haul time is generally no more than 2 hours.

5.3) Broodstock holding and spawning facilities.

The adult holding area consists of a large in-ground concrete pond measuring 2 feet wide, 50 feet long, and 5 feet deep with a water depth of 3 feet. Metal railings above the pond prevent fish from jumping out. The adult holding area is segregated with vertical metal bar dividers. Each pen has the capacity to hold approximately 100 fish.

5.4) Incubation facilities.

Egg incubation is conducted in the main hatchery building. There are 19 stacks of vertical incubator trays (16 trays per stack) with a total capacity of approximately 1.7 million eggs to hatching. Water flow is about 5 gallons per minute (gpm) to each stack. Multiple stacks are utilized for the stock 32 winter steelhead program.

Incubation of eggs for the STEP classroom projects is done in small aquariums with a natural substrate bottom. Systems usually have a standard aquarium pump and filter setup. Temperature control is accomplished by insulation around the tank and the addition of bottles of frozen water as needed. Some classrooms are equipped with chiller units which maintain a constant temperature. Water is partially changed on a regular basis to keep it “fresh”.

5.5) Rearing facilities.

The hatchery uses Canadian style troughs as starting tanks. The hatchery also has four 6 feet circular fiberglass tanks, and four 5 feet circular fiberglass tanks that can also be used for starting tanks, although these are not currently used.

After fry have absorbed the yolk sack they are reared in two fiberglass Canadian style troughs. The Canadian troughs are 21’x 32”x 24”, with a volume of 658 gallons of water. As the fish grow, they are further distributed into four Canadian troughs.

Once the juvenile steelhead reach the rearing capacity of the Canadian troughs they are transferred to concrete raceways. All raceways are in-ground and measure 75 feet long, 16 feet wide, and 4 feet deep, with a typical water depth of 3 feet (3,825 cubic feet of water). The raceways are modified burrows ponds. As such, they have a solid center wall down the length of the pond, except for 8 feet at the head and tail ends of the pond. Thus, each pond can be divided lengthwise into 2 raceways by blocking the openings at the head and tail ends of the pond.

Each raceway has a maximum capacity of 5,000 pounds of fish. Nehalem Hatchery stock 32 winter steelhead production is contained in 6 raceways (up to 23,000 fish per raceway). At the target size of 6 fish per pound (ODFW 1986), there are about 3,833 pounds of fish in each raceway (about 76% of maximum capacity).

5.6) Acclimation/release facilities.

Stock 32 winter steelhead are not currently acclimated, although acclimation may be considered in the future if deemed necessary to meet fish management goals (see Section 1.16.2). Releases into the North Fork Nehalem River are volitional at the hatchery or direct released to the river downstream of the hatchery via liberation truck. Releases into the Necanicum River are made directly via liberation truck into the mainstem Necanicum River and/or a tributary site.

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

There have been no operational difficulties or disasters that have led to significant fish mortality. Potential operational difficulties that could result in significant fish mortality include loss of power to run the pumps which supply water to the hatchery; or high flows that deliver large amounts of debris, which may plug intake screens or deposit silt on eggs; or disease outbreaks. Thus far, hatchery staff and/or fish health staff have been able to minimize the effects of these events and substantial fish mortality has been avoided.

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.

Winter steelhead propagated under this program are not a listed population. Any operational failures would be anticipated to have minimal or no effect on naturally produced fish species.

To minimize the risk to propagated fish, the hatchery is staffed full-time, 24 hours per day. Alarm systems are in place to warn employees of low water, plugged intakes, and other problems. Employees work schedules are adjusted as conditions warrant (i.e. during large storm events) to maintain hatchery operations. A backup generator is available to supply power for the pumps that supply water to the hatchery in the event of a power outage.

SECTION 6

BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Broodstock is collected at Nehalem Hatchery (or possibly in the future at a recapture facility in the Necanicum River basin if developed). Hatchery adults collected at upstream research facilities may be used if needed to meet production goals. Adults are descendants of North Fork Nehalem River origin stock (although influenced to some degree by prior releases of smolts from Big Creek stock 13). North Fork Nehalem winter steelhead are part of the Oregon Coast ESU and are listed as a "*Species of Concern*" under the Federal ESA.

6.2) Supporting information.

6.2.1) History.

Stock 32 originated from North Fork Nehalem River natural spawners. Prior to the establishment of the stock 32 winter steelhead program in 1977, the basin was stocked with juvenile steelhead (stock 13) of Big Creek origin. Naturally spawning hatchery fish may have passed on genetic quality of Big Creek stock to the North Fork Nehalem population. However, the extent to which this occurred, and the extent of continuing impacts to both hatchery and naturally produced steelhead populations is unknown. The current program utilizes only hatchery steelhead returning to the North Fork Nehalem River. No fish have been imported from Big Creek since at least 1982.

6.2.2) Annual size.

The stock 32 winter steelhead program requires a minimum of 100 females and 100 males for broodstock needs. Additional adults may be collected as necessary to cover shortages resulting from, but not limited to, fecundity variation, early egg mortality, positive disease test, etc.

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

Prior to the 1992-93 adult return, which were the first returns of mass marked hatchery winter steelhead, it is unknown at what level, if any, naturally produced fish were included in the broodstock. With the return of mass marked fish back to the facility, no unmarked (naturally produced) adults have been used for broodstock purposes. Unmarked winter steelhead trapped are passed above the weir/trap facility to spawn naturally.

6.2.4) Genetic or ecological differences.

The current broodstock are likely to exhibit differences from the naturally produced North Fork Nehalem basin winter steelhead. A significant percentage of returning hatchery adults appears to be 2-salt fish, and may represent a higher percentage than might be expected in a naturally producing population. Return timing appears to be in an earlier period (late November through February, peaking in late December to mid

January) compared to a wild steelhead return period (January through April, usually peaking in mid to late March). Steelhead spawning in the North Fork Nehalem above the hatchery occurs primarily in mainstem and larger tributaries. Smaller tributaries are utilized to a lesser degree (Dalton, ODFW Research, personal communication). Some information is available on spawning locations in the Necanicum basin and the mainstem Nehalem River basin. In general, steelhead appear to spawn mostly in larger tributaries and upper mainstem areas. Smaller tributaries are used to a lesser degree and tend to be used more often by earlier returning winter steelhead (likely due to higher flow regimes earlier in the winter). This may vary significantly between basins based on local geography within the basins.

6.2.5) Reasons for choosing.

Stock 32 eggs have been used for winter steelhead production at Nehalem Hatchery since the current program began in 1977. It was felt the use of a locally adapted stock was likely to reduce out-of-basin straying and provide broodstock better suited to the basins of release. The Nehalem stock 32 appears to be a good contributor to angling success. Prior to the 1992-93 return year, there was not mass marking of stock 32 hatchery fish. However, it was assumed that, based on timing, fish being taken for broodstock were primarily of hatchery origin.

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.

Stock 32 winter steelhead hatchery broodstock selection should have minimal impact to naturally produced coho salmon. Naturally produced coho may be trapped during winter steelhead broodstock collection. Any unmarked coho trapped are passed upstream of the hatchery facility to spawn naturally.

Additional risk aversion measures associated with the stock 32 winter steelhead broodstock collection (and selection) are discussed in Section 7.9.

SECTION 7
BROODSTOCK COLLECTION

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

Adult stock 32 hatchery steelhead are collected to meet the objective of 130,000 smolts and to meet genetic guidelines.

7.2) Collection or sampling design.

Hatchery winter steelhead adults begin returning to the Nehalem Hatchery trap in November. Fish are collected for broodstock from throughout the run, which is usually complete by late February or early March. Hatchery fish may also be collected from anglers as needed.

7.3) Identity.

The hatchery reared winter steelhead have distinctive external fin clips that distinguish them from the unmarked, naturally produced fish. Currently, NF Nehalem releases consist of fish marked with an adipose only clip, an adipose/right maxillary clip, and an adipose/left maxillary clip to enable evaluation of different release sites in the basin. Necanicum River releases are currently adipose clipped only. Marks may change in the future if and when the need for differential marks ends.

7.4) Proposed number to be collected:

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

Existing program utilizes a minimum of 100 females and 100 males for broodstock to meet production goals and genetic guidelines. Additional adults may be collected as necessary to cover shortages resulting from, but not limited to, fecundity variation, early egg mortality, positive disease test, etc. Sufficient numbers of fish may be spawned during the early portion of the run to ensure that production goals are met and genetic quality of the population is maintained. Once spawning is complete, surplus eggs are culled and destroyed (see section 9.1.2). Several hundred thousand eggs may be taken for this program (Table 7-1), with a goal of producing 130,000 smolts and to meet STEP program needs.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7-1. **Brood stock collection levels for Stock 32 winter steelhead (1992-2007 brood years)[1]**

Brood Year	Females	Adults Males	Jacks	Eggs	Smolts released[2]
1992	221	222	13	252,000	137,301
1993	228	280	0	222,000	147,611
1994	86	87	0	178,000	89,410
1995	287	343	7	200,000	94,426
1996	429	342	16	187,000	94,356
1997	353	396	46	261,000	94,587
1998	188	224	0	259,000	55,405
1999	376	349	9	236,000	97,341
2000	373	352	4	449,000	96,187
2001	213	117	21	332,000	96,925
2002	1,365	981	2	302,000	88,463
2003	341	277	14	235,000	94,846
2004	672	577	3	274,000	91,880
2005	480	445	5	426,000	94,370
2006	572	696	50	317,000	90,337
2007	595	473	22	307,000	91,494

Data source: ODFW HMS database, Nehalem Hatchery.

[1] Broodstock collection represents all stock 32 StW collected.

[2] North Fork Nehalem and Necanicum River releases. Releases prior to the 1994 brood also included fish released in the mainstem Nehalem River and its tributaries.

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

Hatchery winter steelhead broodstock shall be collected at the Nehalem Hatchery trap facility, from a recapture facility in the Necanicum basin (if developed), from NF Nehalem research trap sites upstream of Nehalem Hatchery, or from anglers, if needed. Surplus green adults not needed for the program are recycled back into the North Fork Nehalem River to provide additional angling opportunity. Excess ripe males may be released into local lakes, providing additional fishery opportunities for the public. Ripe females may be stripped of eggs and recycled into the North Fork Nehalem River, or may be released into local lakes. In addition, spawned adults and/or surplus adults may be used for stream enrichment. All naturally produced steelhead (unmarked) collected are passed upstream to spawn.

7.6) Fish transportation and holding methods.

Adult hatchery winter steelhead collected for brood at Nehalem Hatchery are held in the trapping facility until ready to spawn. All spawning activities take place at the Nehalem Hatchery trap facility.

See Sections 5.2 and 10.5 for description of transportation equipment and procedures.

7.7) Describe fish health maintenance and sanitation procedures applied.

Developing eggs receive regular treatments with formalin or other approved treatments to prevent/control fungal (*Saprolegnia parasitica*) outbreaks. Green eggs are water-hardened in an iodine solution to prevent disease or viral contamination. Juveniles are treated, if necessary, with medicated feed or formalin as directed by ODFW fish health staff. Adult steelhead are not currently treated. Additional fish health maintenance and sanitation procedures are described in section 9.2.7. See Attachment A.

7.8) Disposition of carcasses.

Hatchery winter steelhead carcasses may be used for stream enrichment activities in the Nehalem and/or Necanicum river basins. Carcasses suitable for human consumption may be used for food programs, or carcasses may be sold for processing into fish food or other products. Carcasses not used for stream enrichment, food programs, or sold, are buried or disposed of in 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.

It is unlikely that winter steelhead broodstock collection will have any genetic effects on naturally produced coho. To minimize genetic and ecological effects between hatchery produced and naturally produced steelhead as well as to minimize adverse ecological effects on naturally produced coho, the following measures will be taken:

- Naturally produced coho that enter the Nehalem Hatchery trap will be released alive above the trapping facility. The hatchery trap will be visually checked at least daily, and fish sorted at least weekly (or as needed) to minimize delay and potential harm to naturally produced coho.
- Stock 32 winter steelhead will be managed as a hatchery broodstock isolated to the extent possible from naturally produced steelhead populations in the Nehalem basin. Only returning hatchery steelhead are currently used in the broodstock (see Section 1.16.2 for possible alternatives to the program).
- No transfers from other hatchery winter steelhead broodstocks into the stock 32 program (for breeding purposes) are permitted.
- Only hatchery steelhead (stocks 32 or if deemed necessary in the future, any new broodstock derived from a local Nehalem natural steelhead population (see Section 1.16.2 for a list of possible alternatives), will be released in the Nehalem Basin.
- A disease monitoring plan will be implemented (Attachment A).
- To safeguard against catastrophic loss of broodstock, excess adults are retained.

SECTION 8
MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Collection of winter steelhead for use as broodstock occurs throughout the run. Fish are typically selected for spawning at random from the fish available and ripe at the time of spawning. Spawning usually occurs from late December to February. All broodstock selection is done on a random basis on the dates incoming fish are sorted. The program attempts to balance the number of fish collected from the first, middle, and end of the run to insure a representative sample of the entire run. Excess eggs may be collected from the early portion of the run to assure meeting the production goal. Excess eggs are culled after spawning is completed if necessary (see section 9.1.2).

8.2) Males.

Males are generally only used once during spawning. If necessary, in the case of a shortage of males, individual fish may be spawned more than once. Jacks (1-salt fish) will be included in the broodstock when available.

8.3) Fertilization.

Winter steelhead are either live- or kill-spawned with the goal of a 1:1 male-to-female ratio. Each fish is typically only used once in spawning, however if necessary, in the case of a shortage of males, individual fish may be spawned more than once.

Spawning is conducted using a matrix design (2x2, 3x3, etc.). Eggs from females are spawned into a single plastic bucket. The eggs are then divided into separate buckets. Males are spawned, one into each of the buckets of eggs. These groups are held separate for at least 3 minutes to induce the fertilization, then combined into larger groups and transferred to the incubation facility. Once the incubation facility receives the eggs, they are trayed down into stack incubator trays containing a solution of iodophore and disinfected for 10 minutes before being introduced to the pathogen-free incubation water. This matrix-spawning regime provides for the possibility of producing offspring having genetic diversity due to multiple family groups created per female spawned.

Ovarian samples are taken from 60 females and visceral (kidney, spleen) samples are collected from 60 fish to detect the presence of any viral pathogens. Egg group(s) that test positive for viral disease may be kept or destroyed, at the direction of ODFW fish health staff. Fertilized eggs are water-hardened in an iodine solution prior to placement in incubators.

8.4) Cryopreserved gametes.

Cryopreservation of winter steelhead gametes is 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 genetic or ecological effects to listed naturally produced fish is expected from the mating scheme of the stock 32 hatchery winter steelhead program. However, to maintain the genetic diversity within the propagated winter steelhead population, broodstock are randomly selected from throughout the entire run. Spawning is done randomly based on availability of ripe fish. Matings are done with a goal of a 1:1 sex ratio (i.e. one male and one female). Each fish is typically only used once in spawning. However if necessary, in the case of a shortage of males, individual fish may be spawned more than once.

SECTION 9

INCUBATION AND REARING

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

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

Table 9-1. **Data of stock 32 winter steelhead eggs taken and survival rates.**

Brood Year	Egg Take	Eyed Eggs	Percent Survival to Eye-up
1992	252,000	200,000	79
1993	222,000	212,000	95
1994	178,000	135,000	76
1995	200,000	173,000	86
1996	187,000	168,000	90
1997	261,000	242,000	93
1998	259,000	254,000	98
1999	236,000	198,000	84
2000	449,000	406,000	90
2001	332,000	293,000	88
2002	302,000	249,000	82
2003	235,000	200,000	85
2004	274,000	207,000	76
2005	426,000	370,000	87
2006	317,000	285,000	90
2007	307,000	288,000	94

Data source: ODFW HMS database, Nehalem Hatchery files.

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

Extra winter steelhead eggs are typically collected in order to compensate for egg to smolt mortality and genetic considerations, such as increased family size to promote genetic diversity, etc. In addition, extra eggs may be taken during the early portion of the run to assure that enough eggs are collected to meet production goals. Surplus eggs are later culled, usually at the eyed stage. Eggs are culled randomly across the egg take groups (except that a higher proportion of eggs may be culled from early groups if additional eggs were taken to ensure meeting production goals) to retain diversity among those adults spawned. Eggs that are used for production are randomly taken from the family groups based on a percentage to ensure equal representation throughout the population. For example, if one egg-take date consists of 4 family groups and will make

up 25% of the total population of the brood, then an equal number of eyed eggs will be retained from each of the 4 family groups to achieve the 25% of the total population goal.

Mortality and culled eggs are disposed of by freezing and then burial. Culled eggs (which are rendered non-viable by freezing) may also be used in the stream enrichment program.

9.1.3) Loading densities applied during incubation.

Winter steelhead egg average size at spawning is 225 eggs per ounce. The vertical stack egg incubators have a water flow of 5 gpm. The standard loading density from green to eyed is approximately 10,000 eggs per tray. When eggs eye-up they are shocked, picked, inventoried, and densities are reduced to approximately 8,000 eggs per tray. The number of trays utilized per stack will vary from 1 to 15 depending on the need for isolation of family groups, heated versus ambient water, etc.

Loading densities for STEP classroom incubators varies with the size and setup of equipment being used but typically runs from 200 to 1,000 eggs per aquarium (typical aquariums hold 10-40 gallons of water). A standard aquarium re-circulating type pump supplies flow. No flow rates have been calculated but the flow is sufficient for the small number of eggs used in these programs.

9.1.4) Incubation conditions.

The water supply to the egg incubator is supplied by a spring. The water is monitored for flow and temperature daily. The incubating eggs are held in water that is typically 40º to 51º F. Dissolved oxygen (DO) levels are not monitored during incubation. Temperature regimes will vary according to what is necessary to bring egg groups together for common ponding dates. The incubation facility is not equipped to chill water. All of the temperature manipulation is achieved by using up to three, in-line, single-pass, spa heaters. The incubation facility typically does not have a silting problem, as the spring water normally remains clear. Eggs are treated with formalin daily to control fungus and soft-shell.

Students will sometimes monitor temperature in the STEP classroom incubators. However, it is likely to vary significantly between incubators, rooms, and schools. Typically, these systems run at ambient room temperatures. Ice is added daily to keep temperatures in the optimum range of 50º to 60º F. A standard aquarium re-circulating type pump supplies flow.

9.1.5) Ponding.

Fry are transferred from the incubator trays to Canadian style starter troughs when at least 50% of the fry are estimated to be buttoned up. This occurs with approximately 1,000 temperature units. Winter steelhead fry average approximately 2,000 fish per pound at this point. Fry are relocated outside to a concrete raceway when they reach about 600 fish per pound.

9.1.6) Fish health maintenance and monitoring.

See Attachment A regarding state approved fish health protocols.

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.

Incubation of stock 32 hatchery winter steelhead eggs should have no genetic effect on listed naturally produced fish. To minimize ecological effects to the receiving stream and the inhabiting natural fish populations, hatchery personnel check incubating eggs daily to remove dead eggs, treat eggs for disease/fungus, and keep the incubation facility clean to prevent transmission of diseases.

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 (1988-99), or for years dependable data are available.

Average survival for stock 32 winter steelhead at Nehalem Hatchery from fry to the time of marking was 73% for the 1992-2006 brood years. The survival to time of marking ranged from 36% to 92%. See Table 9-2.

The average survival from fry to release for stock 32 winter steelhead was 70% for 1992-2006 brood years. The survival to release ranged from 33% to 90%. See Table 9-2.

Table 9-2. **Stock 32 winter steelhead survival rates.**

Brood Year	Fry Ponded	Juveniles at Marking	Fish Released[1]	Percent Survival to Marking	Percent Survival to Release[2]
1992	178,000	144,000	137,301	81	77
1993	207,000	168,332	168,443	81	81
1994	105,000	92,000	89,410	88	85
1995	152,000	97,900	94,426	64	62
1996	164,000	98,200	94,356	60	58
1997	151,000	99,400	94,587	66	63
1998	168,000	60,400	55,405	36	33
1999	166,000	149,518	148,659	90	90
2000	180,000	138,355	137,842	77	77
2001	182,000	166,868	166,493	92	91
2002	201,000	169,933	166,046	85	83
2003	162,000	127,111	127,661	78	79
2004	157,535	94,693	94,247	61	60
2005	181,746	107,834	94,370	74	52
2006	169,933	98,591	90,337	58	53
Average	168,348	120,876	117,306	73	70

Data Source: ODFW HMS database; Nehalem Hatchery files

[1] Includes fingerling releases to standing water bodies (1993, 1999 - 2003 broods)

[2] Count of juveniles at marking is hand count. Count at release is by water displacement gauge (weight). High survival and rounding errors from release estimate likely account for more fish released than counted.

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

The criteria for Nehalem Hatchery fish density and loading varies considerably through the various life stages and by rearing container. Rearing densities are below goals set by Piper (1982).

Fry are transferred into Canadian troughs at about 2,000 fish/lb after fry button up. At 600 fish/lb they are moved to a concrete raceway. They are split into ponds in July at about 160 fish/lb. After marking in September at approximately 15 fish/lb, the juveniles are split into ponds with about 23,000 fish per pond.

The raceways at Nehalem Hatchery are managed for a maximum of 5,000 pounds of fish per raceway (about 1.31 lb/ft^3).

Maximum density occurs at release when the fish are at their largest size (target size is 6 fish/lb).

Density targets from fry to smolt (reared in ponds at Nehalem River Hatchery) are not to exceed 1.7 lb/ft^3 water (rearing space). Actual density levels are at about 1.00 pounds of fish per cubic feet water at release. Maximum loading level criteria for rearing is 10 pounds of fish per gpm. Actual target pond loading level at smolt release time is about 8.0 pounds of fish per gpm.

9.2.3) Fish rearing conditions.

Winter steelhead are reared at Nehalem Hatchery on incoming river water; hence, rearing water temperatures vary with seasons and with natural fluctuations. Water temperatures range approximately from 45º to 65ºF during spring and summer and from 36 º to 45 º F during the fall and winter. Dissolved oxygen (DO) levels coming into the facility are typically between 10.0 ppm and 11 ppm in the fall and winter. However, in the summer, DO levels can be as low as 7 ppm. Re-circulation of effluent water through the ponds is possible in extreme drought conditions.

Monitoring of the pond conditions is done daily at feeding time. While feeding fish, personnel are observing for signs of stress, disease, water clarity, and general fish behavior. Pond mortality is picked and recorded daily. Ponds are cleaned at regular intervals. During late summer and early fall, the fish are closely monitored by ODFW's fish health staff for external parasites and diseases. Water quality is monitored under the prescribed 300J general NPDES permit as required by the DEQ (see Section 4).

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.

Weight samples are collected regularly and reported on ponded fish reports in the ODFW Hatchery Management System (HMS). Length frequency measurements are made at the time of liberation (see section 9.2.8). Mark quality observations are also made at this time. Table 9-3 shows average monthly fish sizes for the program from ponding to release.

Table 9-3. **Average Monthly Fish Size for Nehalem Stock 32 Winter Steelhead, 2006-2007.**

Week	Size in fish/pound*
March	1,770
April	878
May	375
June	102
July	72.9
August	31.3
September	16.6
October	12.4
November	10.8
December	9.3
January	8.0
February	6.8
March	5.7

Data Source: HMIS; Nehalem Hatchery files

* Numbers represent end-of-month averages

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

Once the fry have been ponded, their weight increases substantially each month (see Table 9-3) until the time of marking when their feed is programmed to ensure that the fish do not exceed pond density limitations and are on target to meet production size goals.

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*).

Stock 32 winter steelhead juveniles are fed a fish food diet at a rate and frequency that varies with fish size. During the first two months, they are fed approximately 8 times per day (about once/hour during a normal 8 hour day). During the third month, the fish are fed twice a day, once in the morning and once in the afternoon. For the next 5 to 6 months, the fish are demand fed, by use of demand feeders daily.

During the last 3 months of rearing, prior to release, the feed ration is reduced to a slow rate of growth and/or a maintenance diet to meet the desired size and condition factor at release. The fish are still fed using the demand feeders; however the amount of feed is controlled.

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

Fish health of rearing juvenile winter steelhead is monitored regularly by Nehalem Hatchery staff and ODFW fish health staff. ODFW fish health staff diagnoses disease problems and prescribes the appropriate treatments to eliminate or control disease. See Attachment A for description of treatments and fish health management protocol.

Tools and equipment used for winter steelhead rearing are not routinely disinfected (other than allowing to air dry). During the winter steelhead spawning season, no other adults are on station. The spawning facilities are not routinely disinfected during the spawning season.

If it becomes necessary, iodine antiseptic is used to sanitize hatchery equipment and prevent the incidence or spread of disease. For further description, see Attachment A.

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

Weight samples of the fish are taken monthly to ensure proper growth rate (Table 9-3). Prior to release, length frequencies are taken (Table 9-4). A visual mark quality check is completed on a representative sample of the fish targeted for release.

Table 9-4. **Average Fork Length Frequency Percentages At Release, 2006-2007.**

Fork Length Size Range	Average Percentages at Release
< 18 cm.	8.5%
18 – 22 cm.	82.8%
> 22 cm.	8.7%
Data Source: HIMS; Nehalem Hatchery files	

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

No “natural” rearing methods are applied in this program.

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

The stock 32 winter steelhead under this propagation program are not listed under either the Federal or State ESA. However, fish will be reared to full-term smolt size and released directly into rivers in order to minimize ecological interactions with listed fish.

Fish that are released in the North Fork Nehalem are semi-volitionally released directly from the hatchery facility or are hauled and direct released in the lower river. Releases in the Necanicum River are hauled and direct released at several sites. Release sites are in mainstem river reaches or tributary sites in the respective river systems. The majority of smolts should quickly migrate downstream, minimizing the amount of time spent in the freshwater portions of these basins.

SECTION 10
RELEASE

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

10.1) Proposed fish release levels.

Table 10-1. **Proposed fish release levels.**

Age Class	Maximum Number	Target Size (fpp)	Release Date	Location
Eggs	N/A	N/A	N/A	N/A
Unfed Fry (STEP)	4,000	1,000-2,000	April-May	Nehalem River and/or Necanicum River, or tributaries[1]
Fry[2]	Surplus	1,000-2,000	April-May	Standing Water
Fingerling[2]	Surplus	15-30	Sep.-Oct.	Standing Water
Yearling	90,000	6.0	Late March/April	North Fork Nehalem River
Yearling	40,000	6.0	Late March/April	Necanicum River or tributary

Data Source: ODFW hatchery production schedules; District files

[1] Releases of unfed fry from classroom incubators varies depending on the number of schools that may choose to become involved. Due to this variation, it is difficult to predict a "proposed" release level. For the last 12 brood years, few releases have occurred. However, interest in this program has been expressed by local educators. Release sites are typically in systems close to the participating school. Note: STEP releases prior to the 1992 brood year included extensive releases from in-stream hatchboxes. Data on those releases is available upon request.

[2] This program does not produce fingerlings for release as a program goal for stock 32 winter steelhead. In any given year there may be surplus fingerlings (typically from above average fry and fingerling survival). These will be released to standing water bodies.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: North Fork Nehalem River *(*ODFW waterbody code 0100310000)
Release point: Nehalem Hatchery (RM 10.3) or downstream
Major watershed: Nehalem River
Basin or Region: Nehalem River, North Oregon Coast, West Region
Stream, river, or watercourse: Necanicum River (ODFW waterbody code 0100110000)
Release point: Various mainstem access points downstream of RM 18,
Tributary site (to be determined for possible future release strategy)
Basin or Region: Necanicum River, North Oregon Coast, West Region
Major Watershed: Necanicum River

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

Table 10-2. **North Fork Nehalem River Stock 32 Winter Steelhead Releases (1992-2014 brood years). (Note: Beginning with the 2008-09 return year, production of stock 32 for NF Nehalem River will increase to 90,000, replacing the previous 40,000 stock 99 production).**

Brood year	Eggs/ Unfed Fry	Avg size (fpp)	Fry[1]	Avg size (fpp)	Fingerling[1]	Avg size (fpp)	Yearling	Avg size (fpp)
1992							97,310	6.3
1993					20,832	22.4	107,223	5.1
1994							49,689	5.0
1995							52,640	4.3
1996							49,264	5.9
1997							54,582	5.8
1998							16,362	5.4
1999	474[2]	~2,000			51,318	48.7	57,350	6.0
2000					41,655	42.4	56,125	5.7
2001					69,568	60.6	56,933	5.8
2002					77,583	51.6	48,447	5.8
2003			38,000	~1500	32,815	48.8	54,846	6.3
2004					2,367	79	51,879	5.7
2005					40,425	61	54,370	6.0
2006	428[2]	~2,000			4,891	34.4	50,355	6.0
2007							51,494	6.26
2008							53,516	6.65
2009							95,195	6.02
2010							93,725	6.39
2011							94,639	6.18
2012							90,400	6.13
2013							93,479	6.28
2014							97,090	5.91
Average	451	~2,000	38,000	~1500	37,939	49.9	**66,388**	**5.87**

Data source: ODFW HMS database; Nehalem Hatchery files

[1] Fry and fingerling releases were to various standing water bodies

[2] STEP releases in 1999 were into the upper Nehalem River basin; and into the Trask basin in 2006.

Table 10-3. **Necanicum River Stock 32 Winter Steelhead Releases (1992-2014 brood years).**

Brood Year	Eggs/ Unfed Fry	Avg size (fpp)	Fry	Avg size (fpp)	Fingerling	Avg size (fpp)	Yearling	Avg size (fpp)
1992							39,991	6.4
1993							40,388	5.5
1994							39,721	5.1
1995							41,786	4.8
1996							45,092	6.1
1997							40,005	5.4
1998							39,043	5.6
1999							39,991	6.0
2000							40,062	5.7
2001							39,992	6.1
2002							40,016	5.9
2003							40,000	6.0
2004							40,001	5.8
2005							40,000	5.7
2006							39,982	6.2
2007							40,000	6.26
2008							40,040	6.65
2009							40,113	6.02
2010							39,998	6.39
2011							40,081	6.18
2012							40,580	6.13
2013							40,105	6.28
2014							40,239	5.91
Average							**40,314**	**5.92**

Data source: ODFW HMS database; Nehalem Hatchery files

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

Winter steelhead smolts are released annually in late March or April. A portion of North Fork Nehalem smolts are released semi-volitionally from the facility (fish are given a period of time to leave on their own and then the remaining fish are pushed out of the raceways, if necessary). A portion of the North Fork Nehalem River releases may be

hauled and released to the lower river. Necanicum River smolt releases are made directly from liberation trucks at several mainstem sites from RM 18 downstream. Future Necanicum releases may occur in a tributary (to be determined). Examples of recent release dates are presented in Table 10-4.

Table 10-4. **Annual Winter Steelhead Smolt Release Dates.**

Year	North Fork Nehalem River	Necanicum River
1999	4/15	3/30-3/31
2000	4/14-4/15	4/6-4/7
2001	4/16	4/4-4/5
2002	4/15	4/2-4/3
2003	4/14	4/3
2004	4/15	3/29-3/30
2005	4/15	4/3-4/4
2006	4/15	4/2
2007	4/15	3/31

Data Source: ODFW HMS database; hatchery files

Note: These dates represent the final date of release. Fish released in the North Fork Nehalem from the hatchery are allowed to leave volitionally for a period of time (up to approximately two weeks) prior to the remaining fish being pushed out. Unless directed otherwise by fish health or Department staff, date(s) of release is determined annually based on the ODFW production schedule and the size of the fish.

Fry from STEP prgrams are usually released in mid-April to mid-May, dependent on incubation water temperatures in individual classrooms. Depending on the situation, temperature may be "controlled" (to the extent feasible) by teachers to allow fry release timing to avoid spring break periods when students are unavailable for release activities. Transportation is typically done in a set of buckets or a garbage can (some with aeration) to the site and a direct release into the stream by students using a small aquarium dipnet. Transportation time is typically very short, less than 30 minutes.

10.5) Fish transportation procedures, if applicable.

Stock 32 winter steelhead smolts released from the hatchery to the North Fork Nehalem River are released semi-volitionally directly from the hatchery raceways. The screens at the downstream end of the raceways are removed, and the fish are allowed to migrate on their own. After a period of time (generally 1-2 weeks), any remaining fish are forced out of the raceways through the use of a crowding device.

Stock 32 winter steelhead released in the lower North Fork Nehalem River and the Necanicum River basin are hauled in liberation trucks to the selected release sites. Liberation trucks are typically 1,000-2,500 gallon capacity units, either mounted on a

large flatbed truck, or a tanker style truck. The lib trucks are equipped with oxygen diffusing systems, water re-circulation pumps, and may have dissolved oxygen meters.

Juvenile steelhead in excess of production needs are released to standing water bodies at the time of marking. The surplus juveniles are hauled in liberation trucks (as above) to the selected standing water release site.

10.6) Acclimation procedures.

Currently, no acclimation of juvenile steelhead occurs prior to release. Acclimation may be considered in the future if required to meet management goals.

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

Stock 32 winter steelhead smolts are mass marked (100%) with an adipose fin clip, and some will have adipose/right maxillary clip, or adipose/left maxillary clip. Use of multiple marks is to evaluate the performance of current release strategy, and may not necessarily continue in the future. Mass marking of smolts will continue with at least an adipose fin clip (although alternate clips may be used if necessary). Unfed fry released from STEP programs are not marked.

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

Any juvenile fish surplus to production are released into standing water as fry or fingerlings, prior to or at the time of marking, not at the time of smolt release. Smolt releases have generally been within programmed and approved levels.

10.9) Fish health certification procedures applied pre-release.

Per ODFW Fish Health Management Policy, fish health status is examined prior to transfer or release; and only certified fish are released. Also, see Attachment A, for fish health management protocol and certification.

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

In the event of a water system failure an emergency release of steelhead juveniles will only occur after:

- The hatchery crew has exhausted all possibilities for retaining the fish.
- The hatchery crew has consulted with the ODFW District Fish Biologist.
- The release will be into the North Fork Nehalem River, the Necanicum River, or into a closed water body, as directed by the District Fish Biologist.

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.

Full-term winter steelhead smolts will be released shortly before the majority of naturally produced winter steelhead smolts typically emigrate. Peak outmigration of naturally produced coho and steelhead smolts typically occurs during mid-late April (Solazzi et al, 2003). The hatchery smolts are expected to migrate upon or shortly after release, which should keep freshwater residence time to a minimum.

This release strategy should minimize potential interactions and adverse ecological effects that may occur between hatchery winter steelhead and juvenile salmonids rearing or migrating through these systems.

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.

Existing staff, funds and resources are available to conduct the following monitoring and evaluation activities. These activities will directly measure performance standards and indicators previously described in Sections 1.9 and 1.10. Information on the catch of hatchery winter steelhead is compiled from returned salmon/steelhead tags and is available from Fish Division in the Salem office of ODFW. A volunteer creel survey with angler survey stations has been recently used and may contine to be used to further assess angler success. Specific economic data for sport caught fish is not routinely developed for all stocks. Economic data that is compiled is available in the Salem Headquarters. Steelhead population health goals are currently being developed under the *Oregon Plan for Salmon and Watersheds* and will be incorporated into the conservation plans developed under the ODFW Native Fish Conservation Policy. New performance standards (and subsequent M&E) may be prescribed in the future as these population health goals are established. Monitoring of naturally spawning salmon and steelhead has increased coast-wide in recent years. Additional information regarding the number of naturally spawning steelhead of hatchery origin may become available in the future.

Monitoring of in-hatchery performance and adult returns at Nehalem Hatchery will be conducted by the hatchery crew. This information is stored on the ODFW mainframe computer in the HIMS database. This will include at least the following information:

Adults

- The number of females, males, and jacks collected at Nehalem Hatchery, (Standard 2.1; 3.3).
- Number of unmarked winter steelhead, unmarked coho, fall chinook, chum, and cutthroat handled and released from Nehalem Hatchery, (Standard 4.5).
- Any observed mortalities of unmarked winter steelhead, unmarked coho, fall chinook, chum, and cutthroat handled at Nehalem Hatchery (Standard 4.5).
- Date of entry into the Nehalem Hatchery trap, specified by hatchery and naturally produced fish, (Standard 2.1).
- Date of entry into the Nehalem Hatchery trap for fish retained for broodstock, Standard 2.1).
- Dates of spawning at Nehalem Hatchery, (Standard 2.1).
- The number of males, jacks, and females spawned, (Standard 3.3).
- Fecundity of females spawned, (Standard 2.1).
- Disposition (spawned, sold, stream enrichment, etc.) of all winter steelhead collected, (Standard 4.4).

Juvenile Rearing

- Monthly number of eggs/fish on hand, mortality, feeding rate, and growth, (Standard 4.1).
- Results of fish health checks and any incidence of disease occurrence, (Standard 4.1).
- Results of water quality sampling, (Standard 4.2).

Release

- Number of fish released, by mark type, (Standard 1.2, 2.2).
- Fish age and size at release; average weight, and length frequency distribution, (Standard 2.3).
- Location of releases, (Standard 2.2; 2.3).
- Date releases started and ended, (Standard 2.2).

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 available as part of normal hatchery operation for those activities associated with hatchery operations.

However, as with all state and federal programs, budgets are approved by the Legislature, and no commitment of funds can be made past the approved budget period. Funds for various projects associated with this HGMP come from (or could come from) a variety of sources, possibly including license dollars, state general funds, and federal funding sources. Funds are committed for certain activities; but can change with relatively short notice. This could result in elimination or reduction in the hatchery program and associated monitoring and evaluation activities.

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 in-hatchery monitoring program is not expected to increase risks to naturally produced fish above those imposed by operation of the program. Thus, risk aversion measures for the monitoring program are the same as those discussed under prior sections of this document

SECTION 12
RESEARCH

A life cycle monitoring research project is conducted in the North Fork Nehalem River upstream of the hatchery. See Solazzi et. al. (2003) for details.

In addition, the Coastal Multi-Species Conservation and Recovery Plan or CMP (ODFW 2014) adopted by ODFW calls for evaluation of the winter steelhead hatchery program in the Necanicum River. Specifically, the plan calls for developing a strategy to reduce the number of naturally spawning hatchery winter steelhead (pHOS) by developing a new smolt release and adult recapture strategy. The goal of the strategy is to maintain harvest opportunity in the river sport fishery while reducing the straying hatchery winter steelhead to natural spawning to acceptable levels (≤ 30% as specified in the CMP).

12.1) Objective or purpose.

The objective of this research is to evaluate the effectiveness of a tributary release strategy at reducing the number of naturally spawning hatchery winter steelhead in the Necanicum River basin. The effect of this strategy on sport harvest opportunity for hatchery winter steelhead will also be evaluated.

12.2) Cooperating and funding agencies.

This project is being undertaken by ODFW. North Coast Watershed District staff in Tillamook will take the lead on implementing the project, with input from ODFW Fish Division staff.

Funding for district staff is provided by base operating budgets for ODFW staff, authorized by the Oregon Legislature. Funding for temporary sampling crews and equipment/supplies would need to be sought from grant funding sources, and has not been determined as of this writing.

Use of tributary release sites would likely require an access agreement with a private landowner. Much of the basin is in corporate timber ownership, with individual private landowners along portions of the river. The preferred tributary site(s) are on corporate timber lands, and ODFW will be seeking an access agreement to utilize on of these sites.

It is anticipated that volunteers will be utilized as available/needed to conduct some aspects of this work.

12.3) Principle investigator or project supervisor and staff.

Name (and title): Robert Bradley, District Fish Biologist
Agency or Tribe: Oregon Department of Fish & Wildlife
Address: 4907 Third St, Tillamook, OR 97141
Telephone: 503-842-2741
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Name (and title): Michael Sinnott, Assistant District Fish Biologist
Agency or Tribe: Oregon Department of Fish & Wildlife
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Email: michael.v.sinnott@state.or.us

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

All as described in Section 2.

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

Tributary Trapping

Adult winter steelhead will be captured using a box and weir adult trap. The trap will be located in a tributary of the Necanicum River. Currently we are considering Volmer, Klootchie, and Little Humbug creeks. Final site selection is to be determined, but Volmer Creek is the preferred alternative as this stream has the lowest intrinsic potential for coho, is located in a favorable part of the watershed, and offers good access to potential release and trap sites. The trap will be operated from late November through as late as April. The trap will be operated continuously, as conditions allow. The trap will be checked and cleared of fish and debris daily; visits will be more frequent during storm events or periods of high debris transport, or when fish abundance is high.

Winter steelhead will be sampled for basic biological information, including fin mark, length, and sex. Scales samples may be collected. The disposition of captured hatchery winter steelhead is yet to be determined, but may include recycling to the river fishery, transport to local lakes for additional fishery opportunity, or killed for stream enrichment (or possibly taken to a food bank program). Any hatchery winter steelhead recycled within the river basin would be given an external mark (such as an opercle punch or Floy tag). No anesthetics or other drugs are anticipated to be used.

Any wild adult salmonids collected will be passed upstream of the weir/trap facility and allowed to migrate upstream. Coho, winter steelhead, fall Chinook and cutthroat trout are the species expected to be encountered. Visual observation of fin marks and sex will be made, but no other biological sampling is planned. Wild winter steelhead may be externally marked (Floy tag or opercle punch) for identification in case they are recaptured during surveys in other parts of the basin.

Stream Sampling

Surveys will be conducted throughout the Necanicum River basin to determine distribution and relative abundance of naturally spawning wild and hatchery winter

steelhead. We will capture adult winter steelhead using dip nets and/or tangle nets (other methods may be employed if needed) in tributary or mainstem reaches where spawning is likely to be occurring. Fish will be examined and basic biological data collected (fin mark, sex, length, scale sample). The fish will be tagged externally with a Floy tag or other suitable mark (such as an opercle punch) for later identification if captured again.

Any wild coho salmon or other non-target species inadvertently captured will be immediately released at or near (downstream) the capture site. Handling will be minimized. No biological sampling is planned, although visual observation of fin mark and sex will be made.

Creel

We plan to evaluate the effect of this new release strategy on sport harvest opportunity by conducting a creel survey of winter steelhead anglers. Details of the creel survey are still to be determined. However, this activity will involve interviewing anglers and examining their catch. No handling of wild salmon or steelhead will be necessary, although catch and release of fish encountered by anglers will be recorded.

12.6) Dates or time period in which research activity occurs.

Research efforts are expected to start during the winter of 2016-17 with preliminary site selection and some exploratory surveys of spawning sites. Adult trapping and surveys for naturally spawning hatchery winter steelhead may begin as early as the winter of 2017-18, with all facets of the research implemented by the winter of 2019-20. Research activities are expected to continue at least through the winter of 2024-25, depending on funding. Work could run beyond that if necessary to achieve management goals. The following describes activities in more detail.

Differentially marked hatchery winter steelhead smolts will be released beginning in the spring of 2017. Tributary trapping efforts are expected to start during the winter of 2018-19, when the first adult year class begins returning. Trapping is expected to continue annually beginning in late November and extending through April.

Exploratory surveys of naturally spawning hatchery winter steelhead are expected to start as early as the winter of 2016-17, primarily to establish survey locations and access points. We expect to begin fully sampling during the winter of 2017-18 to establish a baseline pHOS estimate prior to adults returning from the new tributary release strategy. Surveys are expected to be conducted from December through May when winter steelhead are spawning.

Creel surveys are planned to begin during the winter of 2017-18, again to establish a baseline prior to returns of fish from the new release strategy. Creel will be conducted annually (dependent on funding) beginning in 2019-20 when all age classes of adults from the new release strategy are returning. Creel would be conducted from as early as late November to March.

All aspects of the project are dependent on funding and availability of district staff. As such, not all aspects of the project may be conducted in a given year, or sampling may not occur in all years. The overall duration of the research is yet to be determined, but may occur over a 10-12 year period (until the CMP is due to be reviewed).

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Trapping

The trap used to capture adult winter steelhead returning to the tributary release site will be monitored at least daily. Salmonids captured would be held a maximum of approximately 24 hours in the live trap. During times of heavy fish movement, high flows, or large debris loads, the trap will be checked more frequently, or closed down. Soft mesh dip nets will be utilized to remove fish from the trap.

Wild adult salmonids will be passed upstream of the weir/trap facility. Handling will be limited to brief observation of species, sex, and fin mark. Wild winter steelhead may be externally marked with a Floy tag or opercle punch, which may slightly increase handling time. Transport upstream would be via hand if released immediately above the weir, or by dip net if released at the first available site upstream. If feasible, a PVC release tube could be utilized to pass fish upstream. Transport would be limited to a short distance and a minimal amount of time.

Hatchery winter steelhead will be collected and sampled for length, sex, and fin mark. A scale sample may be collected, and if fish are recycled downstream in the river fishery, an external mark (Floy tag or opercle punch) would be given. Hatchery winter steelhead adults may also be outplanted to local lakes to provide additional fishing opportunity. In either case, transport would be in a portable liberation tank mounted in a pickup (See section 5.2 for further description). Haul time would be up to approximately 30 minutes.

Hatchery winter steelhead killed for stream enrichment would be placed in plastic totes in a pickup for distribution. Heads may be removed to avoid mis-identification as natural spawners by spawning ground surveyors. Similarly, if any hatchery winter steelhead are donated to food banks, fish would be placed in plastic totes or a cooler for transport to the processing site. Stream enrichment and/or food bank transport would be up to 2 hours.

Stream Surveys

Surveys to sample for naturally spawning hatchery winter steelhead will utilize soft-mesh dip nets and/or tangle nets to capture adult steelhead. Other methods (such as angling) could be employed if necessary. Adult hatchery and wild winter steelhead captured will be sampled for length, sex, and fin mark. A scale sample may be taken, and an external mark (Floy tag or opercle punch will be applied. Fish be handled at the site of capture, and released downstream of the capture site within a few feet or yards (to avoid immediate recapture). Total handling time will be just a few minutes.

Wild coho or other non-target species will be released downstream of the capture site (to

avoid immediate recapture). Release will be within a few feet or yards of the capture site, and should be completed within a minute or so of capture and identification. Visual observation of species, sex, and fin mark will be made during handling, but no other sampling will occur. Although some overlap will occur, most of the sampling is expected to occur after coho spawning is completed, which will contribute to reducing take.

12.8) Expected type and effects of take and potential for injury or mortality.

Trapping

Take of adult coho would be through capture and release from the trap site. A short migration delay (up to approximately 24 hours) may occur for fish captured in the trap. Potential for injury is minimized by regular monitoring of the trap site and removal of fish. Trap operations may be modified during periods of high water or debris load, including closing the trap down until conditions improve. Potential injuries include wounding (likely abrasions) from contact with the trap or from encounters with other fish within the trap. The opportunity for impingement exists, but is minimized by proper spacing of the weir and trap bars. There is potential for poaching, but this is minimized by the remote location of the trap site and through the ability to lock the trap lid.

Stream Surveys

Coho may be inadvertently captured during stream surveys for naturally spawning hatchery winter steelhead. Surveys will utilize dip nets or tangle nets (or perhaps other methods such as angling if necessary). Take would occur through handling during capture and release. Handling will be limited to the minimum necessary to remove the fish from the net and release. No sampling of non-target species is planned, although visual observations of sex and fin mark will be made. Although some overlap will occur, most of the sampling is expected to occur after coho spawning is completed, which will contribute to minimizing take.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table".

See Table 2.8 for the projected take level.

12.10) Alternative methods to achieve project objectives.

The best available techniques will be used in this monitoring program to minimize take of coho or other nan-target species while achieving the project objectives. In order to achieve the evaluation objectives, winter steelhead must be captured and handled. The project does not target coho, or any species other than steelhead, but due to some overlap in run timing it is possible that some will be handled.

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

In addition to the target species (winter steelhead), Fall Chinook and coastal cutthroat trout are also likely to be encountered. Based on run timing, it is expected that few to no fall Chinook will be captured as that run will be nearly complete each year at the time this project begins work in the basin. Coastal cutthroat trout are likely to be captured in small numbers either in the tributary trap or in stream surveys attempting to capture adult winter steelhead. The potential for handling mortality is low as fish will be released very shortly after capture. Mortality could occur if fall Chinook or coastal cutthroat caught in the trap suffer injury from contact with other salmonids within the trap box.

12.12) 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.

To minimize take levels, the trap will be monitored/inspected daily with visits more frequent during storm events, periods of high debris transport, or period of high fish abundance. In cases of high flows or excessive debris loads, the adult trap may be closed to reduce fish mortality.

Any coho inadvertently captured during stream surveys for winter steelhead will be released immediately at the site of capture (or just downstream to avoid recapture). Handling time will be limited, and only visual sampling for sex and fin mark will be made.

SECTION 13
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SECTION 14
CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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: Chris Knutsen, North Coast Watershed District Manager, ODFW, West Region

Signature: _____Date:_____

Certified by: Scott Patterson, Fish Propagation Program Manager, ODFW, Salem

Signature: _____ Date: _____

SECTION 15
ATTACHMENTS

Attachment A

Table A-1. Disease History[1] (1995 to present) by Fish Stock at Nehalem Hatchery

Disease or Organism	Hatchery Programs (Stock Code and Species)					
	32 STW	**99 STW**	**72 Rb**	**32 Coho**	**99 Coho**	**34 CHF**
IHN Virus	No	No	No	No	No	No
EIBS Virus	No	No	No	Yes	No	No
Coho Anemia Disease	No	No	No	Yes	Yes	No
Aeromonas salmonicida	Yes	Yes	Yes	Yes	Yes	Yes
Aeromonas/Pseudomonas	Yes	Yes	Yes	Yes	Yes	Yes
Flavobacterium psychrophilum	Yes	Yes	Yes	Yes	Yes	No
Fl. Columnare	Yes	No	Yes	No	No	No
Fl. branchiophilum	No	No	Yes	No	No	No
Fusiform gill disease bacterium	No	No	Yes	No	No	No
Renibacterium. salmoninarum	Yes	Yes	Yes	Yes	Yes	No
Yersinia ruckeri	No	Yes	No	No	No	No
Carnobacterium sp.	Yes	No	Yes	Yes	No	No
Ichthyobodo	Yes	Yes	Yes	No	Yes	No
Gyrodactylus	Yes	Yes	Yes	No	No	No
Ichthyophthirius multifilis	Yes	Yes	Yes	No	No	No
Gill Ameba	Yes	No	Yes	Yes	Yes	Yes
Trichodinids	Yes	Yes	Yes	Yes	Yes	No
Loma sp	No	Yes	No	Yes	Yes	No
Nanophyetus salmincola	Yes	Yes	Yes	No	Yes	Yes
Glochidia	Yes	Yes	Yes	No	No	No
Sanquinicola sp.	Yes	Yes	Yes	No	No	No

[1] "Yes" indicates detection of the pathogen but in many cases no disease or fish loss was associated with presence of the pathogen. "No" indicates the pathogen has not been detected in that stock.

CHF = Fall Chinook Salmon
STW = Winter Steelhead
Rb = Resident Rainbow Trout
Stock 032 = North Nehalem River
Stock 099= Fish Hawk Lake
Stock 034 = Trask River
Stock 072= Roaring River

The fish health monitoring plan is identical to that developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin Anadromous Salmonid Hatcheries, Annual Report 1994. Bonneville Power Administration).

- All fish health monitoring will be conducted by a qualified fish health specialist.
- Annually examine brood stock for the presence of viral reportable pathogens. Number of individuals examined, usually 60 fish, will be great enough to assure a 95 percent chance of detection of a pathogen present in the population at the 5 percent level. American Fisheries Society "Fish Health Blue Book" procedures will be followed.
- Annually screen each salmonid brood stock for the presence of *R. salmoninarum* (*R.*s). Methodology and effort will be at the discretion of the fish health specialist.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices will be reviewed as necessary with facility personnel. Where and when pertinent, nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures, and treatments will be discussed.

Disease Treatment

Treatments for disease at Nehalem Hatchery include: green eggs are routinely water hardened in diluted buffered iodophor; formalin flush treatments of 1:600 formalin for 15 minutes given three to five times per week for fungi prevention on eggs; and juvenile fish are treated with either formalin or hydrogen peroxide to control external fungi and parasites. Hydrogen peroxide is used at 50-100 ppm for one hour on three consecutive days. Depending on species of fish, parasite treating and water temperature, formalin is used at 1:15,000 to 1:6,000 for one hour for three consecutive days and occasionally at 1:20,000 to 1:15,000 for 4 to 6 hours daily until *Ichthyophthirius* is controlled. Juvenile fish are treated for bacterial infections with oxytetracycline or Romet medicated feed according to label. Each spring a 28 day feeding of Aquamycin (erythromycin) medicated feed is administered to the coho juveniles under an investigational new animal drug permit to prevent bacterial kidney disease. If bacterial gill disease is detected, potassium permanganate is given as a one hour bath at 1.0 ppm treatment on the first day and 1.25 ppm treatment on days 2 and 3.