HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**SAB Fall Chinook**
Species or Hatchery Stock:	**Fall Chinook Stock-52 (Rogue stock)**
Agency/Operator:	**Oregon Department of Fish and Wildlife (ODFW) and Clatsop Economic Development Council (CEDC)**
Watershed and Region:	**Lower Columbia River and Estuary**
Date Submitted:	**September 28, 2005**
Date Last Updated:	**September 27, 2005**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Select Area Bright (SAB) Fall Chinook Salmon

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

The SAB fall chinook salmon (*Oncorhynchus tshawytscha*) stock (stock 052) in the lower Columbia River (LCR) originated from Rogue River stock egg transfers to Big Creek Hatchery in 1982 and to CEDC's South Fork Klaskanine Hatchery in 1983. The wild population of fall chinook in the lower Columbia River is part of the Lower Columbia River Chinook Evolutionarily Significant Unit (ESU), which contains both fall and spring chinook. This ESU was listed as threatened under the Endangered Species Act (ESA) in 1999 (Federal Register Notice 1999). The SAB program fall chinook are not considered part of the Lower Columbia River chinook ESU.

1.3) Responsible organization and individuals

Primary management responsibility:

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Name (and title):	Alan Meyer, Hatchery Manager, Big Creek Hatchery
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Name (and title):	Alan Meyer, Hatchery Manager, Klaskanine Hatchery
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Name (and title):	Tod Jones, Hatchery Manager, SF Klaskanine Hatchery
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Name (and title): John North, ODFW Ocean Salmon/Col. River Asst. Fisheries Manager
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

ODFW R&E: 100% funding for SAB production at Big Creek Hatchery and approximately 50% at North Fork Klaskanine Hatchery
BPA: Provides partial project funding (CEDC and ODFW-Big Creek/Klaskanine Hatcheries)
WDFW: Co-manager of Columbia River fisheries under the Columbia River Compact

Note: *ODFW R&E funding for the 2005-2007 biennium was reduced by 50%. In addition, a water right request recently submitted by CEDC to obtain August-September water rights for the South Fork Klaskanine Hatchery was recently denied. These two recent developments may force relocation of the SAB broodstock program from North Fork Klaskanine Hatchery to the South Fork facility. The potential program change is currently being evaluated. Most of the descriptions and data presented herein represent the recent past and current program and do not reflect potential program modifications.*

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

Funding Sources:

BPA - Approximately 75% funding for CEDC SAB Program (staff/production costs)
- 50% funding for North Fork Klaskanine SAB Program

ODFW R&E - 100% funding for SAB production at Big Creek Hatchery and approximately 50% of SAB funding at North Fork Klaskanine Hatchery
- Approximately 25% funding for CEDC SAB Program (acclimation component)

State of Oregon - additional funding for SAB program

Voluntary Commercial Fishery Assessment Program - Partial funding for CEDC rearing

Operational Information:

Full time equivalent staff:	CEDC:	7 FTE
	Klaskanine:	1.5 FTE
	Big Creek:	8 FTE

Annual operating cost:	CEDC:	$743,800
	Klaskanine:	$382,534
	Big Creek:	$628,377

Comments: Funding and staffing levels for Big Creek and Klaskanine hatcheries and CEDC are for the entire facility and/or project and are not specific to the SAB fall chinook program.

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

1) Klaskanine Hatchery is at RM 3.0 on the North Fork Klaskanine River in the Columbia Estuary watershed, Clatsop County, Oregon.
   SAB program functions include:
   - Primary broodstock source
   - Broodstock collection
   - Adult holding
   - Spawning
   - Juvenile rearing/acclimation

2) South Fork Klaskanine Hatchery is at RM 3.0 on the South Fork Klaskanine River in the Columbia Estuary Watershed, Clatsop County, Oregon.
   SAB program functions include:
   - Broodstock source
   - Broodstock collection
   - Adult holding
   - Spawning
   - Incubation
   - Juvenile rearing/acclimation
   - Release location

3) Big Creek Hatchery is at RM 3.3 on Big Creek in the Columbia Estuary Watershed, Clatsop County, Oregon.
   SAB program functions include:
   - Incubation
   - Juvenile rearing

4) Youngs Bay Net Pens at RM 1.5-1.7 in Youngs Bay in the Columbia Estuary Watershed, Clatsop County, Oregon.
   SAB program functions include:
   - Juvenile rearing
   - Release location

5) Tidewater section of Youngs and Klaskanine Rivers at RM 8.0/0.0 on the Youngs and Klaskanine rivers, Columbia Estuary Watershed, Clatsop County, Oregon.
   SAB program functions include:
   - Broodstock collection

1.6) Type of program.

Isolated Harvest

1.7) Purpose (Goal) of program.

The primary goal of the program is to provide higher quality fall chinook for harvest in LCR Select Area commercial and recreational fisheries than the traditional tule chinook hatchery stock. Select Area fisheries provide harvest of hatchery-produced salmon released from and returning to Select Areas with minimal interception of non-SAFE salmon stocks. Thus, fishing opportunities can be maintained while helping to conserve naturally-produced native stocks. A secondary goal is to supplement harvest in Oregon commercial troll, Oregon ocean recreational, and Columbia River mainstem commercial and recreational fisheries. Select Area fisheries are managed to provide broodstock for the Klaskanine Hatchery SAB program (a separate HGMP).

1.8) Justification for the program.

Select Area fisheries for SAB fall chinook provide harvest of a high quality hatchery-produced salmon released from and returning to Select Areas with minimal interception of non-SAFE salmon stocks. Select Area bright fall chinook are less mature and in prime condition upon return to the Columbia River estuary, compared to lower river tule stock fall chinook which are rapidly maturing and have poor flesh quality. Therefore, SAB fall chinook have a higher market value and provide greater economic benefit to local fisheries. In addition, because SAB fall chinook are Rogue River stock, they migrate south of the Columbia River when released, thereby providing opportunities for harvest in Oregon ocean commercial and recreational fisheries whereas tule fall chinook contribute to fisheries north of the Columbia River. Currently all (100%) smolts released are mass-marked with a left-ventral (LV) fin clip to facilitate identification and provide accountability in harvest, straying, and spawning programs. A 100% marking rate allows for selective harvest of hatchery fish while minimizing impacts on wild populations. The program was initially established at Big Creek and South Fork Klaskanine hatcheries but was eventually relocated to the North Fork Klaskanine Hatchery in 1996 to minimize straying of the stock which occurred with Big Creek releases. Straying is currently low and harvest rates have increased substantially since fish now migrate through the Youngs Bay Select Area fishery.

1.9) List of program "Performance Standards".

See Section 1.10

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

1.10.1) "Performance Indicators" addressing benefits.

Benefits Performance Standards	Performance Indicators	Monitoring & Evaluation
Contribute hatchery fish to target fisheries.	Harvest of SAB fall chinook in LCR Select Area commercial and recreational fisheries.	Fish buyer and dock-side creels, recoveries of CWT marked fish from commercial and recreational sampling programs.
Successfully maintain a brood stock of SAB fall chinook.	Achieve a smolt to adult survival rate and escapement adequate to collect 900 female broodstock.	Marking and tagging of specific release groups, plus sampling of adult catch and escapement.
Design and implement projects that improve the quality of the SAB fall chinook program.	Projects are identified, reviewed, and implemented that aim to increase survival of program fish while minimizing impacts on wild fish.	Research and monitoring programs have and continue to be incorporated into project designs. Examples of projects include: rearing/release studies and feeding studies. See Section 12.
Release groups that are sufficiently marked for proper identification.	Type and number of program marked fish, both fin clips (mass marking) and tags (group id.).	With the exception of the 1987-1989 brood years, all SAB fall chinook smolts have been uniquely marked with an LV fin clip to identify this stock upon its return to the lower Columbia River Basin. Standard lots of ~25,000 fish are coded-wire tagged from each unique release occurring at each release site. Fin clipping and tagging quality checks are performed during marking and prior to release. Results are reported, and issues addressed as needed.

1.10.2) "Performance Indicators" addressing risks.

Risks Performance Standards	Performance Indicators	Monitoring & Evaluation
Harvest of hatchery produced fish minimizes impacts to wild fish populations.	Number of non-target or wild fish caught in Select Area fisheries targeting SAB fall chinook.	Impact rates on listed stocks are estimated annually based on sampling of the landed catch (sport and commercial) for CWTs.
Juvenile hatchery releases minimize interactions with wild fish species.	Release timing, location, condition of juveniles, and emigration patterns.	Effective rearing studies and monitoring of juvenile health.
Minimize disease risk to wild fish.	Program complies with all state and federal health monitoring, transfer, and release guidelines (e.g. USFWS Fish Health Policy and Implementation Guidelines; IHOT fish policy).	Juvenile fish health is monitored on at least a monthly basis at the rearing hatchery. A fish health specialist will examine affected fish and recommend remedial or preventative measures. Disposal of affected eggs or fish follows IHOT policy.
Straying of hatchery fish is minimized.	Recovery of program fish in non-target fisheries and watersheds.	CWT and mark recoveries throughout the Columbia Basin are recorded and summarized annually in order to estimate the amount of straying of program fish.
Natural spawning of program fish is minimized.	Escapement of hatchery fish to natural spawning areas (through straying) of less than 5%.	CWT analysis and spawning ground surveys are conducted annually in Youngs Bay drainage streams to determine extent of natural spawning.
Comply with DEQ water quality standards to minimize habitat degradation	No long-term change in aquatic invertebrate biodiversity and relative abundance. Disposal of waste at hatcheries per IHOT standards.	Aquatic biomonitoring and benthic sampling at all net pen sites. Water quality sampling at all hatcheries.
Water use at hatcheries is in compliance with water rights	Amount of water diverted through hatcheries in months approved for usage	Water rights permits are maintained. Water flows at diversions are recorded regularly and reported as needed.

1.11) Expected size of program.

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

The current escapement goal for this program is to return enough adults to the North Fork Klaskanine Hatchery trap, South Fork Klaskanine trap, and/or via offsite broodstock collection to meet broodstock needs, or about 900 females. Actual numbers of males and females spawned since 1992 are reported in Table 18 Section 7.4.1.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (Use standardized life stage definitions by species presented in Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs	N/A	N/A
Unfed Fry	N/A	N/A
Fry	N/A	N/A
Yearling	NF Klaskanine Hatchery	700,000 (sub-yearling smolts)
	SF Klaskanine Hatchery	50,000 (sub-yearling smolts)
	Youngs Bay Net Pens	1,500,000 (sub-yearling smolts)

The targeted maximum annual release is 1,500,000 sub-yearling smolts released from the Youngs Bay net pens, 50,000 sub-yearling smolts released from the South Fork Klaskanine Hatchery, and 700,000 sub-yearling smolts released from the North Fork Klaskanine Hatchery. Actual annual releases since 1993 (1992 brood) are presented in Tables 19 and 24, Sections 9.1.1 and 10.3.

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

The purpose of this hatchery program is to provide fish for fisheries. Performance is measured by catch and survival. The total catch of this stock since 1996 is provided in Table 1. Smolt-to-adult survival rates are provided in Table 2.

Table 1. Estimated total harvest, hatchery returns, and escapement of Select Area Bright (Rogue stock) fall chinook, 1996-2003 (North et al. 2004). Data based on coded-wire tag recovery data, sport and commercial sampling programs, hatchery trap records, and stream surveys.

Return year	Harvest	Hatchery Returns	Escapement	Total
1996	4,023	2,061	251	6,335
1997	5,255	674	367	6,296
1998	3,718	1,018	245	4,981
1999	2,959	713	104	3,776
2000	2,658	920	455	4,033
2001	6,853	1,054	380	8,287
2002	7,738	1,513	588	9,839
2003	10,370	1,066	>400	11,836

Table 2. Annual smolt-to-adult survival rates (%) of Select Area Bright fall chinook by release site, 1985-1998 brood years (North et al. 2004).

Brood Year	Big Creek Hatchery	Klaskanine Hatchery	South Fork Klaskanine Hatchery	Youngs Bay Net Pens
1985	2.1	--	0.8	--
1986	2.3	--	0.4	--
1987	2.3	--	3.0	--
1988	1.4	--	--	--
1989	0.8	--	1.4	--
1990	0.8	--	--	--
1991	0.5	--	--	0.2
1992	1.5	--	--	--
1993	0.6	--	--	1.1
1994	0.3	--	--	0.3
1995	0.2	0.2	--	0.4
1996	--	0.3	--	0.1
1997	--	0.6	--	0.3
1998	--	0.9	--	1.7
1999	--	3.1	--	2.0
2000[a]	--	0.8	--	1.2

[a] Preliminary data for age-3 adult returns only

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

The SAB fall chinook stock originated from Rogue River stock egg transfers from Cole Rivers Hatchery (Rogue River) to Big Creek Hatchery in 1982 and to CEDC's South Fork Klaskanine Hatchery in 1983. The broodstock program was maintained at Big Creek Hatchery through 1995. Fishery enhancement efforts in Youngs Bay began with South Fork Klaskanine releases and expanded to include net-pen rearing in 1989. Releases from the South Fork Klaskanine facility were discontinued in 1988 due to poor survival, but net-pen releases have continued annually. The broodstock program was transferred to Klaskanine Hatchery in 1996. The SAB program expanded to current production goals in 1993 with funding by Bonneville Power Administration for the Select Area Fisheries Enhancement Program (SAFE).

1.14) Expected duration of program.

The program is on-going with no planned termination.

1.15) Watersheds targeted by program.

Youngs Bay and tributaries (N. Fork and S. Fork Klaskanine River), Columbia River Estuary.

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

1.16.1) Brief Overview of Key Issues

Issue 1. Maintenance of SAB fall chinook broodstock at Klaskanine Hatchery.

Select Area Bright fall chinook are currently reared at Big Creek Hatchery and released from the North Fork Klaskanine Hatchery, South Fork Klaskanine Hatchery (releases resumed effective with the 2003 brood) and from net pens in Youngs Bay for harvest in commercial and recreational fisheries. The broodstock for this program was developed using eggs from fall chinook stock returning to Cole Rivers Hatchery on the Rogue River. The first eggs were transferred from Cole Rivers Hatchery to Big Creek Hatchery in 1982 with additional egg transfers occurring periodically through 1990. Subsequent adult returns to Big Creek Hatchery through 1995 were used to develop the local broodstock that is currently being used by the program. Beginning with the 1996 brood, the broodstock program was relocated to Klaskanine Hatchery to address excessive stray rates (percentage of adult return escaping to non-natal streams) from Big Creek releases. Relocation of releases to Youngs Bay has reduced stray rates and increased the harvest rate from 46.3% to 77.2-86.3%; however, maintaining the broodstock program at Klaskanine Hatchery has been challenging due to difficulties with adult collections, juvenile rearing, and acclimation of smolts.

Klaskanine Hatchery is located at approximately river mile 3.0 on the North Fork of the Klaskanine River, near Olney, Oregon. The North Fork of the Klaskanine River is a small stream that has limited in-river flows during July through mid-October, which encompasses the peak time of adult returns for this stock. Adult trapping at Klaskanine Hatchery is the primary source of eggs for the broodstock program so low flows during the peak migration months can severely limit the program's ability to collect enough adults to achieve full smolt production.

Klaskanine Hatchery was constructed in 1911 and rebuilt in 1953 with funding from the Mitchell Act. Due to budget constraints, the facility was scheduled to be closed down in 1995. Fortunately, funding by the SAFE program and ODFW allowed the facility to remain in operation for collection of SAB adults and rearing and acclimation of juvenile SABs and steelhead. However, the limited water supply during July-October complicates adult collections, restricts the number of juveniles that can be reared or acclimated, prohibits full-term rearing of juveniles, and negates simultaneous juvenile rearing and adult collections. In addition, the limited water supply has fostered serious disease outbreaks in juvenile SABs during some years.

Issue 2: Uniquely mark total production with left ventral (LV) fin clip.

All SAB fall chinook smolts have been uniquely marked with an LV fin clip to identify this stock upon its return to the lower Columbia River basin. This unique mark was necessary to ensure that this non-endemic stock of fall chinook was not included in broodstock collections for other lower Columbia River hatcheries. Stray rates for releases from net pens in Youngs Bay were much lower than for broodstock releases from Big Creek Hatchery. Therefore, the broodstock program was moved from Big Creek Hatchery to Klaskanine Hatchery, which is located at river mile 3.0 of the Klaskanine River, a tributary to Youngs Bay. The purpose for the move was to reduce straying rates and maximize harvest. The move was effective with stray rates declining from an average of 14.2% for Big Creek releases (1991-1995 broods) to an average rate of 1.5% for Klaskanine Hatchery releases (1995-2000 broods).

With these reduced stray rates, program managers are considering eliminating the unique LV mark to improve survival. The LV fin clip results in an approximate 50% survival reduction. Discontinuing this fin clip would increase adult returns; thereby increasing the number of adult fish available for harvest and help address broodstock shortages. Few SAB fall chinook now stray to other lower Columbia River hatcheries, thereby reducing the concern of inadvertently incorporating SAB fall chinook into other LCR broodstocks. The spawning period of SAB fall chinook is later than that of tule fall chinook produced in other lower Columbia River hatcheries, adding another safeguard against potential mixing. The current Ad+coded-wire tag (CWT) marking program can be used to estimate stray rates and determine freshwater distribution for this stock. Currently, standard lots of ~25,000 fish each are coded-wire tagged from each unique release occurring at each release site. This level of tagging is adequate for run reconstruction, fishery management under the ESA, and stock status monitoring and evaluation purposes. Increasing the CWT marking level may be beneficial for monitoring stray rates of SAB fall chinook in natural spawning areas to ensure that straying of this stock remains at the low levels observed for the 1995-2000 broods released from the North Fork Klaskanine Hatchery. The decision to discontinue the LV fin-clip will likely be contingent upon ongoing discussions regarding mass-marking of all Columbia River Basin fall chinook.

1.16.2) Potential Alternatives to the Current Program

Issue 1. Maintenance of SAB fall chinook broodstock at Klaskanine Hatchery.

Alternative 1: <u>Collect broodstock with tangle nets in Youngs Bay or tributaries.</u> SAB fall chinook hold in Youngs Bay and tidewater sections of the Klaskanine and Youngs rivers during late-July through early-September prior to migrating upstream. During this time, adult SABs can be collected in a benign manner with small-mesh (≤5¼”) tangle nets at the confluence of the Klaskanine and Youngs rivers. The feasibility of this collection method was evaluated in September of 2003 with assistance from a contracted test fisher. During this trial, a total of 155 adult chinook were collected during 3 test fishing days. Of these fish, 120 were held in net pens located on site until ready for spawning in October and November. Immediate mortality during collection was moderate with only 12 mortalities and holding survival was 89%. This alternative was continued during August-September 2004 and 2005 with approximately 200 adult SAB chinook collected annually with a 92.5% holding survival rate in 2004 (2005 holding in progress). This alternative is supported and being implemented by ODFW, therefore specific information for this alternative is included throughout this document.

Alternative 2: Collect broodstock with a trap in Youngs Bay. Adult SAB fall chinook enter tidewater sections of the Youngs and Klaskanine rivers prior to migrating up the Klaskanine River. As the fish mingle in the lower sections of these rivers, they should be susceptible to capture using a fixed trap. However, this alternative was tested in September 2003 with poor results. During September 17-18, 2003 a Merwin trap was operated for ~26 hours and captured four coho and zero SAB fall chinook. This alternative was considered by ODFW but the temporary loan of the Merwin trap has terminated and no trap is currently available. Due to the success of the current off-site broodstock collections described in Alternative 1, the use of a trap may not be needed.

Alternative 3: Utilize adult SAB fall chinook that return to SF Klaskanine Hatchery for broodstock. During some years, flow in the North Fork Klaskanine can persist at low levels from July through mid-October. These conditions occasionally result in moderate numbers of adult SABs returning to the South Fork Klaskanine. Since returning adult SAB fall chinook are currently 100% marked with an LV fin clip, these fish can be collected and spawned to supplement the total egg take of the program and minimize straying. This situation occurred in 2003 when hatchery staff collected 109 adults, of which 99 were spawned, yielding 309,000 additional eggs for the project. Adults were held on-site at the South Fork Klaskanine Hatchery until spawning. Eggs were incubated at the hatchery and transferred to net pens in Youngs Bay as button-up fry, except 50,000 fish were retained and reared/released on-site to establish annual returns to this facility as an alternative SAB broodstock source. A similar release of ~45,000 smolts were reared and released from the South Fork Klaskanine Hatchery in 2005. Since this alternative was implemented by CEDC in 2004-05, specific information for this alternative is included throughout this document. Even if the LV fin clip was discontinued, this alternative could continue since the run timing of naturally occurring fall chinook in the South Fork Klaskanine is significantly later than SAB fall chinook. This alternative is supported by ODFW if a reliable weir or fish collection system (planned for construction in 2006) can be installed on-site to collect returning adults. The current trap is located in the rearing pond outlet and is only capable of collecting a portion of returning adults.

Alternative 4: Rear/acclimate juvenile SAB fall chinook in raceways instead of the concrete pond at Klaskanine Hatchery. From 1996-2002, hatching and early rearing of SAB fall chinook has occurred at Big Creek Hatchery. All fish are then transferred by truck to Klaskanine Hatchery as fingerlings. Production strategies for juvenile SAB fall chinook at Klaskanine Hatchery have consisted of growing fingerlings to the smolt stage in a large concrete pond, followed by a two week acclimation of the smolts in raceways. The concrete pond has a capacity of ~400,000 smolts (15 fish/pound) and was used to rear the majority of the production during this period. Unfortunately, disease outbreaks have been common for fish reared in this pond, especially during the summer when stream flows are low and rearing densities peaked prior to release. The remaining fish were acclimated in the raceways, with disease outbreaks being less common for this rearing strategy. In 2003 and 2004, all rearing and acclimation was conducted in the raceways, which seemed to reduce disease losses. However, this release strategy requires more frequent transfer of release groups from Big Creek Hatchery and limited the size of smolts at release since fish had to be liberated to make room for the next incoming group. Installation of a supplemental oxygen system to increase dissolved oxygen levels in the water supply would help alleviate this situation by improving the quality of the water supply. Alternative water sources do not exist since test wells have only produced saltwater. Increased dissolved oxygen would likely yield faster growth rates, better fish conditions, and higher rearing densities so that acclimation times at Klaskanine Hatchery could be increased. This alternative is supported by ODFW and is being implemented.

Alternative 5: Discontinue releases of Select Area Bright fall chinook. The SAFE project was initiated to provide and expand commercial and recreational fishing opportunities in off-channel areas of the lower Columbia River that would minimize negative effects on listed stocks. Since SAB fall chinook are the only fall chinook reared and released by the SAFE project, this option would eliminate a critical component of the project's production. Under this alternative, if sport and commercial fisheries for fall chinook in the lower Columbia River were to be maintained at current levels, harvest of hatchery SAB fall chinook would be replaced by harvest of indigenous Columbia River fall chinook (both hatchery and wild). This would increase impacts on listed stocks such as lower Columbia and Snake River fall chinook. This alternative is not supported by ODFW or industry.

Issue 2: Uniquely mark total production with left ventral (LV) fin clip.

Alternative 1: Eliminate LV fin clip and maintain current Ad+CWT marking rates. Stray rates for SAB fall chinook can be documented through the current CWT marking and recovery programs. Additionally, the current marking program provides recovery data that is adequate for use in fishery management under the ESA, fall chinook run reconstruction and stock status monitoring and evaluation. Current CWT mark rates may not identify low levels of straying to escapement areas, primarily natural spawning locations. However, straying is primarily limited to the Youngs Bay Basin where only limited, and late natural fall chinook production occurs.

Alternative 2: Eliminate LV fin clip and increase Ad+CWT marking rates from current levels. Elimination of the LV fin clip will result in monetary savings for the SAFE project, which could be reinvested to increase Ad+CWT mark rates for this stock. Increased Ad+CWT mark rates for this stock would result in increased precision for determining stray rates and freshwater distribution of SAB fall chinook. Recovery of Ad+CWT marked fall chinook would benefit from increased sampling effort in natural spawning locations. Increased mark rates and recovery efforts would better evaluate whether stray rates remain at the low levels observed for the 1995-2000 broods released from Klaskanine Hatchery.

Alternative 3: Evaluate alternative mass marking techniques. Alternative means of mass marking might include adipose-only fin clips or otolith marking. Marking chinook salmon with an adipose fin clip but no CWT is not currently allowed under regional marking agreements;

however, mass-marking of fall chinook in the Columbia Basin is being evaluated and considered. Otolith marking would likely have little to no impact on survival of SAB program fish, but would require investment in incubation water temperature control systems. Otolith marks are also not externally visible, and thus would require additional sampling to collect otoliths (only possible from dead fish) and laboratory expenses to have the otoliths read.

Alternative 4: Maintain current LV fin clip and Ad+CWT marking rates. Maintains the status quo. Would allow for continued high level of detection of stray SAB adults at hatcheries and on natural spawning grounds. Would not gain benefits of reduced marking costs or increased smolt to adult survival of SAB program fish.

1.16.3) Potential Reforms and Investments

Reform/Investment 1: Secure funds to pay for contract fishers to collect SAB adults for broodstock and purchase holding pens. This option would ensure that additional broodstock are collected each year to maintain and possibly increase juvenile production. The cost would be minimal at approximately $5,000 annually. ODFW staff will conduct this work until funding can be secured.

Reform/Investment 2: Install an oxygen supplementation system at Klaskanine Hatchery to improve rearing capacity and improve smolt quality. A similar system is currently being considered for Gnat Creek Hatchery for similar reasons. Cost of such a system is minimal with installation requiring approximately $3,000 and annual operation costs of approximately $1,000.

Reform/Investment 3: Enlarge and deepen the "hatchery hole" at Klaskanine Hatchery to improve holding conditions for adult SAB fall chinook that successfully reach the hatchery prior to opening of the trap in October. Currently, most early returning adults die prior to being spawned since holding conditions in the "hatchery hole" are poor. The hole has filled-in over time due to erosion of the bank adjacent to the hole. Securing funds to conduct bank stabilization and to enlarge the hole could yield increased juvenile production through improved adult survival. This work could be completed for approximately $8,000 assuming some volunteer assistance.

Reform/Investment 4: Secure funds to construct a fish barrier mechanism in the North Fork Klaskanine River near the Klaskanine Hatchery facility site. This investment would include placing permanent concrete footing in the river to secure a removable weir during the fall SAB migration period. This reform is needed to keep SAB fall chinook from moving upstream of the hatchery hole (and the adult trap) during low water periods when the Klaskanine Hatchery trap cannot be operated. Although a velocity barrier currently blocks fish from migrating upstream of the hatchery, fish tend to migrate up to, and stay at this barrier which is upstream of the fish trap. The nature of the river ottom in this area makes seining and other collection methods impratical. This reform will result in higher efficiency in collecting SAB broodstock,. A preliminary evaluation of this reform has been undertaken which confirmed costs would approach $20,000.

Reform/Investment 5: Discontinue the use of the left ventral fin-clip to uniquely mark Select Area Bright fall chinook. The unique mark is no longer necessary now that the broodstock program has been moved to Klaskanine Hatchery and straying of SAB fall chinook is minimal. This reform would result in a cost savings of approximately $26,000 annually and improved survival would yield increased returns for both harvest and broodstock purposes. This option would not be logical if full-scale mass-marking of fall chinook throughout the Columbia River Basin is approved.

Reform/Investment 6: Fund a project to increase Ad+CWT mark and recovery rates. Increase the number of smolts marked with an Ad+CWT mark prior to release to allow for increased recovery rates for SAB fall chinook straying to escapement areas other than Klaskanine Hatchery, especially natural spawning areas. Additional seasonal field sampling staff would also be required to increase CWT recovery rates in natural spawning areas. Current recovery programs at hatchery facilities are adequate for detecting stray SAB fall chinook. Increased marking and recovery rates will increase precision of estimates of stray rates and freshwater distribution data for SAB fall chinook. Cost of this reform/alternative is moderate especially if the LV fin clip is eliminated. Current costs are about $149/K fish tagged or about $15,000 to AD+CWT an additional 100,000 fish. An additional month of staff sampling time would require an additional $3,500.

Reform/Investment 7: Secure funds to install a fish ladder and adult collection facility at the South Fork Klaskanine Hatchery operated by CEDC. This investment is needed to provide improved fish passage (especially during periods of low flow), and to allow for selective removal of hatchery-origin spring and SAB fall chinook. If all SAB fall chinook production is relocated to the South Fork facility, this reform will be needed to collect adults for spawning purposes. Cost of this reform/alternative would be approximately $20,000.

Reform/Investment 8: Secure funds for general upgrades and improvements to Klaskanine Hatchery (Table 3). Deferred maintenance at this facility since the early 1990's has resulted in a backlog of needed repairs that will need to be addressed before production at this facility can be increased significantly. For instance, the head box is deteriorating rapidly and general raceway repair is needed. This reform is needed if any additional production is ever considered for this facility.

Reform/Investment 9: Transfer 25,000 SAB fall chinook fry from the proposed 50,000 fish production at the South Fork Klaskanine Hatchery to Astoria High School for early rearing and application of coded-wire tags. Fish would be transferred back to the South Fork Klaskanine Hatchery for acclimation (approximately 30 days) and released. This reform/alternative would enable a public education link as well as increase the representative CWTs for SAB production. The cost of this reform is minimal due to an annual donation of marking equipment and tags from Northwest Marine Technologies and labor provided by the students.

Reform/Investment 10: Investigate the feasibility of drilling wells at The North Fork Klaskanine Hatchery to obtain a source of salt water for use in control and treatment of fresh-water white-spot disease (*Ichthyophthirius multifiliis i.e. "Ich"*). If feasible, this option could provide a natural prophylactic treatment for SAB fall chinook acclimated at this site during June-August.

Table 3. Repairs and improvements needed at Klaskanine Hatchery.

Building	Description	Comments
0	Tree Removal	Remove trees near hatchery building for safety.
0	Rip Rap Work	Place rip rap at main intake to stop erosion.
4427	Water Supply Line	Pour concrete cap over water supply line that runs across the river to protect from damage. Consideration should be given to replacing the entire pipeline.)
0	Pond Headbox and Spout Replacement	Replace or repair the pond head box and all the spouts.
4425	Rearing Lake	Rearing lake outlet repairs
4426	Hatchery Bldg. 1.5 Stories 58'x171'	Replace soffits and gutters.
4425	Rearing Lake	Replace the metal screen frames in the large rearing lake.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-LISTED SALMONID SPECIES AND NON-SALMONID SPECIES ARE ADDRESSED IN ADDENDUM A)

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

Fish production activities conducted by the Select Area fisheries project are covered by a Biological Opinion received from NMFS in 1998. Re-initiation of consultation regarding SAFE production was planned to begin in spring 2004 with a new production Biological Assessment (BA). This and other species-specific HGMPs for the SAFE project may serve as the basis for a new BA or may serve to replace it (Personal communication with Rich Turner; NOAA).

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

All Columbia River anadromous salmonids that successfully return to spawn must migrate through the lower Columbia River and estuary twice during their life cycle. Thus, hatchery programs in the lower Columbia have the potential to affect the 13 listed ESUs in the Columbia basin. However, it is more probable that the program could affect those ESA listed natural salmonid populations that occur in the subbasin where the program fish are collected and released, including:

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

The Columbia River chum salmon (*Oncorhynchus keta*) ESU is federally listed as threatened, effective May 24, 1999.

The lower Columbia River coho salmon ESU was federally-listed as threatened under the ESA on June 28, 2005 with an effective date of August 26, 2005.

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

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

The SAB fall chinook salmon program primarily uses adult returns to Klaskanine Hatchery in its broodstock program (see Section 6.0). Additional broodstock may be collected at CEDC's South Fork Klaskanine Hatchery, Big Creek Hatchery (strays), and in tidewater sections of Youngs and Klaskanine rivers. All fish are identified as Rogue stock by left-ventral fin clips. Rogue River chinook are not listed as a threatened or endangered species at this time. No listed species are expected to be directly affected by the SAB fall chinook salmon propagation program. Direst take of listed species resulting from Select Area fisheries is addressed in Section 3.3

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

The fall component of the Lower Columbia River chinook ESU is comprised of two groups: 'tules' and 'brights'. Native fall chinook in Oregon tributaries of the lower Columbia River are almost all tule fall chinook, with the exception of bright stock fall chinook produced in the Sandy River. Small, scattered, naturally spawning fall chinook populations are observed in small Oregon tributaries, with the largest numbers in Big Creek and Plympton Creek, where a significant portion of the natural spawning is comprised of hatchery produced tule fall chinook. Small numbers of tule fall chinook spawn in Youngs Bay tributaries in some years. Tule fall chinook generally arrive at the mouth of the Columbia River beginning in August, with peak migration generally in September; bright fall chinook return timing generally is later than tules. Tule fall chinook are sexually mature upon river entry and spawn soon after arrival to the spawning grounds, while bright fall chinook are sexually immature and may hold in freshwater for months prior to spawning. Populations in the lower Columbia have short migrations, which are more characteristic of coastal populations than upper Columbia populations. Depending on spawn timing and water temperature, tule fall chinook juveniles in the lower Columbia River generally emerge beginning in March-April and follow an ocean-type life history, emigrating in late spring/early summer of their first year as sub-yearlings. Meanwhile, bright fall chinook juveniles in the lower Columbia River generally emerge from March-June and emigrate in early/late summer. Ocean distribution of lower Columbia fall chinook extends from the coast of Washington to Southeast Alaska; bright fall chinook salmon are generally more northerly distributed.

Lower Columbia River chum salmon are occasionally observed in the South Fork Klaskanine River and Big Creek. Chum salmon in the lower Columbia generally arrive at the mouth of the Columbia River beginning in late October, with peak migration generally in November. Chum salmon are sexually mature upon river entry and spawn soon after arrival at the spawning grounds. Depending on spawn timing and water temperature, chum fry begin emerging in early spring (March) and emigrate shortly after emergence; peak emigration is usually late April. Current chum salmon ocean distribution is not well documented but is expected to extend along the coast from Washington to Alaska.

Lower Columbia River coho salmon are present in Youngs Bay tributaries and Big Creek; evidence suggests that most coho observed in these subbasins are Type S hatchery stocks and that relatively few wild fish are present in most years. Lower Columbia River coho are categorized as either Type S or Type N, based on their general ocean distribution either south or north of the Columbia River. Managers also refer to Type S as early stock coho and Type N as late stock. Early stock coho salmon in the lower Columbia generally enter the Columbia River beginning in August, with peak spawn timing generally in late October. Late stock coho salmon in the lower Columbia generally enter the Columbia River beginning in September, with peak spawn timing generally in late November and December. Depending on spawn timing and water temperature, coho fry begin emerging in the spring and rear for a year in freshwater; emigration begins the following spring.

Listed populations that may be incidentally affected by the SAB fall chinook salmon program include species utilizing habitat in the North and South Forks of the Klaskanine River, Youngs River, Lewis and Clark River, Youngs Bay, and the Columbia River and estuary downstream of Youngs Bay. All NMFS ESA-listed salmonids use the lower Columbia River as a migratory route, although effects of the SAB fall chinook salmon program are expected to be minimal. Potential for impacts associated with the SAB fall chinook program are more likely to occur in populations of threatened chinook and chum, as well as ESA candidate coho salmon that may occur in the Youngs Bay tributaries. Lower Columbia tule fall chinook abundance is generally low and other Columbia River chinook stocks (e.g. Lower River Bright, Upriver Brights, etc.) have not been observed spawning in the Youngs Bay tributaries. The Rogue River Bright stock, which are produced in the SAB fall chinook program, are currently the most abundant fall chinook stock spawning in the Youngs Bay tributaries. Big Creek natural spawning fall chinook are predominately Lower River tule stock, however, it is assumed that a large proportion of the natural spawners are hatchery produced fish (Table 4). Chum salmon are periodically observed in South Fork Klaskanine River and are trapped at Big Creek Hatchery, although abundance is quite low (Table 5). Estimates of total escapement have not been quantified for coho salmon in the Youngs Bay area. However, fish per mile estimates have been made for the Youngs River and for Big Creek. The 2000-2003 fish per mile data represents only wild coho as marked hatchery fish could be accounted for and removed from the data (Table 5).

Table 4. Fall chinook aggregate natural spawning escapement estimates for select lower Columbia River subbasins, 1990-2003, Youngs Bay tributaries, 1998-2003, and Big Creek, 1998-2003.

Run Year	Aggregate Lower Columbia Tribs [a]	Youngs Bay Tributaries: North Fork Klaskanine LRH [b]	North Fork Klaskanine RRB [c]	South Fork Klaskanine LRH [b]	South Fork Klaskanine RRB [c]	Lewis and Clark LRH [b]	Lewis and Clark RRB [c]	Youngs LRH [b]	Youngs RRB [c]	Big Creek LRH [b]	Big Creek RRB [c]
1990	2,545	na	na	na	na	na	na	na	na	na	na
1991	1,712	na	na	na	na	na	na	na	na	na	na
1992	2,230	na	na	na	na	na	na	na	na	na	na
1993	2,225	na	na	na	na	na	na	na	na	na	na
1994	5,189	na	na	na	na	na	na	na	na	na	na
1995	3,906	na	na	na	na	na	na	na	na	na	na
1996	2,307	na	na	na	na	na	na	na	na	na	na
1997	2,175	na	na	na	na	na	na	na	na	na	na
1998	1,206	7	0	7	0	10	0	9	0	461	8
1999	2,057	0	80	0	0	7	0	15	0	725	6
2000	2,843	0	347	2	0	0	0	25	46	1,197	61
2001	11,651	0	173	0	14	5	0	0	90	7,227	7
2002	22,685	0	0	0	685	14	0	0	0	11,677	0
2003	30,036	0	505	0	224	160	46	0	56	19,308	0

a Expanded spawning ground surveys for nine Oregon lower Columbia River tributaries; South Fork Klaskanine, North Fork Klaskanine, Lewis and Clark River, Youngs River, Bear Creek, Big Creek, Plympton Creek, Gnat Creek, and Clatskanie River.
b LRH = Lower River Hatchery stock.
c RRB = Select Area Bright (Rogue River) stock.

Table 5. Chum and coho salmon escapement estimates in select lower Columbia River subbasins, 1990-2003.

Run Year	Chum: Big Creek Hatchery Trap	Chum: S. Fork Klaskanine Hatchery	Coho: Youngs River [a] (fish/mile)	Coho: Big Creek [a] (fish/mile)
1990	10	N/A	0.0	0.0
1991	3	N/A	0.0	0.0
1992	2	N/A	0.0	0.7
1993	1	N/A	0.0	0.7
1994	6	N/A	0.0	1.4
1995	0	N/A	3.3	0.0
1996	0	N/A	0.0	0.0
1997	3	N/A	0.0	0.0
1998	3	N/A	0.0	0.0
1999	0	N/A	0.0	0.0
2000	0	6	71.4	0.0
2001	4	4	0.2	0.0
2002	0	0	15.6	1.0
2003	27	2	23.3	2.2

a Escapement estimates represent fish per mile counts; estimates from 2000-2003 represent wild fish only while pre-2000 estimates include both hatchery and wild fish, of which, many are hatchery fish.

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

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

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

The WLC-TRT and ODFW have both assessed the current viability status of salmon and steelhead populations in the lower Columbia and Willamette ESUs (McElhany et al. 2004). Both assessments used the same persistence probability criteria to estimate extinction risk for each population. To estimate the extinction risk, four key attributes were evaluated: 1) abundance and productivity, 2) diversity, 3) spatial structure, and 4) habitat. The populations were ranked from 0-4, with category 0 representing a 0-40% chance of persistence in the next 100 years and category 4 representing a 99 percent chance of persistence in the next 100 years. A population was considered viable with a category 3 score. The status assessment includes fall chinook, coho, and chum populations in Youngs Bay tributaries, Big Creek, Scappoose Creek, and the Clatskanie River. The persistence probability scores of both the WLC-TRT and ODFW are reflected as a range (Figure 1). The scores for fall chinook are generally low ranging from 1-2, for chum very low at less than 1, and for coho low from 1 to 2.

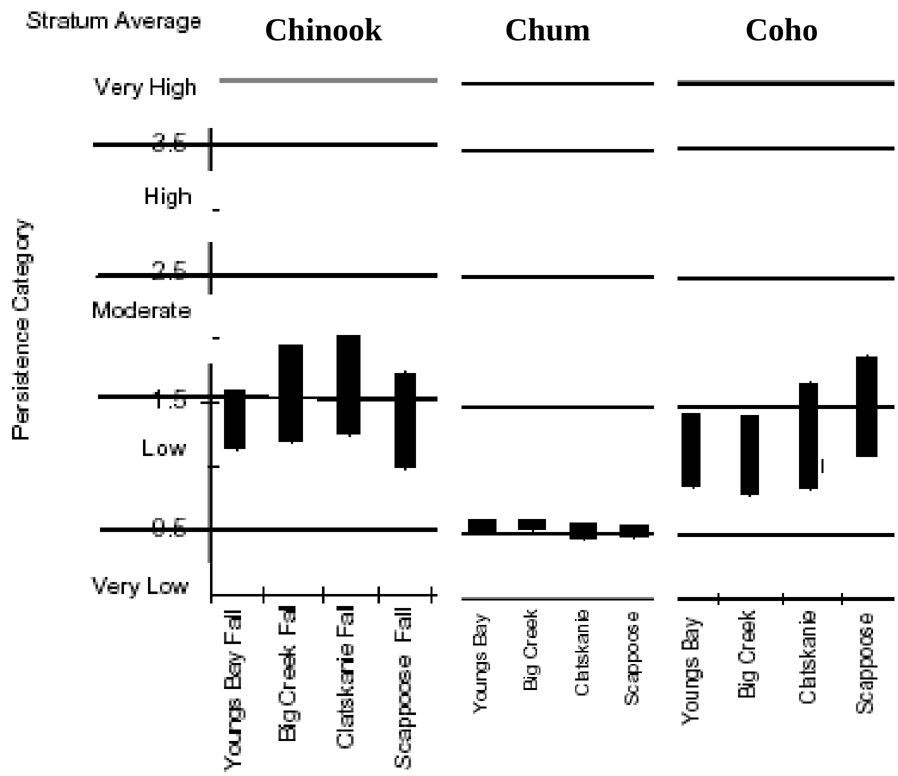

Figure 1. Current viability status of fall chinook, chum and coho salmon populations in Youngs Bay, Big Creek, Clatskanie River, and Scappoose Creek. Figure adapted from McElhany et al. 2004.

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

These data are not available.

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

Most recent available spawning escapement estimates are shown in Table 4 and Table 5.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

These data are not available for chum, although few hatchery chum salmon are expected to be present in Oregon tributaries of the lower Columbia because of a lack of chum salmon hatchery programs in the region (two hatchery programs on the Washington side of the Columbia River, at

Grays River and Chinook River, may contribute strays). Natural chinook spawning escapements in Oregon tributaries of the lower Columbia River have been separated by stock components since 1998. No wild fish (LRW) have been observed during that time; the primary stock components are LRH and RRB. Thus, all chinook in these Oregon tributaries are expected to be of hatchery-origin. Available hatchery coho proportions are summarized below (Table 6). Naturally spawning unmarked coho are thought to be primarily of hatchery origin due to the long history of extensive hatchery releases and outplantings in lower Columbia River tributaries, as well as the lack of genetic distinction between hatchery and naturally produced coho (NMFS 1991).

Table 6. Estimated percent of hatchery coho in the natural spawning escapement for select Oregon lower Columbia tributaries (ODFW stream survey data).

Year	Youngs River	Big Creek	Clatskanie River	Scappoose Creek
1999				7%
2000	49%	49%		9%
2001	99%	92%	17%	20%
2002	91%	91%	60%	0%
2003	65%	65%	0%	1%

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

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

Incidental take of lower Columbia River chinook, Columbia River chum, or Columbia River coho could occur through activities associated with adult broodstock collection for the SAB fall chinook program. However, any incidental take is expected to be minimized as a result of the broodstock collection methods describe in Sections 6 and 7. Take estimates are included in Table 7. Broodstock are collected via volitional returns of adults to fish traps at both the Klaskanine and South Fork Klaskanine hatcheries or via active collection with tangle nets in tidewater reaches of Youngs Bay tributaries. Only those chinook with a left ventral fin clip identifying them as SAB Rogue stock are retained for broodstock purposes; any other fish are released unharmed at the location of collection. The presence of listed salmonids at the point of collection during the timing of annual broodstock collection is extremely low, thereby minimizing incidental take of listed species. Additionally, any adult SAB Rogue stock fall chinook collected in excess of annual broodstock needs are used for one of the following purposes: stream enrichment, sold to a fish buyer, donated to a food bank, or processed into fish food or fertilizer. No excess broodstock are returned to the river and allowed to spawn naturally.

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

The only listed fish taken during SAB program operations were chum salmon voluntarily entering the South Fork Klaskanine Hatchery during SAB broodstock collection. A total of 12 chum have entered the hatchery trap during 2000-2003. All chum were released back into the South Fork Klaskanine to spawn naturally. In 2003 and 2004, SAB broodstock were collected with tangle-net gear in tidewater areas of Youngs Bay. There were no non-SAB chinook, chum or coho handled during these broodstock collection efforts.

- 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).

Incidental take of juvenile lower Columbia River chinook, Columbia River chum, or Columbia River coho could occur through activities associated with rearing and acclimation of Select Area bright fall chinook at Select Area net pens sites; however, any potential take would be indirect and difficult to estimate (i.e. disease transfer). Few listed juvenile salmonids are expected to be present in the vicinity of the net pens for extended periods. All fish transferred to the net pens are vaccinated to minimize disease outbreaks. Further, nets are checked for holes during regular cleaning schedules to prevent early, accidental releases that could possibly prey on juvenile chum. Quantifiable take of listed lower Columbia River juvenile salmonids is expected to be zero (Table 7). Indirect take of listed adult salmonids is limited to collection in adult fish traps operated at the hatcheries, offsite broodstock collection, visual observation during stream surveys. Take resulting from Select Area fisheries is discussed in Section 3.3.1.

Table 7. Estimated annual take of lower Columbia River listed salmonid ESUs based on typical hatchery operations.

Action	Lower Columbia Chinook		Columbia Chum		Lower Columbia Coho	
	Life stage[b]	Estimated Annual take	Life stage[b]	Estimated Annual take	Life stage[b]	Estimated Annual take
Observe or harass	A	<30/0	A	0	A	<30/0
Collect for transport	A	0	A	0	A	0
Capture, handle, and release	A, J	<17/0	A	<15/0	A, J	<2/0
Capture, handle, tag/mark/tissue sample, and release	A	0	A	0	A	0
Capture and remove (e.g., broodstock)	A	0	A	0	A	0
Intentional lethal take	A	0	A	0	A	0
Unintentional lethal take	A, J	0	A, J	0	A, J	0
Other take (specify)	A, J	0	A, J	0	A, J	0

a Data includes combined values for Klaskanine Hatchery, S. Fork Klaskanine Hatchery, and offsite broodstock collection.
b A = Adult, J = Juvenile.

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

Contingency plans to address take associated with release of SAB fall chinook could include modifying release locations, release size, and release timing. Potential contingencies for broodstock collection include:

1) Change or reduce collection periods at the collection site(s) where listed fish were taken above described levels.
2) Increase collection efficiency at Klaskanine Hatchery to reduce need to collect fish at other locations where listed fish may be taken.

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.

The SAB fall chinook program operates in accordance with the ODFW Hatchery Management Policy (OAR 635-007-0542 through 635-007-0548), the Northwest Power and Conservation Council Annual Production Review Report (NPPC document 99-15), the Lower Columbia Salmon and Steelhead Recovery and Subbasin Plan (LCFRB 2004), and the Lower Columbia River and Estuary Bi-State Subbasin Plan (LCREP 2004).

Oregon’s Native Fish Conservation Policy was adopted in 2002 and calls for conservation plans to be developed for each grouping of populations. The conservation plans are required to identify management strategies to rebuild and conserve native fish populations to a desired status. Hatchery programs will be reviewed in the conservation planning process and this program will be consistent with the ODFW Commission-approved conservation plan for Lower Columbia River fall chinook. Efforts will be made to ensure that the federal recovery plan currently being developed will be consistent with the Native Fish Conservation Policy.

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

US v. Oregon
Weyerhauser agreement with CEDC for site access
Oregon Division of State Lands submerged land lease(s)
Bonneville Power Administration Statement of Work
ODFW R&E contract (001-3300)

This HGMP is consistent with these plans and commitments

Oregon Plan for Salmon and Watersheds (Executive Order 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 of Oregon. The Oregon Plan includes measures linked to the hatchery production of fall chinook in Young's Bay including nutrient enrichment, acclimation, and other separations of hatchery and wild production, terminal fisheries that reduce harvest impacts on listed salmon, and monitoring of hatchery and wild runs.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Two of the primary goals of the Select Area fisheries project were to develop fisheries that provided greater protection for depressed and listed stocks and to maximize harvest of returning adults while minimizing catch of non-SAFE stocks. This program is managed to provide fall chinook salmon production to supplement harvest in ocean, Columbia River, and Youngs Bay commercial fisheries and ocean, Columbia River and SAFE sport fisheries (Table 8).

Table 8. Contribution to fisheries of coded wire tagged SAB fall chinook from various Select Area release sites, 1991-2000 brood years.

	Release Site			
	Big Creek Hatchery	Klaskanine Hatchery	Youngs Bay Net Pens	Select Area Net Pens [a]
Brood Years	1991-1995	1995-2000	1993-2000	1993-2000
Number of CWT groups	12	11	36	40
Fishery Contributions (% of total adult return)				
Commercial				
SAFE	0.7%	27.0%	42.0%	42.0%
Ocean	31.0%	26.0%	23.3%	23.1%
Columbia River	4.2%	12.7%	16.9%	16.8%
Total	35.9%	65.7%	82.2%	81.9%
Recreational				
Ocean	2.3%	7.5%	3.4%	3.4%
Freshwater	7.8%	14.4%	11.1%	11.1%
Total	10.1%	21.9%	14.5%	14.5%
Escapement [b] (Straying)	54.0% (13.8%)	12.4% (0.7%)	3.3% (1.9%)	3.6% (2.0%)

a Includes two releases each from Blind Slough and Tongue Point net pens in addition to Youngs Bay net pen production.
b Escapement includes unharvested fish recovered in streams and hatcheries (natal and out-of-system).

Table 9. Summary of harvest impacts on upriver chinook during Youngs Bay Select Area commercial fisheries, 1993-2000 [a] (North et al. 2004).

Year	URB [b] Run Size	URB Harvest	SRW [c] Run Size	SAFE SRW Harvest [d]	% SRW Impacts [d]
1993	102,908	46	1,620	1	0.045
1994	132,839	0	1,055	0	0.000
1995	106,459	44	1,223	1	0.041
1996	143,193	0	1,957	0	0.000
1997	161,727	4	2,048	0	0.002
1998	142,301	22	864	0	0.015
1999	166,066	17	2,739	0	0.010
2000	155,744	86	1,977	1	0.055

a Impacts have not been calculated for 2001-2003 fisheries because Snake River run size estimates are not available.
b URB = Upriver Brights.
c SRW = Snake River Wild.
d SRW harvest and impacts are estimated based on the ratio of URB harvest and URB run size.

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

Impact rates on ESA-listed fish in SAFE fisheries adopted during 1993-2000 were very low. Impacts to wild Snake River fall chinook during 1997-2000 SAFE fall fisheries never exceeded 0.15 percent for all SAFE fisheries combined. Youngs Bay SAFE commercial fisheries impacts to chinook and chum are summarized in Table 9 and Table 10.

To ensure impacts (lethal take) of listed stocks resulting from SAFE commercial fisheries remain within management guidelines, fish run sizes and harvest of individual stocks is tracked in-season based on visual stock identification (winter-spring seasons only) and CWT recoveries, with regulations and fishing periods adjusted in-season if necessary. In-season catch estimates are produced immediately following each fishing period. Stock-specific catch estimates for fisheries are monitored in conjunction with in-season run size updates to track stock-specific impact rates. If the data suggests that impacts will exceed management guidelines, adopted seasons are modified through the Compact Hearing process. Joint staff reports are prepared in advance and distributed for public review prior to each hearing. Adopted seasons and regulations are presented in a Compact Action Notice following each Compact Hearing.

Table 10. Summary of harvest impacts on lower Columbia River chinook and chum salmon during all Select Area commercial fisheries, 1993-2002 (data specific to Youngs Bay impacts are not available) (North et al. 2004).

Year	LRH [a] Run Size	SAFE LRH Harvest	% LRH Impacts	LRW [b] Run Size	SAFE LRW Harvest	% LRW Impacts	Chum Run Size	SAFE Chum Harvest	% Chum Impacts
1993	52,300	0	0.000	13,300	0	0.000	na	na	na
1994	53,600	0	0.000	12,200	0	0.000	na	na	na
1995	46,400	0	0.000	16,000	0	0.000	na	na	na
1996	75,500	2,938	3.891	14,600	0	0.000	3,300	5	0.152
1997	57,400	2,220	3.868	12,300	0	0.000	1,700	4	0.235
1998	45,300	498	1.099	7,300	0	0.000	1,900	4	0.211
1999	40,000	380	0.950	3,300	0	0.000	2,400	3	0.125
2000	27,000	135	0.500	10,200	0	0.000	2,500	2	0.080
2001	94,300	1,193	1.265	15,700	0	0.000	5,500	1	0.018
2002	156,400	3,887	2.485	24,900	0	0.000	11,900	1	0.008

a LRH = Lower River Hatchery stock.
b LRW = Lower River Wild stock.

In contrast to the low harvest rates on non-local stocks shown in Table 10, coded-wire tag recoveries document extremely high harvest rates for SAB fall chinook (96.4 percent) in Select Area fisheries. As intended, the majority of the fish harvested in SAFE fisheries were of local origin. Fall chinook harvest and stock composition varied among SAFE release sites, but was highest in Youngs Bay. During 1996-2002 Youngs Bay had an average annual harvest of over 1,960 fall chinook, with 97.0 percent originating from SAFE sites based on non-expanded CWT recoveries (Table 11).

Fisheries adopted as a result of the Select Area program have resulted in a significant increase in interest by both commercial and recreational user groups. The number of participating commercial vessels increased from 96 to 192 in fall fisheries. Since recreational surveys were initiated in 1998, sport harvest has increased significantly especially for spring chinook and SAB fall chinook. The economic value of the fishery, as measured in ex-vessel dollars for commercial fisheries, and the non-market user value per fish landed in sport fisheries, increased from approximately $492,000 in 1996 to $3.3 million in 2003. The economic impact of SAFE salmonid production on personal incomes of families in lower Columbia River communities increased from $987,000 in 1996 to $4.6 million in 2003. The annual contribution of the SAB fall chinook program to the overall SAFE fisheries economic impacts are summarized in Table 12.
As a result of SAB fall chinook releases, fall commercial fisheries were established and monitored from early August through the end of October in Youngs Bay (1993-2003). The August portion of the season in Youngs Bay targets SAB fall chinook with the fisheries shifting to coho beginning in September.

Some harvest of non-target species has occurred during fall Select Area fisheries. For example, white sturgeon are incidentally harvested during SAFE fisheries, primarily in Youngs Bay and

Tongue Point; however, these fish are accounted for in the annual commercial allocation. Inseason management is used to maintain annual harvest to less than 400 sturgeon annually with no more than 300 allowed in winter-summer fisheries. The 400 sturgeon harvest guideline for SAFE fisheries represents 5.0% of the current 8,000 white sturgeon commercial harvest allocation.

Table 11. Stock composition of chinook salmon harvested in Select Area fall [a] commercial fisheries based on coded-wire tag recoveries, 1996-2002.

Fishery	Year	Harvest	Total Recoveries	Above Bonneville	Below Bonneville: Non-SAFE	Below Bonneville: SAFE Local	Below Bonneville: SAFE Non-Local	Origins of above Bonneville Dam recoveries
Youngs Bay	1996	1,439	113		1	112		
	1997	1,726	317	1	1	315		1- Col. R. @ Turtle Rock
	1998	1,422	323	5	4	312	2	2- Clearwater R., 1- Col. R. general, 2-Snake R.
	1999	1,589	240	1	5	234		1-Lower Snake R.
	2000	1,744	431	14	6	407	4	2-Umatilla R., 6-Snake R., 3-Priest Rapids, 3-Columbia R. general
	2001	2,040	587	27	3	557		14-Lyons Ferry Hat., 6-Ringold Pond, 4-Spring Cr, NFH, 2-Turtle Rock Hat., 1-Umatilla R.
	2002	3,774	1,068	24	22	1,022		20-Lyons Ferry Hat., 2-Hanford Reach, 2-Spring Cr. NFH
				1.8%	1.2%	96.8%	0.2%	

a Fall commercial fisheries include those conducted from August to October.

Table 12. Total SAB fall chinook program contribution to regional commercial and recreational fisheries by landings and total personal income impacts, 1996-2003.

Year	Commercial Harvest						Recreational Harvest						Total Contribution	
	SAFE		Columbia River		Ocean		SAFE		Columbia River		Ocean			
	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]	Number Harvested	Total Personal Income [a]
1996	1,469	$25,678	309	$8,575	2,048	$60,416	400	$20,280	606	$55,861	198	$12,809	5,030	$183,619
1997	1,570	$37,919	248	$6,845	1,964	$58,920	400	$20,280	699	$35,439	139	$8,992	5,020	$168,395
1998	1,385	$9,907	281	$7,756	1,294	$38,820	400	$20,280	713	$57,076	81	$5,240	4,154	$139,079
1999	1,375	$50,694	327	$12,410	573	$19,425	300	$22,815	453	$36,263	73	$4,722	3,101	$146,329
2000	1,130	$35,416	177	$6,186	450	$15,525	50	$4,609	221	$17,691	80	$5,175	2,108	$84,602
2001	1,557	$35,109	384	$9,101	1,207	$34,037	150	$13,827	475	$12,787	248	$16,043	4,021	$120,904
2002	2,450	$60,372	1,105	$21,713	2,347	$63,604	500	$46,090	1,173	$104,948	627	$40,561	8,202	$337,288
2003	3,043	$74,693	2,335	$45,883	2,999	$81,273	637	$48,444	1,837	$91,611	627	$40,561	11,478	$382,465

a Total impact on state level personal income (direct, indirect, and induced based on Oregon Fisheries Economic Assessment Model) and prices in 2001 dollars.

3.4) Relationship to habitat protection and recovery strategies.

Natural production in the North and South Forks of the Klaskanine River is likely limited by the following: water quantity, water quality, sedimentation, stream substrate, cover, and barriers to fish passage. No single entity is responsible for habitat protection and recovery strategies in the Columbia Estuary region; Oregon Department of Fish and Wildlife, Oregon Department of Forestry, the Lower Columbia River Estuary Partnership, and numerous regional, state, and local organizations have interest in habitat protection in the region. Habitat conditions in the Klaskanine River are considered to be fair to good.

Habitat protection and recovery strategies were recently developed in the draft Lower Columbia River and Estuary Bi-State Subbasin Plan (LCREP 2004); the SAB fall chinook program is consistent with these habitat strategies.

3.5) Ecological interactions.

1. Species that could negatively impact the program include:
    - Avian predators, such as great blue herons, Caspian terns, cormorants, and gulls,
    - Mammalian predators such as river otters, harbor seals, or sea lions,
    - Introduced fish species such as American shad, walleye, smallmouth bass, and channel catfish,
    - Northern pikeminnow,
    - Out-of-basin hatchery salmonid releases,
    - Known or unknown aquatic non-indigenous animals and plants.

The majority of the preceding species list can be characterized as predators of juvenile salmonids, which will negatively affect SAB fall chinook juvenile survival after release and may attract predators to the Youngs Bay net pens. Attention to limiting or eliminating losses in the net pens from avian and mammalian predation is an ongoing concern. Typically the net pens, regardless of location, are visited by several species of piscivorous birds. Sewing bird covers to the nets has been tried with some success. Current net-pen covers need to be replaced with finer-mesh netting to prevent chronic predation by blue herons. In recent years, Caspian terns (*Sterna caspia*) have colonized the Columbia River estuary; the colony currently represents the largest in North America. Recent estimates of annual Caspian tern predation on salmonid smolts have been as high as about 25 million (Roby et al. 1998). Caspian tern predation is highest on large smolts, such as steelhead or coho that spend 1-2 years rearing in freshwater; predation is lower on ocean-type salmonids such as fall chinook and chum salmon that emigrate as sub-yearlings. Northern pikeminnow (*Ptychocheilus oregonensis*) have been estimated to annually consume millions of juvenile salmonids in the lower Columbia River (Ward et al. 1995). Most Northern pikeminnow predation is thought to occur downstream of dams. Pikeminnow abundance in the Columbia River estuary is likely low; therefore, pikeminnow effects are expected to be minimal. Walleye (*Stizostedium vitreum*), smallmouth bass (*Micropterus dolomeiui*), and channel catfish (*Ictalurus punctatus*) have been estimated to consume substantial numbers of emigrating juvenile salmonids (Zimmerman 1999). Effects of these species is thought to be highest around dams and throughout impounded reaches of the Columbia River (Zimmerman and Parker 1995). Like pikeminnow, their abundance in the Columbia River estuary is thought to be low; thus, their predation effects in Youngs Bay and the estuary should be minimal.

The net pens attract families of river otters (*Lutra canadensis*) as well. Legal trapping has been tried with some success. Incidences of otter predation continue to plague the project and new treatments are underway to address the problem. A solar-powered electric deterrent device similar to the kind used in agriculture to contain bovines has been evaluated at some sites. The Deep River pen complex has been successful in reducing otter predation using this technique, yet it was only marginally successful when tested at Youngs Bay net pens. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food (NMFS 1999). These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, seals and sea lions may be attracted to the Youngs Bay net pens and could potentially cause equipment damage.

American shad (*Alosa sapidissima*) and large out-of-basin hatchery salmonid releases represent potential competitors of juvenile SAB fall chinook and may decrease juvenile survival through density dependent competition effects. In the Columbia River estuary, juvenile American shad were described as year-round residents in all areas of the estuary (Bottom et al. 1984). Multiple studies have found overlap in both habitat use and diet items in juvenile American shad and both sub-yearling and yearling salmonids (McCabe et al. 1983, Bottom et al. 1984), suggesting competition for food and space. Additionally, other hatchery fish may be a source of competition for SAB fall chinook. The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Food availability may be negatively affected by the temporal and spatial overlap of juvenile salmonids from different locations; competition for prey may develop when large releases of hatchery salmonids enter the estuary (Bisbal and McConnaha 1998), although this issue remains unresolved (Lichatowich 1993 as cited in Williams et al. 1998).

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

2. Species that could be negatively impacted by the program include:
   - Lower Columbia River chinook,
   - Lower Columbia River chum,
   - Lower Columbia River coho,
   - Out-of-basin wild salmonids using Youngs Bay or the Columbia River estuary,
   - River otters.

Wild juvenile salmonids using Youngs Bay or the Columbia River estuary may be affected by releases of SAB fall chinook. However, the fall chinook are released as full-term sub-yearling smolts so they are expected to promptly emigrate through the Klaskanine River, Youngs Bay, and the lower Columbia River estuary with a minimum of ecological interaction with other species. Ledgerwood (1997) found radio-tagged spring chinook smolts released from Youngs Bay net pens out-migrated from Youngs Bay within one full tidal series and moved through the Columbia River estuary rapidly. The same behavior is expected of SAB fall chinook released in Youngs Bay. Preliminary results from recent acoustic tracking studies corroborate the findings of rapid emigration rates documented by Ledgerwood (1997), with average travel time of 13.9 hours to the mouth of the Columbia River (personal communication; Robert Warren; Sea Resources). The influence of these hatchery juveniles on predator behavior in the lower Columbia is unknown. Some researchers purport that releases of hatchery juveniles in general attract predators, thereby potentially increasing predation on wild juvenile salmonids (Bayer 1986, Collis et al. 1995). Other researchers maintain that releases of hatchery fish may overwhelm predators, thereby providing a competitive advantage to wild juvenile salmonids that have better predator avoidance capability than hatchery fish (Petersen and De Angelis 1992).

As adults, SAB fall chinook return at a time of year when adult chum are not usually present but overlap the run timing of other lower Columbia River fall chinook and coho salmon. As discussed in Section 2, the abundance of wild fall chinook, chum, and coho in Youngs Bay and the Klaskanine River is thought to be low (Table 4); therefore, the probability of SAB fall chinook interacting ecologically with wild adult salmonids in these areas should also be low. Although the likelihood of interactions may be low, the impact of these interactions on small wild populations is largely unknown. To help identify potential program effects on wild salmonids, research has been ongoing throughout the history of the SAB program. Studies designed to determine the extent of straying and reproductive success of naturally spawning SAB fall chinook, as well as identify smolt migration characteristics, are summarized in Section 12. Information gathered from these studies is used to assess potential effects on wild salmonids and modify the program, as necessary, to minimize negative effects.

River otters have proven to be a major predator of hatchery fish rearing in net pens in the Columbia River estuary. Non-lethal methods of deterring otter predation, such as completely enclosing the tops of pens with bird netting, as well as electric “fencing” have been used, but none of these methods has been successful in the long term. Therefore, the only recourse has been to trap and remove the otters by lethal methods. The effect of these removals on local otter populations is unknown.

3. Species that could positively impact the program include invertebrate and fish species that could be utilized for food by SAB fall chinook rearing in net pens. This natural food supply can

increase growth and survival of released fish.

4. Species that may be positively impacted through the program include any freshwater or marine species that depend on salmonids as a nutrient or food base. Pacific salmon carcasses are important for nutrient input back to freshwater streams (Cederholm et al. 1999). Many species are known to utilize juvenile and adult salmon as a nutrient food base (Groot and Margolis 1991; McNeil and Himsworth 1980). Declines in wild salmonid populations during the last few decades could reduce overall ecosystem productivity. Hatchery production has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climatic cycles.

SECTION 4. WATER SOURCE

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

Adults are held at the Klaskanine Hatchery, South Fork Klaskanine Hatchery, and in net pens in the Klaskanine and Youngs River tidewaters. Significant incubation and rearing occurs at Big Creek Hatchery and to a lesser extent at S. Fk. Klaskanine Hatchery. Rearing and acclimation occurs at Klaskanine Hatchery. The water source at Big Creek Hatchery comes from Big Creek, Mill Creek, and an upper and lower natural spring. The water source for Klaskanine Hatchery comes from the N. Fk. Klaskanine River. The incubation water source at the S. Fk. Klaskanine Hatchery comes from a nearby unnamed tributary of the S. Fk. Klaskanine River. Rearing water is supplied by either the unnamed tributary or the S. Fk. Klaskanine River. The water supply in the net pens is tidal. The water source in all locations is accessible to anadromous fish. The water used results in natural water temperature profiles that provide optimum maturation and gamete development. At Big Creek Hatchery, incubation water can be heated or chilled to approximate natural water temperature profiles. The water meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality guidelines for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. The water supply is protected by flow alarms at the intake(s) and the head box at all hatcheries. At Big Creek, seasonal flows limit production in July-September. The water supply limits production capacity in July to mid-October at the Klaskanine Hatchery and the S. Fk. Klaskanine Hatchery. The water supply is not protected by alarms at the net pens, but the water supply is secure. Limitations from the water source in the net pens include: 1) the availability of leasable space for securing pens, and 2) summer water temperatures.

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.

The facilities operate within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit. Water intake screens at Klaskanine and South Fork Klaskanine Hatchery are compliant, or in the process of becoming compliant, with fish passage guidelines. Water intake screens at Big Creek Hatchery are not in compliance with screening guidelines.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock for this program are collected by several methods including volitional return of adults to both Klaskanine and South Fork Klaskanine hatcheries and active collection of adults in tidewater sections of Youngs Bay tributaries. At both hatcheries, the fish traps utilize simple v-slot weirs, with a concrete raceway holding facility available at Klaskanine Hatchery and a simple unlined earthen ditch at South Fork Klaskanine Hatchery. Offsite collection (i.e. Youngs Bay tidewater) involves the use of commercial tangle nets (< 5.25" mesh) and recovery box technology to capture adults and transfer to holding pens temporarily situated nearby at the confluence of Klaskanine and Youngs Rivers. Once captured, adult fish are removed from the net, revived in a recovery box and placed in a live well onboard the collection boat until they can be transferred to the holding pens.

Table 13. Description of adult broodstock facilities at Klaskanine and South Fork Klaskanine hatcheries, and for offsite collection in tidewater sections of Klaskanine and Youngs rivers.

Facility	Number of traps or ponds	Type of ponds	Volume (cu. ft.)	Length (ft)	Width (ft)	Depth (ft)	Flow (gpm)
Klaskanine	1	Concrete series	5,760	120	16	3	3,000
S. Fork Klaskanine	1	Earthen ditch	<2,000	100	10	<2	4,650
Offsite	<8	Net pen	3,200/pen	20	20	8	Unlimited

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

The transfer of fish on station is done by the use of a distribution box, irrigation pipe, and a gas powered pump at Big Creek and Klaskanine hatcheries. All off station transfers are done with the use of a large liberation truck. Additional information about fish transportation equipment is provided in (Table 14). Fish transportation at the South Fork Klaskanine Hatchery is limited to brief onsite movements.

Table 14. Fish transportation equipment used at Big Creek, Klaskanine, and South Fork hatcheries, and at offsite net pens.

Facility	Equipment type	Capacity (gallons)	Supplemental Oxygen (y/n)	Normal transit time	Chemicals used
Big Creek	Tank	1,000-250	Y	Varied	None
Klaskanine	Tank	1,000-250	Y	Varied	None
S. Fork Klaskanine	Tank	400	Y	<30 min	None

5.3) Broodstock holding and spawning facilities.

Broodstock holding facilities are the same as those described in Section 5.1. At both Klaskanine and S. Fk. Klaskanine hatcheries spawning facilities consist of a spawning shed adjacent to the holding ponds.

5.4) Incubation facilities.

At Big Creek Hatchery, incubation is conducted in up to 46 shallow troughs, 16 deep troughs, and 96 vertical incubation trays. Total capacity to the eyed stage is 22 million and to hatch is 9.5 million. Additional information is provided in Table 15. For this program, maximum incubation of SAB fall chinook at Big Creek Hatchery will be limited to ≤1.6 million eggs. At the South Fork Klaskanine Hatchery, incubation is conducted in up to 16 double-stack vertical "Heath" style incubators. Maximum incubation of SAB fall chinook at the South Fork Hatchery for this program will be limited to ≤800,000 eggs.

Table 15. Incubation facilities at Big Creek and South Fork Klaskanine hatcheries.

Facility	Incubator Type	Units (number)	Flow (gpm)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Big Creek	Deep Troughs	16	10/12	100,000 eggs/section 10 sections/trough	NA
Big Creek	Shallow Troughs	46	12	NA	23,000 eggs/section 10 sections/trough
Big Creek	Vertical Incubator Trays	96	5	8,000	8,000
South Fork Klaskanine	Vertical Incubator Trays	96	5	8,000	6,000

5.5) Rearing facilities.

Rearing facilities are described in Table 16.

Table 16. Description of rearing facilities used for the SAB fall chinook at Big Creek and Klaskanine hatcheries and in Youngs Bay net pens.

Number of ponds	Pond type	Volume (cu. ft)	Length (ft)	Width (ft)	Depth (ft)	Flow (gpm)	Max flow index (lb/gpm)	Max density index (lb/ft^3)
11	Concrete raceways (Big Creek)	4,000	80	20	2.6	Varied	7	0.9
4	Concrete ponds (Klaskanine)	3,600	90	20	2	200	20.8	1.15
≤64	Youngs Bay net pens (CEDC)	3,200	20	20	8	NA	NA	0.75

5.6) Acclimation/release facilities.

Net pens at rearing/release sites consist of two to four individual 6.1-m^2 inside dimension frames of high-density polyethylene pipe (33 cm o.d.) filled with styrofoam. A wooden walkway of 2" x 12" lumber is bolted to the plastic frame for access. A 3.1-m deep net hung within each frame confines the fish during rearing and acclimation. Mesh sizes of 3.2-19.0 mm (0.125-0.750") are utilized and adjusted depending on fish size. Vertical plastic standpipes are submerged around the perimeter of each pen to maintain the shape of the net. Actual rearing area of each net is approximately 91 m^3 (3,200 ft^3).

There are currently 76 pens at Youngs Bay, 37 at Tongue Point, and 15 at Blind Slough. Fish are grown and released from these pens under varying management and grow-out regimes including two-week acclimation, over-winter, and full-term net-pen rearing.

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

Moderate to high seasonal losses have occurred for this stock at Klaskanine Hatchery and in the net pens due to a variety of diseases. Losses at Klaskanine Hatchery have been acute at times, primarily due to *Ichthyophthirius multifiliis* or "Ich". Losses at the net pens are generally chronic during summer months due to high water temperatures.

No major catastrophic disasters related to net-pen rearing or related operational activities have occurred over the twenty-some years the program has existed. Several minor incidences, such as floating debris, have torn holes in nets allowing early escapement, however, the maximum event has not exceeded the contents of one net pen. Of the three Oregon net-pen sites, Youngs Bay is the most dynamic with tidal changes providing superior flushing and greater opportunity for debris problems. The only ongoing operational challenge for high survivals in the pens is predator avoidance. Bird covers of various designs have been used with increasing success. River otter predation is a chronic problem with various passive methods employed in the past. Each method seems to work for a season before the otters learn to outsmart these systems. In 2001 a local trapper (under permit from ODFW) focused on one of our sites and has significantly reduced the river otter population, reducing problems for us. He will be expanding his efforts to include our other two sites.

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.

Few listed fish are handled or reared at the facilities used for this program. Nets are checked for holes during regular washing schedules to prevent accidental releases. Net pen complexes are sufficiently constructed to avoid accidents due to weather, etc. Fish transferred to the net pens are vaccinated at ~100/# for *Vibrio angularium* and Furunculosis to minimize disease outbreaks.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source

The SAB fall chinook stock used in the Select Areas originated from Rogue River stock egg transfers to Big Creek Hatchery in 1982, and to CEDC's South Fork Klaskanine Hatchery in 1983. The brood stock was maintained at Big Creek Hatchery through 1995. Fishery enhancement efforts in Youngs Bay began with releases from the South Fork Klaskanine Hatchery in 1983 and expanded to include net-pen releases in 1989. Currently, adult returns to Klaskanine Hatchery are the primary source of broodstock for this program. When necessary, additional broodstock are collected at CEDC's South Fork Klaskanine Hatchery (N. Fk. Klaskanine Hatchery strays) and in tidewater sections of the Youngs and Klaskanine rivers. Beginning in 2004 (2003 brood) releases from South Fork Klaskanine were reestablished to provide an alternate broodstock source. All fish are identified as Rogue stock by left-ventral fin clips.

6.2) Supporting information

6.2.1) History

Historically, the broodstock program was established at Big Creek Hatchery in 1982 with eggs obtained from Cole Rivers Hatchery on the Rogue River. The last transfer of eggs from Cole Rivers Hatchery occurred in 1990. Smolt releases were limited to Big Creek and Youngs Bay. Smolt releases from Big Creek resulted in adult straying into Washington tributaries below Longview, Washington. For the same broods the majority of strays from Youngs Bay releases were recovered in Oregon tributaries (Big Creek and Klaskanine River only). Therefore, in 1996, smolt releases were eliminated at Big Creek Hatchery and relocated to Klaskanine Hatchery in Youngs Bay, where the broodstock is now also collected.

6.2.2) Annual size

The average number of males and females spawned over the past three years has been 288 males and 480 females. Annual broodstock levels are discussed in section 7.4.1.

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

None/None proposed.

6.2.4) Genetic or ecological differences.

This stock is not native to the lower Columbia River. The SAB fall chinook arrive earlier than other lower Columbia River fall chinook stocks and tend to spawn later. They also have a different ocean distribution compared to other lower Columbia fall chinook--migrating south from the Columbia River rather than north.

6.2.5) Reasons for choosing.

This stock was selected for use in Select Area fisheries because it has characteristics desirable for these fisheries. Due to their relatively early run timing and "bright" condition, SAB fall chinook provide earlier opportunities for fall chinook fisheries while providing fish of high quality. This stock has also exhibited good survival. In addition, their migration south from the Columbia River allows them to contribute to Oregon coastal fisheries.

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

Only fish that are marked as SAB Rogue stock (LV-clip) are currently selected for broodstock. Broodstock are primarily collected at the North Fork Klaskanine Hatchery and during offsite collections in tidewater sections of the Klaskanine and Youngs rivers. Some additional broodstock are collected at the South Fork Klaskanine Hatchery. Due to the benign nature of the tangle net gear, all unmarked fall chinook and all coho captured in offsite broodstock collection activities are released immediately unharmed. Any non-LV clipped chinook collected at the hatcheries are released back into the river. Nearly 100% of adult chinook collected at the hatcheries are LV fin clipped and very few coho are present during the majority of the SAB broodstock collection period.

SECTION 7. BROODSTOCK COLLECTION

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

Returning adults and jacks are collected. Only adults are used for broodstock.

7.2) Collection or sampling design

All hatchery adults that enter the trap at Klaskanine and the South Fork Klaskanine hatcheries and those captured offsite are held for spawning purposes. Adults are selected randomly from the available fish at a 2:1 female:male ratio. Actual collection and spawning beginning and ending dates are listed in Table 17.

Table 17. Select Area Bright (Rogue stock) fall chinook program adult collection and spawning dates for all sites, 1992-2004.

Run Year	Collection		Spawning	
	Beginning	Ending	Beginning	Ending
1992	4-Sep	12-Dec	10- Oct	19- Nov
1993	3-Sep	3- Dec	24- Sep	17-Nov
1994	30-Aug	3-Nov	6- Oct	22- Nov
1995	18-Aug	22- Nov	4- Oct	22- Nov
1996	3-Sep	12-Nov	2- Oct	20- Nov
1997	18-Aug	12- Nov	7- Oct	10- Nov
1998	28-Aug	23-Nov	12- Oct	16- Nov
1999	13-July	22-Nov	12-Oct	16-Nov
2000	25-Jul	31-Oct	17-Oct	27-Nov
2001	28-Aug	31-Oct	16-Oct	06-Nov
2002	30-Aug	14-Nov	15-Oct	14-Nov
2003	9-Sep	24-Nov	22-Oct	24-Nov
2004	24-Aug	4-Nov	11-Oct	4-Nov

7.3) Identity.

All (100%) of the SAB fall chinook are currently mass marked with a left-ventral fin clip that allows them to be specifically identified. However, the LV clip may be discontinued in the future in order to increase survival rates and increase the rate of CWT+ad marking. If discontinued, there will be no external mark to uniquely identify the SAB Rogue stock. Recent data suggest few SAB fall chinook now stray to other lower river hatcheries, thereby reducing the concern of SAB fall chinook being mixed with broodstock of other lower Columbia River hatcheries. Additionally, the spawn timing of SAB Rogue stock is later than the spawn timing of tule fall chinook produced in lower Columbia River hatcheries.

7.4) Proposed number to be collected:

The current escapement goal for this program is to return enough adults to the Klaskanine Hatchery trap to meet broodstock needs, or about 900 adult females and 450 adult males annually.

Program goal:

The goal is to collect enough broodstock to meet full-program production needs of 2.4 million eggs. This goal has only been achieved in two years since the program's inception. If the egg goal is not achieved or egg to fry survival is less than 96%, smolt production is reduced accordingly.

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

Table 18. Annual returns of adult SAB fall chinook, number spawned, fecundity, and total egg take by facility, 1992-2004.

Brood Year	Facility	Males Return (Spawn)	Females Return (Spawn)	Spawning Ratio F/M	Average Fecundity	Egg Take (in 1,000s)
1992	Big Creek Hatchery	162 (140)	229 (190)	1.36	2,937	558
1993	Big Creek Hatchery	422 (275)	550 (503)	1.83	2,690	1,353
1994	Big Creek Hatchery	782 (391)	1,022 (947)	2.42	3,106	2,941
1995	Big Creek Hatchery	1,641 (356)	1,672 (856)	2.40	3,196	2,736
1996	NFK/BC	741 (214)	778 (582)	2.72	3,069	1,786
1997	NFK/BC	417 (152)	575 (311)	2.05	2,875	894
1998	NFK/BC	324 (196)	513 (428)	2.18	2,675	1,145
1999	NFK/BC	339 (101)	273 (197)	3.93	3,062	711
2000	NFK/BC	388 (180)	423 (360)	2.00	3,253	1,182
2001	NFK/BC	468 (266)	570 (363)	1.37	3,135	1,154
	Offsite net pens	58 (18)	95 (32)	1.78	2,813	90
2002	NFK/BC	879 (309)	692 (568)	1.84	2,161	1,813
2003	NFK/BC	351 (170)	411 (328)	1.53	3,441	1,152
	S.F. Klaskanine	57 (51)	109 (99)	1.94	3,121	309
	Offsite net pens	58 (49)	80 (50)	1.02	3,491	177
2004	NFK/BC	Not Avail.	Not Avail.	Not Avail.	Not Avail.	821
	S.F. Klaskanine	20 (11)	12 (12)	1.78	4,205	56
	Offsite net pens	54 (27)	100 (56)	1.48	3,550	183

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

All hatchery fish that enter the hatchery trap are collected and are either selected for the broodstock or are disposed of. All excess fish are used for stream enrichment, sold to a fish buyer, given to a food bank, or taken to Bio-Oregon for processing into fish food or fertilizer. All mortality is hauled to the local landfill.

7.6) Fish transportation and holding methods.

The fish transportation facilities used for this program are described in Section 5.2. The IHOT guidelines for transport are followed for this program.

7.7) Describe fish health maintenance and sanitation procedures applied.

IHOT, Pacific Northwest Fish Health Protection committee (PNFHPC), and state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults, and broodstock holding and disposal of carcasses.

7.8) Disposition of carcasses.

All excess fish are used for either stream enrichment, sold to a fish buyer, given to a food bank, or taken to Bio Oregon for processing into fish food or fertilizer. All mortality is hauled to the local 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.

Any unmarked chinook or chum that enter the hatchery trap are returned to the river below the hatchery. Off-site broodstock collection is conducted with live-capture gear including small-mesh tangle nets and recovery boxes to enable the release of non-target salmonids unharmed. Feasibility work conducted in 2003 and 2004 using this gear did not handle any chum or non-target chinook.

SECTION 8. MATING

8.1) Selection method.

Male and female broodstock available on a given day are mated randomly.

8.2) Males.

The typical spawning ratio for this program is 1 male for every 2 females.

8.3) Fertilization.

Current protocols are to pool the eggs from two females and use the milt from a single male for fertilization.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not used.

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.

This is an isolated harvest program of hatchery stock, and therefore, it is unlikely that the mating scheme will have any adverse genetic or ecological impacts on listed natural fish. However, to maintain within hatchery-population genetic diversity, adults used for brood are mixed and randomly selected (throughout entire run). Groups of males and females are mated randomly with conscious effort made to avoid bias due to size or other external characteristics. Since broodstock is collected throughout the temporal duration of the run, it is believed that this method is sufficiently random to avoid genetic bias within the hatchery program.

SECTION 9. INCUBATION AND REARING

9.1) Incubation:

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

Table 19. Numbers of eggs collected, fry ponded, smolts released, and early survival of SAB fall chinook at Klaskanine Hatchery/Big Creek Hatchery, South Fork Klaskanine Hatchery, and offsite net pens, 1992-2004 brood years.

Brood Year	Facility	Egg Take (1,000s)	Fry Ponded (in 1,000s)	Smolts Released	Egg to Ponded Fry Survival (excludes intentional culling)	Fry to Smolt Survival
1992	NFK/BC	558	488	443,916	87%	91%
1993	NFK/BC	1,339	1,190	1,142,586	89%	96%
1994	NFK/BC	2,944	2,632	2,274,843	89%	86%
1995	NFK/BC	2,736	2,192	1,968,924	80%	90%
1996	NFK/BC	1,786	1,476	1,122,558	83%	76%
1997	NFK/BC	894	820	779,560	92%	95%
1998	NFK/BC	1,145	1,027	925,172	90%	90%
1999	NFK/BC	749	578	562,420	77%	97%
2000	NFK/BC	1,183	926	875,058	78%	94%
2001	NFK/BC	1,155	1,167	1,087,583	94%	93%
	Offsite	90	n/a	n/a	n/a	n/a
2002	NFK/BC	1,835	1,549	1,482,502	84%	96%
2003	NFK/BC	1,138	944	681,178	83%	72%
	SFK	309	261	Not avail.	84%	Not avail.
	Offsite	177	136	Not avail.	77%	Not avail.
2004	NFK/BC	803	743	Not avail.	93%	Not avail.
	SFK	56	54	Not avail.	96%	Not avail.
	Offsite	183	139	Not avail.	76%	Not avail.

NFK=Klaskanine Hatchery; BC=Big Creek Hatchery; SFK=CEDC's South Fork Hatchery; Offsite=Temporary net pen holding facility in tidewater sections of Youngs/Klaskanine rivers.

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

If eggs are found to be in excess of production goals, excess eggs are frozen and disposed of. To date, all collected eggs have been utilized for production.

9.1.3) Loading densities applied during incubation.

IHOT species-specific incubation recommendations were followed for loading density, water quality, flows, and temperature. Eggs are incubated under conditions to allow for equal survival of all segments of the population to ponding. Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.

Table 20. Loading densities at incubation facilities involved in the SAB fall chinook program.

Facility	Incubator Type	Units (number)	Flow (gpm)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Big Creek	Deep Troughs	16	10/12	100,000	23,000
Big Creek	Shallow Troughs	46	12	20,000	20,000
Big Creek	Vertical Incubator Trays	96	5	8,000	8,000
South Fork Klaskanine	Vertical Incubator Trays	96	5	8,000	6,000

9.1.4) Incubation conditions.

Incubation facilities are described in Section 5.4. IHOT species-specific incubation recommendations were followed for loading density, water quality, flows and temperature. Eggs are monitored when needed to determine fertilization efficiency and embryonic development. Eggs are incubated under conditions to allow for equal survival of all segments of the population to ponding. Families are not incubated individually, but rather, may be mixed with other families from the same spawn group.

At Big Creek Hatchery incubation (to eyed stage) takes place at 47 degrees F (from spring water). Flow through the incubators is 5 gpm in the vertical stacks, 10 or 12 gpm in the deep troughs, and 12 gpm in the shallow troughs. Dissolved oxygen generally remains between 7-10 ppm, but is only monitored intermittently. Loading densities and flows are such that D.O. is not a problem at this facility. Temperature is monitored daily.

Incubation of eggs at S. Fk. Klaskanine is conducted in vertical incubator trays. Flow rate is generally 4.5 – 5.0 gpm with approximately 8,000 eggs/tray in the green to eyed stage, and then ~6,000/tray from eyed to hatching. Temperature is recorded on a Partlow thermograph that is re-wound and has it's chart changed once per week. Dissolved oxygen levels are not routinely checked, but loading densities and flows are such that D.O. is not a problem. Temperatures typically range from 34-50 ° F.

9.1.5) Ponding.

Rearing facilities are described in Section 5.5. Prior to ponding, family groups are mixed randomly so that rearing protocols will affect families equally. The procedures used for determining when fry are ponded include visual inspection of the amount of yolk remaining and reaching a specified number of accumulated temperature units.

At Big Creek and S. Fk. Klaskanine hatcheries, ponding is forced. Fish are ponded at approximately 900-1,100 fish/lb. In the case of SAB CHF destined for the net pens, ponding is forced when both cumulative TUs and visual inspection of fry indicate they are ready. When TUs approach 1,600 then fry are inspected frequently to determine if the majority are completely "buttoned-up" and suitable for ponding. Actual accumulated TUs at ponding can range from 1,550 to 1,650.

9.1.6) Fish health maintenance and monitoring.

IHOT, Pacific Northwest Fish Health Protection Committee (PNFHPC), and state or tribal guidelines are followed for fish health inspections. Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on site. Eggs are monitored when needed to determine fertilization efficiency and embryonic development. Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the disease control guidelines. Dead or culled eggs are discarded in a manner that prevents transmission of disease to the local watershed.

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.

This broodstock is not listed under federal ESA. No listed fish are cultured at these facilities. Dead or culled eggs are discarded in a manner that prevents disease transmission to the local watershed.

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 (1990-2001), or for years dependable data are available.

Egg to fry survivals, and fry to smolt survivals since 1992 are provided in Table 19.

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

In the hatcheries, juvenile rearing densities and loading guidelines are based on: standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error), and other criteria. IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading, and density. Target and actual raceway loading densities at Klaskanine and Big Creek hatcheries have always been <1.0 lb fish/ft^3.

For fish reared in the net pens, fish are ponded at a rate to achieve loading densities of ≤0.5lb/ft^3. This target density was developed based on an evaluation of smolt-to-adult survival rates for coded-wire tag groups released during 1995-1998. These release trials were continued through 2002 and survival data will be used to update target loading densities. Actual densities from 1994-2000 ranged from 0.14-0.67 lb/ft^3.

Target raceway loading densities at S. Fk. Klaskanine Hatchery are approximately 0.5 lb fish/ft^3.

9.2.3) Fish rearing conditions

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

In the net pens, fish are fed daily-recommended rations based on water temperature and body weight. Pens are cleaned and/or changed as needed to ensure adequate flow. Excess feed and feces do not accumulate in the pens. Benthic monitoring is conducted seasonally under and adjacent to the net pens. Results to date indicate waste accumulation below the pens is minimal and does not adversely affect the invertebrate communities (North et al. 2004).

At Big Creek Hatchery, rearing temperatures are monitored daily via a thermograph. Temperatures range from 33-70 degrees F. Dissolved oxygen is not actively monitored. Rearing ponds are cleaned once a week and mortalities removed daily.

At Klaskanine Hatchery, rearing temperatures are monitored daily via a thermograph. Temperatures range from 50-69 degrees F (July–Sept). Dissolved oxygen is not actively monitored. Rearing ponds are cleaned once a week and mortalities removed daily.

At S. Fk. Klaskanine Hatchery, rearing temperatures range from 34-50 degrees F and are monitored daily by a Partlow thermograph. Dissolved oxygen is not actively monitored, however loading densities and flows are such that D.O. is not a problem.

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

Feeding rates are followed so that fish size is within 10% of program goal (10-20 fish/lb) each year. Operator conducts periodic feed quality analysis. Feed is stored under proper conditions as described by IHOT guidelines. The available data on fish growth information is provided in Table 21.

Table 21. Average facility-specific growth information for SAB fall chinook.

Facility	Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate (g/month)
Big Creek Hatchery (target)	Jan-Aug	125	15.5	not avail.	not avail.
Klaskanine Hatchery (target)	Jul-Aug	125	15.5	not avail.	not avail.
Youngs Bay Net Pens (2002)	Feb-Mar	not avail.	912	not avail.	not avail.
	Mar-Apr	not avail.	338	not avail.	0.8
	Apr-May	not avail.	160	not avail.	1.5
	May-June	not avail.	55	not avail.	5.4
	June-Jul	not avail.	32	not avail.	5.9
	Jul-Aug	128	17.4	1.24	11.9

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

Monthly growth data is provided in Section 9.2.4. Energy reserve data are not available.

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

Feeding protocols at hatcheries involved in the SAB fall chinook program are presented below in Table 22.

Table 22. Feeding protocols by facility for SAB fall chinook.

Facility	Rearing Period	Food Type	Application Schedule (no. feedings/day)	Feeding Rate Range /1	Lbs. Fed Per gpm of Inflow	Food Conversion
Big Creek Hatchery	Jan-Aug	Bio-Oregon	Demand	Demand	nya	0.94
Klaskanine Hatchery	Jul-Sep	Bio-Oregon	Demand	Demand	nya	nya
Youngs Bay Net Pens (2002)	Feb-Mar	BioVita Starter	4-6	3-5%	na	7.6
	Mar-Apr	BioVita Starter	4-6	3-5%	na	1.16
	Apr-May	1.0-1.5mm Biodiet	1-2	2-3%	na	0.82
	May-Jun	1.5-2.5mm Biodiet	1	2	na	0.95
	Jun-Jul	2.5-3.0mm Biodiet	1	2	na	1.72
	Jul-Aug	3.0mm Biodiet	1	2	na	1.12

/1 Percent of body weight per day

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

At both Big Creek and S. Fk. Klaskanine hatcheries, as well as the net pens, IHOT fish health guidelines are followed to prevent disease transmission between lots of fish on site or transmission or amplification to or within the watershed. Vaccines are used, whenever possible, to minimize the use of antimicrobial compounds. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines, life-stage specific survival studies conducted at other facilities, staff experience (e.g. trial and error), and other criteria. Fish health is monitored daily by on-site staff and monthly by ODFW pathologists.

Fish transferred to the net pens are vaccinated at ~100/lb for *Vibrio angularium* and Furunculosis to minimize disease outbreaks. Although they often experience a vibriosis outbreak during handling for marking and tagging, they quickly respond to treatment with Romet-30 or TM-100, and losses are kept to a minimum. If significant losses occur in any of the three species in the net pens, mortalities are bagged, frozen and put in the facility dumpster. No exchange of dip nets, rearing nets, etc. is made between different rearing sites (Youngs Bay, Tongue Pt., Blind Slough) to minimize risk of disease transfer. Pens are cleaned and/or changed as needed to ensure adequate flow. Pen walkways are swept of excess feed. Fish health is monitored daily by on-site staff and monthly by ODFW pathologists.

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

For fish released from the net pens, ATPase samples are collected periodically beginning several weeks prior to release to establish baseline information and for comparison with adult return rates. Actual release timing is based on smolt behavior, physical appearance, time of year, potential for avian predation, and tidal stage. The potential release window and target size is based on release trials conducted from 1995-2002.

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

The program utilizes net pens for rearing the majority of the production to achieve confirmed benefits of this rearing strategy. Conditions in the net pens may be more natural than can be found in a typical hatchery setting. Growth rates are rapid since natural feed including invertebrates (especially *Corophium* spp.) and small fishes are available as prey. These fish are exposed to natural salinity profiles and daily tidal exchange.

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

This broodstock is not listed under federal ESA. Net pens are checked for holes during regular washing schedules to prevent accidental releases. Net pen complexes are sufficiently constructed to avoid accidents due to weather, etc. In the net pens, fish health is monitored daily and any mortalities are examined for signs of disease. If an outbreak occurs, the CEDC staff biologist will take fish back to the lab for necropsy and gram stains. Usually an ODFW pathologist will receive samples and confirm diagnosis. Treatment for diseases in the net pens is with medicated fish food produced at Bio-Oregon; usually TM-100 or Romet-30, depending on recommendation from ODFW pathology. Potential diseases in the net pens include vibriosis, furunculosis and columnaris. If significant losses occur in any of the three species in the net pens, mortalities are bagged, frozen and put in the facility dumpster. No exchange of dip nets, rearing nets, etc. is made between different rearing sites (Youngs Bay, Tongue Pt., John Day River, and Blind Slough) to minimize risk of disease transfer.

SECTION 10. RELEASE

10.1) Proposed fish release levels.

Maximum annual releases of SAB (Rogue) fall chinook by this program would include up to 700,000 sub-yearling smolts from Klaskanine Hatchery for maintenance of the broodstock program and up to 1.55 million smolts from net pens in Youngs Bay. Proposed releases are presented below in Table 23. Actual annual releases since 1995 are presented in Section 10.3.

Table 23. Proposed releases of SAB fall chinook in 2005.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Sub-yearling Smolts	700,000	15	8/15/05	Klaskanine Hatchery
Sub-yearling Smolts	1,500,000	15	7/15/05	Youngs Bay
Sub-yearling Smolts	50,000	15	7/1/05 (based on water quality)	S.F. Klaskanine

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

Select Area Bright fall chinook are released from three locations:
Klaskanine Hatchery, North Fork Klaskanine River - RM 3.0
South Fork Klaskanine Hatchery, South Fork Klaskanine River – RM 3.0
Youngs Bay net pens; several pen sites; RM 1.5-1.7

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

Annual releases of SAB fall chinook from lower Columbia River production facilities are presented below in Table 24.

Table 24. Annual releases of SAB fall chinook from lower Columbia River production facilities, 1995-2003. Data from North et al. 2004.

Release Year	Big Creek Releases	Big Creek Avg. size (#/lb)[a]	N. Fk. Klaskanine Releases	N. Fk. Klaskanine Avg. size (#/lb)[a]	Youngs Bay Net Pen Releases	Youngs Bay Net Pen Avg. size (#/lb)[a]	Total Releases
1995	1,007,298	17.2	--	--	1,267,545	26.6	2,274,843
1996	521,601	14.3	26,178	22.2	1,421,145	26.1	1,968,924
1997	--	--	603,960	13.8	518,598	21.9	1,122,558
1998	--	--	661,977	16.6	117,583	16.6	779,560
1999	--	--	703,200	14.7	221,972	21.9	925,172
2000	--	--	408,492	17.5	153,928	16.1	562,420
2001	--	--	669,913	17.6	205,145	24.2	875,058
2002	--	--	620,527	36.5	467,056	24.3	1,087,583
2003	--	--	702,188	24.7	780,314	20.0	1,482,502
Average	764,450	15.8	549,554	20.5	572,587	22.0	1,173,002

[a] Weighted average of all annual release groups.

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

Table 25. Dates of releases of SAB fall chinook from lower Columbia production facilities, 1995-2003.

Release Year	Release Start Date	Release End Date	Location
1995	June 27	July 17	Youngs River
1995	Aug 15	Aug 15	S.F. Klaskanine R.
1996	July 16	July 17	Youngs Bay
1996	July 15	July 15	Blind Slough
1996	July 15	July 15	Tongue Point
1997	June 17	July 17	Youngs Bay
1997	July 17	July 17	Blind Slough
1997	July 17	July 17	Tongue Point
1998	June 17	July 17	Youngs Bay
1999	July 1	July 20	Youngs Bay
2000	July 12	Aug 2	Youngs Bay
2001	July 5	July 5	Youngs Bay
2002	July 2	July 2	Youngs Bay
2003	July 24	Aug 2	Youngs Bay

10.5) Fish transportation procedures, if applicable.

The fish are transported from Big Creek to the Klaskanine Hatchery and to the Youngs Bay net pens. Transport equipment is described in Section 5.2. Currently, pre-smolts are transported to

Klaskanine Hatchery from Big Creek Hatchery at approximately 15-20 fish/lb and ponded into 2-4 concrete raceways where they are held for up to 14 days prior to release. Juvenile SABs are transferred at approximately 60 fish/lb from Big Creek Hatchery to the net pens in Youngs Bay in June.

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

SAB fall chinook are acclimated at both Klaskanine Hatchery and the Youngs Bay net pens. Currently, pre-smolts are transported to Klaskanine Hatchery from Big Creek Hatchery at approximately 15-30 fish/lb and ponded into two-four concrete raceways where they are held for up to 14 days prior to release. The current acclimation period is approximately 7 days to reduce chance of “ich”. Juvenile SABs are transferred at approximately 60 fish/lb from Big Creek Hatchery to the net pens in Youngs Bay in June and acclimated until release in July or August at 10-20 fish/lb.

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

SAB fall chinook are mass-marked with a left ventral fin clip for identification. All fish receive this fin-clip. In addition, multiple coded-wire tag release groups (5-15% of total release) occur each year for research purposes. These fish are marked with an AD/LV fin clip combination.

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

Any culling in this program would occur when the fish are at the eyed egg stage or during mass marking. To date, the program has not needed to dispose of any eggs because egg goals have only been achieved in two years. If eggs were collected in excess of program needs, the surplus would be frozen and disposed of in municipal waste.

10.9) Fish health certification procedures applied pre-release.

All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release.

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

Net pen complexes are sufficiently constructed to avoid accidents due to weather. Water system failure or flooding incidents are not possible since the pens and fish are immersed in large water bodies rather than supplied by an external source. In the event of net pen failure, fish would be capable of leaving the pens on their own and could not be recovered. Pen complexes are arranged to provide protection to the net pens and minimize the chances of early release. However, in the event of a weather-related emergency, procedures for the net pens are as follows: Clatsop County coordinates with the municipal government, the Port Authority and the US Coast Guard for general disaster and event preparedness. As a part of that system, the CEDC (SAFE) net pens are identified as “critical water dependent programs”. In the event of any potential hazard or harm the above agencies all have the list of telephone numbers (home and cell) for CEDC staff. Internally, we deploy a minimum of one staff member on duty 365 days a year, and that staff member, who may be alone (usually weekend duty), carries a portable phone for instant communications. Should contact be made the staff are trained to:

- Inform the field supervisor as soon as possible.
- Take corrective action on the site as his/her judgment informs.
- Contact the Project Manager if the event involves policy issues or inter-governmental relations.

The project has sustained several significant flood events, including the 1996 one-hundred year flood without loss of fish or infrastructure. Pilings, to which the pens are moored, are of significant height to withstand such occurrences.

Fish at Klaskanine Hatchery could be released on site. Fish reared at Big Creek cannot be released onsite unless cleared by a district biologist. Staff would contact the district biologist to determine if fish would be allowed to perish or be released onsite. If time allowed, fish could be transferred to Klaskanine or CEDC net pens, depending on space availability.

In regard to the net pens, Clatsop County coordinates with the municipal government, the Port Authority and the US Coast Guard for general disaster and event preparedness. As a part of that system, the CEDC (SAFE) net pens are identified as "critical water dependent programs". The above agencies have a list of CEDC staff phone numbers (home and cell) and a CEDC staff member can be reached 365 days a year in the event of an emergency. If contacted in regard to an emergency, staff are to;

- Inform the field supervisor as soon as possible,
- Take corrective action on the site as his/her judgment informs,
- Contact the Project Manager if the event involves policy issues or inter-governmental relations.

The project has sustained several significant flood events, including the 1996 one- hundred-year flood without loss of fish or infrastructure. Piling to which the pens are moored are of significant height to withstand such occurrences.

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.

CEDC and ODFW have conducted juvenile and adult stream surveys on the North and South Fork Klaskanine rivers since 1999 to determine the extent of natural production of SAB and late-fall chinook. The SAB fall chinook (Rogue stock) are not native to the Columbia River system. The program is designed for harvest and broodstock perpetuation. Fish are released in the estuary on strong ebb tides and are assumed to leave the system rapidly. The release timing and rapid emigration should limit the potential for temporal overlap with listed juvenile fish rearing in the Columbia River estuary. In addition, the release sites are located very low in the estuary, which should minimize spatial overlap with listed upriver fish that are migrating through or rearing in the estuary. Release locations have also been adjusted to minimize straying.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

Many policies within the hatchery program are already in place to minimize and avoid risks to ESA listed species. Thus, much of the monitoring and evaluation of the SAB fall chinook program is incorporated into routine ODFW operations within the Hatchery, Fish Pathology, and Fish Management programs. Ongoing research into additional issues relating to this hatchery program are discussed in Section 12. Refer to Section 1.10 for a listing of monitoring and evaluation efforts associated with each of the performance indicators for the SAB fall chinook program.

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

Funding for monitoring and evaluation is provided entirely by the BPA through one of two projects; the SAFE project in Oregon and Washington, and in Oregon by the coded-wire tag recovery project (BPA Project # 82-01301).

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.

No adverse effects to listed stocks are anticipated from monitoring of the landed catch and analysis of CWT data.

SECTION 12. RESEARCH

The SAFE project has conducted or been involved in several studies with a goal of maximizing smolt survival, improving smolt quality, and minimizing impacts of the project on endangered salmonids and their habitat. Listed below are the studies involving SAB fall chinook.

12.1) Objective or purpose.

Subsurface Feeding

Frequent criticism of hatchery methodologies includes that of teaching raceway-reared fingerlings to feed on the surface and to respond to human presence associated with surface feeding. It is speculated that this conditioning may result in higher than normal avian predation once fish are liberated. Other trials have concluded that salmon fed in captivity will become accustomed to human hand feeding and respond to human presence yet still maintain avoidance responses to avian shapes (Maynard et al. 1996; Olla and Davis. 1998; Maynard et al. 2001).

To determine if subsurface feeding would improve survival of juveniles released by the SAFE project, a multi-year release trial was conducted using 1999-2001 brood SAB fall chinook ponded into net pens in Youngs Bay. It is not expected that this research will have an effect on listed fish.

Rearing Density

Artificial rearing of salmonids is constrained by various factors, one of which is the total biomass that can be produced in a given space. Water flows are needed to provide adequate oxygen for respiration and flushing of metabolites. Research has shown that there is a direct correlation between the total biomass in rearing situations and eventual survival of liberated smolts to adults (Banks 1989; Ewing and Ewing 1995). Each species and stock of fish may have unique tolerances to the known environmental constraints, and this study addresses one of three species reared and released by the SAFE project.

To determine the optimal net-pen rearing density for SAB fall chinook, juveniles of the 1994-2000 broods were reared in floating net pens in Youngs Bay using three loading levels that would yield target biomass densities of approximately 0.25 pound/ft^3, 0.50 pound/ft^3, and 0.75 pound/ft^3 at a release size of 15 fish/pound (Hirose et al. 1998). It is not expected that this research will have an effect on listed fish.

Release Timing and Smolt Size

Fish propagation programs in the Columbia River Basin are generally driven by an underlying goal to grow fish to a predetermined target release size during a specific timeframe to maximize survival. A wealth of propagation information is available from years of species-specific research conducted relative to the extensive land-based hatchery system that has evolved in the system (Senn et al. 1984). In comparison, net-pen culture in the Columbia River system is a recent development, often requiring verification or fine-tuning of long-standing hatchery practices.

To evaluate the effects of release timing on adult survival, two paired CWT groups of SAB fall chinook smolts were released from Youngs Bay net pens annually during 1995 and 1997-1999 (four paired releases). It is not expected that this research will have an effect on listed fish.

Select Area Bright Broodstock Collection and Adult Holding

A common problem throughout the evolution of the SAFE SAB fall chinook program has been how to hold early returning adults in the hatchery facilities. These fish enter freshwater over a protracted period from June through September with returns to hatcheries occurring from July through October. Most of the early returnees are not ripe when they reach the hatcheries. Even if they could be spawned, protracted egg collections complicate subsequent rearing. Utilizing all returning broodstock has been an important goal of the SAB program since full capacity (2.4 million eggs) has seldom been reached (Table 18). Unfortunately these fish do not hold well due to a propensity to jump, resulting in injury. Early returns are especially vulnerable to adverse effects from warm water temperatures. This project has the potential to impact listed fish due to broodstock collection methods.

Spawning Ground and Juvenile Surveys

In addition to systematic stream surveys conducted each fall in LCR tributaries by various state agencies, SAFE project staff also conduct local stream surveys. Spawning ground surveys are conducted each fall in the Lewis and Clark, North and South Fork Klaskanine, and the Youngs rivers (all Youngs Bay tributaries) to estimate straying and escapement of adult SAB fall chinook. To determine if the SAB fall chinook and local late fall chinook stocks are successfully spawning, juvenile abundance surveys were conducted during July of 1999-2002 and the fall of 1999 in Youngs Bay tributaries. Findings from these studies will help to clarify the proportion of hatchery spawners in naturally spawning populations in the Youngs Basin. This project may impact listed fish due to juvenile sampling methods.

12.2) Cooperating and funding agencies.

Entities: Sea Resources, Salmon for All, ODFW, Oregon State University, and USFWS.

Projects:
- Subsurface Feeding
- Rearing Density
- Release Timing and Smolt Size
- Select Area Bright Broodstock Collection and Adult Holding
- Spawning Ground and Juvenile Surveys

12.3) Principle investigator or project supervisor and staff.

Lead Investigator(s): Tod Jones (CEDC) and John North (ODFW)

Projects:
- Subsurface Feeding
- Rearing Density
- Release Timing and Smolt Size
- Select Area Bright Broodstock Collection and Adult Holding
- Spawning Ground and Juvenile Surveys

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

See Section 2.

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

Subsurface Feeding

A multi-year release trial was conducted using 1999-2001 brood SAB fall chinook ponded into net pens in Youngs Bay. Each year, two groups of approximately 25,000 fish each were fed using six-inch diameter polyvinyl chloride (PVC) pipes, three per net pen, extending 1.0 meters below the surface as a delivery system for feeding. Target release densities for the two groups were 0.25 and 0.50 pound/ft^3. As a control, two additional groups of fall chinook were reared at similar densities in nearby pens and surface fed on an identical schedule. All fish received an LV fin clip for stock identification, and each study group was uniquely coded-wire tagged prior to release. Coded-wire tagged fish are recovered through sampling of commercial and recreational fisheries, through returns to the hatchery, and through sampling of carcasses during spawning ground surveys.

Rearing Density

To determine the optimal net-pen rearing density for SAB fall chinook, juveniles of the 1994-2000 broods were reared in floating net pens in Youngs Bay using three loading levels that would yield target biomass densities of approximately 0.25 pound/ft^3, 0.50 pound/ft^3, and 0.75 pound/ft^3 at a release size of 15 fish/pound (Hirose et al. 1998). Approximately 25,000 fish from each study group were coded-wire tagged prior to release. Coded-wire tagged fish are recovered through sampling of commercial and recreational fisheries, through returns to the hatchery, and through sampling of carcasses during spawning ground surveys.

Release Timing and Smolt Size

To evaluate the effects of release timing on adult survival, two paired CWT groups of SAB fall chinook smolts were released from Youngs Bay net pens annually during 1995 and 1997-1999 (four paired releases). One test group represented fish to be released on or near July 15 of each year or when water temperatures reached 65° F. The second CWT group represented fish to be released on or near August 1 of each year or when water temperatures reached 70° F. Release timing was generally driven by water temperature criteria rather than target release date. Coded-wire tagged fish are recovered through sampling of commercial and recreational fisheries, through returns to the hatchery, and through sampling of carcasses during spawning ground surveys.

Select Area Bright Broodstock Collection and Adult Holding

During August-September 2003 and 2004, broodstock collection activities were conducted using tangle nets and a Merwin fish trap (2003) in the tidewater sections of the Klaskanine and Youngs Rivers to determine whether offsite broodstock collection is a feasible alternative for obtaining additional SAB eggs. Tangle nets (<5¼” stretched mesh) were deployed across the confluence hole and weighted heavily to avoid drifting. Fish were removed from the net, revived in one of 3 live boxes, and/or held in a 67-gallon insulated tote prior to being transported to net pens (6) stationed onsite. Both the live boxes and holding tote were plumbed to deliver raw river water. The Merwin trap was fished across the mouth (~85 percent coverage) of the Klaskanine River overnight for ~26.5 hours.

Spawning Ground and Juvenile Surveys

Spawning ground surveys are conducted each fall in the Lewis and Clark, North and South Fork Klaskanine, and the Youngs rivers (all Youngs Bay tributaries) to estimate straying and escapement of adult SAB fall chinook. Each river is surveyed up to five times annually from late-September through October. Data collected includes redd counts and estimates of live and dead fish numbers. Carcasses are examined for gender, spawning success, fin marks, and also measured for length. Scales are collected to determine age composition. Snouts are collected from carcasses with appropriate fin-mark combinations with data incorporated into the Regional Mark Information System (RMIS) for estimating survival and stray rates. Juvenile sampling was conducted within several pools in each of three sections of the Lewis and Clark and Klaskanine rivers (North Fork, South Fork, and mainstem) using multiple passes with a stick seine. Fish were identified to species, counted, examined for fin marks, and measured.

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

Subsurface Feeding

Subsurface feeding occurs throughout the season that fish are in the net pens. Coded-wire tagged fish releases were made in the same season as production releases.

Rearing Density

Differential rearing densities were tested throughout the season in which fish were rearing in the net pens. Groups were CWT tagged, and coded-wire tagged fish releases were made in the same season as production releases.

Release Timing and Smolt Size

To evaluate the effects of release timing on adult survival, two paired CWT groups of SAB fall chinook smolts were released from Youngs Bay net pens annually during 1995 and 1997-1999 (four paired releases). One test group represented fish to be released on or near July 15 of each year or when water temperatures reached 65° F. The second CWT group represented fish to be released on or near August 1 of each year or when water temperatures reached 70° F. Release timing was generally driven by water temperature criteria rather than target release date.

Adult survival rates of 1988-1996 brood spring chinook released from SAFE net-pen facilities were also evaluated. Survival of sub-yearlings released between June 1 and August 1 were compared with yearling fish released prior to March 1, and after March 1.

Select Area Bright Broodstock Collection and Adult Holding

Broodstock collection via tangle nets is conducted in August-September. Adults returning to the hatcheries were held in net pens throughout the months of arrival (August – October).

Spawning Ground and Juvenile Surveys

Spawning ground surveys are conducted in late September through October. Juvenile abundance surveys were conducted during July of 1999-2002 and the fall of 1999 in Youngs Bay tributaries.

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

No listed fish, or their eggs, will be held, maintained, or transported during research activities associated with this program.

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

Subsurface Feeding

This research program is not expected to result in take of listed fish. Program is largely based on recovery of CWT tagged release groups. Tag recoveries are made through sampling of commercial and recreational fisheries, returns to hatcheries, and through sampling of carcasses during spawning ground surveys.

Rearing Density

This research program is not expected to result in take of listed fish. Program is largely based on recovery of CWT tagged release groups. Tag recoveries are made through sampling of commercial and recreational fisheries, returns to hatcheries, and through sampling of carcasses during spawning ground surveys.

Release Timing and Smolt Size

This research program is not expected to result in take of listed fish. Program is largely based on recovery of CWT tagged release groups. Tag recoveries are made through sampling of commercial and recreational fisheries, returns to hatcheries, and through sampling of carcasses during spawning ground surveys.

Select Area Bright Broodstock Collection and Adult Holding

Incidental take of lower Columbia River chinook, Columbia River chum, or Columbia River coho could occur through activities associated with adult broodstock collection for the SAB fall chinook program. Broodstock are collected via volitional return of adults to fish traps at both the Klaskanine and South Fork Klaskanine hatcheries or via active collection with tangle nets in tidewater reaches of Youngs Bay tributaries. Take of listed fish could result from collection and sampling at traps or in the tangle nets. The type of take might include; collection, handling, release and migration delay. The potential for injury or mortality of listed fish is low, as the collection methods are designed and operated to minimize injury and mortality. In addition, the fish are handled carefully, and wild fish are released alive immediately, or as soon as possible after capture.

Spawning Ground and Juvenile Surveys

Incidental take of a very small number of juvenile lower Columbia River chinook or lower Columbia River coho salmon may occur through seining activities associated with juvenile surveys. Most chum have emigrated prior to sampling. Take is not expected to occur as a result of spawning ground surveys. Incidental take of adults will occur through observation of adults and sampling of carcasses. The type of take might include observation, collection, handling and release. The potential for injury or mortality of listed fish is low, as collection methods are designed and operated to minimize injury and mortality. In addition, the fish are handled carefully, and wild fish are immediately released alive, or as soon as possible after capture.

12.9) Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 26).

With the exception of the two research programs discussed below, there has been no take of listed fish resulting from research activities associated with the SAFE program.

Select Area Bright Broodstock Collection and Adult Holding
During this timeframe, adult lower Columbia River chinook are extremely rare in the area and state-listed coho are not yet present. During 2003-2004, zero non-SAB fall chinook and only a few marked coho have been captured.

Spawning Ground and Juvenile Surveys
Incidental take of a very small number of juvenile lower Columbia River chinook (< 52 fish) or lower Columbia River coho salmon (< 52 fish) may occur through seining activities associated with juvenile surveys. Most chum have emigrated prior to sampling. Collection is by seining so fish are released alive and unharmed. Direct take is not expected to occur as a result of spawning ground surveys since adults are simply observed for enumeration and carcasses are sampled.

12.10) Alternative methods to achieve project objectives.

Subsurface Feeding
Rearing Density
Release Timing and Smolt Size

Incidental take of listed species is not expected to occur as a result of activities associated with the research projects listed above. Alternative methods to achieve project objectives are unnecessary with respect to effects of the research on listed fish.

Select Area Bright Broodstock Collection and Adult Holding
Merwin traps were used in the same season as the tangle nets to evaluate effectiveness in broodstock collection. Captures in the Merwin trap were low, and it was not considered a viable alternative to the tangle nets. Due to the timing of this work, the catch consists exclusively of SAB fall chinook. Lower Columbia fall chinook are not generally present in this system until later in the year and sampling occurs prior to arrival of chum or late-run coho.

Spawning Ground and Juvenile Surveys
Concern with reference to listed species is primarily raised by juvenile sampling techniques. Less invasive sampling such as snorkeling could effectively be used to establish presence/absence, species composition, densities, and even to some degree the presence of external marks.

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

Subsurface Feeding
Rearing Density
Release Timing and Smolt Size
Select Area Bright Broodstock Collection and Adult Holding

No other species are affected by the research projects listed above.

Spawning Ground and Juvenile Surveys

Winter steelhead juveniles, cutthroat trout, and coho are handled and released during juvenile salmon surveys. Mortality is very low. Most chum have emigrated prior to sampling. Juvenile surveys have not occurred since 2002.

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.

Subsurface Feeding
Rearing Density
Release Timing and Smolt Size

It is not expected that listed fish would be affected by the research activities listed above.

Select Area Bright Broodstock Collection and Adult Holding

Tangle net gear with <5.25” mesh is used to assure captured fish are tangled and not gilled. All SAB fall chinook broodstock are identified by an LV mark. A recovery box is used to revive any non-target salmon, and they are released unharmed. Fishing occurs in the early fall season and is completed by mid September, prior to chum or late-coho stock entry.

Spawning Ground and Juvenile Surveys

Spawning ground surveys are not expected to affect listed fish. Adults will only be observed and not handled. A very small number of listed juveniles may be handled during juvenile surveys. Juveniles are captured with a stick seine net in the Lewis and Clark and Klaskanine rivers. The juveniles are placed in river water in a container and identified, counted, examined for fin marks and carefully released back to the water. Juvenile surveys have not occurred since 2002.

SECTION 13. ATTACHMENTS AND CITATIONS

Banks, J. L. 1989. A Review of Rearing Density Experiments: Can Hatchery Effectiveness Be Improved? Paper presented, Session III: Hatchery Management Strategies and Supplementation, Spring Chinook Salmon Workshop sponsored by the Coastal Zone and Estuarine Studies Division, November 1989. Available at www.nwfsc.gov/pubs/tm/tm187/Banks.

Bayer, R. D. 1986. Seabirds near an Oregon estuarine salmon hatchery in 1982 and during the 1983 El Nino. Fish. Bull. 84:279-286.

Beckman, B. R, W. W. Dickhoff, W. S. Zaug, et al. 1999. Growth, smoltification, and smolt-to-adult return of spring chinook salmon from hatcheries on the Deschutes River, Oregon. Transactions of the American Fisheries Society 128:1125-1150.

Bisbal, G.A., and McConnaha, W.E. 1998. Consideration of ocean conditions in the management of salmon. Can. J. Fish. Aquat. Sci. 55: 2178-2186.

Bottom, D.L., K.K. Jones and M.J. Herring. 1984. Fishes of the Columbia River estuary. Portland, Oregon: Oregon Department of Fish and Wildlife; final report, Columbia River Estuary Data Development Program.

Cederholm, C.J., M.D. Kunze, T. Murota, and A. Sibatani. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Collis, K., R.E. Beaty, and B.R. Crain. 1995. Changes in catch rate and diet of northern squawfish associated with the release of hatchery-reared juvenile salmonids in a Columbia River reservoir. North American Journal of Fisheries Management 15:346-357.

Emmett, R. L. and Oregon State University. 1997? Estuarine survival of salmonids: the importance of interspecific and intraspecific predation and competition. In Emmett, R.L., and M.H. Schiewe (editors). Estuarine and ocean survival of Northeastern Pacific salmon: Proceedings of the workshop. U.S. Dep. Commer., NOAA Technical Memorandum NMFS-NWFSC-29, 313 p.

Ewing, R. D. and S. K. Ewing. 1995. Review of the effects of rearing density on survival to adulthood for pacific salmon. Progressive Fish-Culturist 57(1):1-25.

Federal Register Notice. 1999. Endangered and Threatened Species: Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington. Vol. 64, No 56, pp 14308-14328.

Groot, C. and L. Margolis. 1991. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, British Columbia.

Healey, M.C. 1991. Life history of chinook salmon. Pacific Salmon Life Histories. C. Groot and L. Margolis. Vancouver, UBC Press: 313-393.

Hirose, P., M. Miller, and J. Hill. 1998. Columbia River: Select Area Fishery Evaluation Project; 1995-1996 annual reports. Project 93-060 Annual Completion Report for the Bonneville Power Administration, Portland, Oregon. 194 pp.

Ledgerwood, R. D., E. M. Dawley, B. W. Peterson, R. N. Iwamoto. 1997. Estuarine recovery of PIT-tagged juvenile salmonids from the Lower Granite Dam transportation study, 1996. Report to the U.S. Army Corps of Engineers, Contract E8960100, 54 pgs. plus appendice p.

Levings, C. D., C. D. McAllister, and B. D. Chang. 1986. Differential use of the Campbell River estuary, British Columbia, by wild and hatchery-reared juvenile chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 43:1386-1397.

Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. Pages 131–136 *in* M. J. Dadswell, R. J. Klauda, C. M. Moffitt, R. L. Saunders, R. A. Rulifson, and J. E. Cooper, editors. Common strategies of anadromous and catadromous fishes. American Fisheries Society, Symposium 1, Bethesda, Maryland.

Lower Columbia Fish Recovery Board. Draft 2004. Lower Columbia Salmon and Steelhead Recover and Subbasin Plan, Technical Foundation Vol III Other Species. Lower Columbia Fish Recovery Board, Longview, Washington.

Lower Columbia River Estuary Partnership. Draft 2004. Lower Columbia River and Estuary Bi-State Subbasin Plan. Lower Columbia River Estuary Partnership, Portland, Oregon.

Maynard, D. J., J. L. Hackett, M. Wastel, A. L. LaRae, G. C. McDowell, T. A. Flagg, and C. V. W. Mahnken. 2001. The effect of automated sub-surface feeders on the behavior and predator vulnerability of fall chinook salmon. Proceedings of the 52nd Annual Pacific Northwest Fish Culture Conference 2001. Available at www.nwr.noaa.gov/1habcon/habweb/caspiantern_references .

Maynard, D. J., T. A. Flagg, C. V. W. Mahnken, and S. L. Schroder. 1996. Natural rearing technologies for increasing post-release survival of hatchery-reared salmon. Bulletin Of Natural Resource Institute for Aquaculture, Supplement 2:71-77.

McCabe, G. T., Jr., W. D. Muir, R. L. Emmett, and J. T. Durkin. 1983. Interrelationships between juvenile salmonids and nonsalmonid fish in the Columbia River estuary. Fish. Bull., U.S. 81(4):815-826.

McElhany, P., T. Backman, C. Busack, S. Kolmes, J. Myers, D. Rawding, A. Steel, C. Steward, T. Whitesel, and C. Willis. 2004. Status evaluation of salmon and steelhead populations in the Willamette and lower Columbia River basins. Willamette/Lower Columbia Technical Recovery Team. NOAA Fisheries, Northwest Fisheries Science Center, Seattle, WA.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Myers, K. W., and H. F. Horton. 1982. Temporal use of an estuary by hatchery and wild juvenile salmon. Pages 377-392 in V. S. Kennedy (editor), Estuarine Comparisons. Academic Press. New York, NY.

National Marine Fisheries Service. 1991. Status review for lower Columbia River coho salmon. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA.

National Marine Fisheries Service. 1999. Report to Congress: Impacts of California sea lions and Pacific harbor seals on salmonids and West Coast ecosystems. National Marine Fisheries Service, Silver Springs, MD.

North, J., C. Rodriguez, M. Miller, J. Sewall, P. Frazier, S. Gray, T. Jones, A. Dietrichs, and T. Miethe. 2004. Select Area Fishery Evaluation Project. Draft Final Completion Report for Project #199206000 prepared for the Bonneville Power Administration, Portland, Oregon. 144 pp.

Olla, B. L. and M. W. Davis. 1998. The role of learning and stress in predator avoidance of hatchery-reared coho salmon (*Oncorhynchus kisutch*) juveniles. Aquaculture 76:209-214.

Petersen, J.H. and D.L. De Angelis. 1992. Functional response and capture timing in an individual-based model: predation by northern squawfish (*Pychocheilus oregonensis*) on juvenile salmonids in the Columbia River. Canadian Journal of Fisheries and Aquatic Science 49:2551-2565.

Reimers, P. E. 1973. The length of residence of juvenile fall chinook salmon in Sixes River, Oregon. Oregon Fish Comm. Res. Rep. 4, 43 p.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 pp.

Senn, H., J. Mack, and L. Rothfus. 1984. Compendium of low-cost Pacific salmon and steelhead trout production facilities and practices in the Pacific Northwest. Project 83-353. Final Completion Report for the Bonneville Power Administration, Portland, Oregon. 488 pp.

Technical Advisory Committee (TAC). 2005. Biological Assessment of Incidental Impacts on Salmon Species Listed Under the Endangered Species Act in the 2005-2007 Non-Indian and Treaty Indian Fisheries in the Columbia River Basin.

Waldeck, R.D., M. Sytsma, J. Cordell, and J. Chapman. 2003. Preliminary results from the lower Columbia River aquatic nonindigenous species survey (LCRANS) 2001-2003. Portland State University, 30 pp.

Ward, D. L., J. H. Petersen, and J. Loch. 1995. Index of predation on juvenile salmonids by northern squawfish in the lower and middle Columbia River, and in the lower Snake River. Transactions of the American Fisheries Society 124:321-3334.

Williams, J., G. Matthews, J. Meyers, S. G. Smith, T. Cooney, and C. Toole. 1998. Hatchery extra mortality hypothesis. WOE Appendix Submission 1. June 30, 1998.

Zimmerman, M. P. 1999. Food habits of smallmouth bass, walleyes, and northern pikeminnow in the lower Columbia River Basin during outmigration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 128:1036-1054.

Zimmerman, M. P., and R. M. Parker. 1995. Relative density and distribution of smallmouth bass, channel catfish, and walleye in the lower Columbia and Snake rivers. Northwest Science 69:19-28.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name and Title of Applicant: Curtis Melcher, Ocean Salmon and Columbia River Program Manager

Signature: _________________________________ Date: _______________________________

Certified by: John Thorpe, Fish Propagation Program Manager

Signature: _________________________________ Date: _______________________________

Table 26. Estimated listed salmonid take levels by hatchery activity.

Listed species affected: __Chum/Chinook___________ ESU/Population:_Columbia River/LCR___________ Activity:_Adult hatchery collections-trap				
Location of hatchery activity:_S. Fork Klaskanine___ Dates of activity:__August-October____ Hatchery program operator:__Tod Jones_(contact)_				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			< 15 per species	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				
Listed species affected: __Fall Chinook/coho________ ESU/Population:___Lower Columbia River__________ Activity:__Adult stream surveys____				
Location of hatchery activity:__Youngs Bay Tributaries Dates of activity:__Oct-Nov___________ Hatchery program operator:_John North_(contact)_____				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			< 30 per species	
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				<25
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

Table 26. Continued.

Listed species affected: _Fall chinook/coho________ ESU/Population:_Lower Columbia River __ Activity:_Juvenile stream surveys				
Location of hatchery activity:__Youngs Bay tributaries Dates of activity:_June-July__________ Hatchery program operator:_John North_(contact)				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)		<50 per species		
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

Table 26. Continued.

Listed species affected: _Fall chinook/coho________ ESU/Population:_Lower Columbia River __ Activity:_SAB broodstock collection				
Location of hatchery activity:__Youngs Bay tributaries Dates of activity:_Aug-Sep__________ Hatchery program operator:_John North_ (contact)				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)		<2 per species	<2 per species	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects.

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 and test fishing where fish are captured, handled and released.

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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Natural origin recruit (NOR) - See natural fish .

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

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

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

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

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

Stock - (see “Population”).

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

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

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

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

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

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (ANADROMOUS SALMONID EFFECTS ARE ADDRESSED IN SECTION 2)

A.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

A.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

General species description and habitat requirements.
Local population status and habitat use.
Site-specific inventories, surveys, etc.

Columbian White-tailed Deer (*Odocoileus virginianus leucurus*, Endangered Species Delisting Proposed)

Currently, there are 38 recognized subspecies on *O. virginianus*. The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) is one of the largest terrestrial mammals associated with the Columbia River estuary. Preferred habitats on the mainland and on islands exist in the upper Columbia River estuary and within the river corridor (LCFRB 2004).

Status: Declines in the Columbia white-tailed deer populations led to its listing under the Endangered Species Act in 1967. These deer occupied floodplain and riparian habitat between the western slopes of the Cascade Mountains and the Pacific Ocean. They ranged as far north as Puget Sound and southward to the Umpqua River Basin. Habitat modification (farming, logging and commercial and residential development) and over hunting are thought to be the cause of the decline in white-tailed deer numbers (ODFW 2003). The few scattered populations now number 300-500 in the Lower Columbia and 5,000 in Douglas County (LCFRB 2004).

Recent reintroduction of Columbia white-tailed deer has taken place on Crims Island and Lord Island in the Columbia River. The Crims Island population has become established in the Willow Grove, Washington area. (LCFRB 2004).

Habitat: The Columbian white-tailed deer are linked closely with riparian habitats. Historically, deer were found throughout the woodlands and bottomlands of the lower Columbia, Cowlitz, Willamette, and Umpqua river basins in Oregon and Washington (LCFRB 2004). Tall shrubs and scattered spruce, alder cottonwood and willows dominated the densely forested habitats associated with white-tailed deer (ODFW 2003). Large numbers of lakes, sloughs, ponds, backwaters, overflow channels and wetlands scattered the habitat.

Columbian white tailed deer are resident in suitable habitat and show little tendency to wander outside the home range. Preferred habitat in the lower Columbia Subbasin is limiting. Extensive losses of habitat have occurred in the lower Columbia and estuary provinces as a result of dredging, filling, diking, and channelization. The floodplain and lowlands likely were much more heavily forested and historically there were many more lakes, ponds, sloughs, overflow channels, backwaters and wetlands. Between 1850 and 1999, 20,000 acres of tidal swamps (with woody vegetation, 10,000 acres of tidal marshes (with non woody vegetation), and 3,000 acres of tidal flats have been lost along the lower Columbia River (BPA unpublished data).

Conservation Measures: Population numbers have increased due to land acquisition, and protection and improvement of habitat. Protection under the Endangered Species Act has resulted in acquisition, protection, and improvement of habitat, which has allowed the two populations to increase in size. A Recovery Plan was developed for the two populations of Columbian white-tailed deer in 1983. Many of the tasks identified in the Recovery Plan have been implemented. In 1972, the Julia Butler Hansen Refuge for the Columbian White-tailed Deer was established in Wahkiakum County, Washington. In Douglas County, the Bureau of Land Management acquired a large parcel of habitat (the North Bank Habitat Management Area) through a land exchange specifically to benefit the Columbian white-tailed deer; this parcel alone provides over 6,000 acres of good habitat for the deer.

Fisher (*Martes pennanti,* Candidate Species)

Status: The west coast population of the fisher was accorded federal candidate status on April 8, 2004. Fishers, found only in North America, occur in the northern coniferous and the mixed forests of Canada and the northern United States. Their range extends from the mountainous areas in the southern Yukon and Labrador Provinces southward to central California and Wyoming, the Great Lakes and Appalachian regions, and New England.

In Oregon, fishers occurred historically throughout the Coastal and Cascade mountains. Currently, the range of the fisher is severely reduced. Despite extensive surveys conducted in forested regions of Oregon, records dating from 1954 to 2001 show that the remaining populations of fishers are restricted to two separate and genetically isolated populations in southwestern Oregon; one in the northern Siskiyou Mountains and one in the southern Cascade Range. The population in the southern Cascades descended from reintroduced fishers that were translocated to Oregon from British Columbia and Minnesota.

The west coast population of the fisher is endangered mainly due to the loss and fragmentation of habitat due to timber harvest, roads, urban development, recreation, and wildfires. Other threats include small population sizes and isolation, predation, and human-caused mortality from vehicle collisions, poaching, and incidental capture and injury

Habitat: Fishers select forests with high canopy closure, large trees, and a high percentage of conifers. The physical structure of this type of forest provides the fisher with reduced vulnerability to predation and an abundance of prey. The distribution of the fisher is likely limited by elevation and snow depth.

Conservation Measures: In December 2000, the Fish and Wildlife Service (Service) received a petition to list the west coast population of the fisher as an endangered species in Washington, Oregon, and California. The Service concluded that the west coast fisher population was a distinct population segment and was warranted for listing, but precluded by other higher priority listing action, and subsequently placed the species on the federal list of candidates. Now the

Service will begin conducting an annual review of the species status and may propose to list the species at a later date. The Service encourages state and federal agencies proposing activities within the historic range of the fisher to give consideration to the fisher during the environmental planning process, especially activities which alter or destroy mature and old growth forests.

Bald Eagle (*Haliaeetus leucocephalus*, Threatened Species – Delisting Proposed)

Status: Bald Eagles were listed as endangered in the conterminous United States under the ESA on March 6, 1967 (32 FR 4001). The population in the Pacific Northwest was later down listed on February 14, 1978 to threatened. Eagles in the remaining states were subsequently down listed to threatened on July 12, 1995 (60 FR 36000). Bald eagle populations have rebounded considerably within the last few years, with nearly all recovery goals met for Oregon, Washington, and other regions of the country. On July 6, 1999 the USFWS proposed delisting bald eagles from the ESA. Bald eagles and golden eagles are, and will continue to, be protected under the Bald Eagle and Golden Eagle Protection Act of 1940 (as amended) and the Migratory Bird Treaty.

The northern bald eagle is closely associated with freshwater, estuarine, and marine ecosystems that provide abundant prey and suitable habitat for nesting and communal roosting (Watson et al. 1991). Breeding territories are typically located within one mile of permanent water in predominantly coniferous, uneven-aged stands with old-growth structural components (Anthony et al. 1982, Stalmaster 1987, Anthony and Isaac 1989). Bald eagles winter along ice-free lakes, streams, and rivers where food and perch sites are abundant and the level of human disturbance is low (USFS 1977, Steenhof 1978, Stalmaster 1980). Communal night roosts are used by bald eagles primarily during the winter months. In the Pacific Northwest, communal roosts generally occur in multi-layered mature or old-growth conifer stands that provide protection from weather and human disturbance (Stalmaster and Newman 1978).

Home range size varies greatly according to food abundance and the availability of suitable nest and perch trees (Stalmaster 1987). Favored nest trees are the largest tree or snag in a stand that provides an unobstructed view of the surrounding area and a clear flight to and from the nest (Stalmaster 1987). Nests are usually built on limbs just below the crown, with the canopy above providing cover (USFS 1977). Nesting behaviors typically begin in January, followed by egg laying and incubation in February and March (Isaac et al. 2001). Young are reared from April-June. Fledging occurs in July and August. Bald eagles are primarily predators but also opportunistic scavengers that feed on a variety of prey including salmon, other fish, small mammals, waterfowl, seabirds, and carrion (Snow 1981). Bald eagles usually forage in large open areas with a wide visual field and suitable perch trees near the food source (USFS 1985). The bald eagle occurs throughout the United States and Canada. It winters primarily along rivers south of the Canadian border. The historic decline of the bald eagle has been attributed to the loss of feeding and nesting habitat, organochloride pesticide residues, shooting, poisoning, and electrocution (Snow 1981, USFS 1985). Human interference has been shown to adversely affect the distribution and behavior of wintering bald eagles (Stalmaster and Newman 1978).

Critical Habitat: Critical habitat for bald eagles has not been formally designated by USFWS.

Northern Spotted Owl (*Strix occidentalis caurina*, Threatened Species)

Status: The northern spotted owl was listed as a threatened species throughout its entire range in June 1990 (55 FR 26114). It ranges from southern British Columbia south to Marion County, California and east to the shrub steppe of the Great Basin in Oregon and California. In the Western Cascades, the northern spotted owl can be found from approximately sea level to 4,000 feet in elevation (USFWS 1992). Most observations of spotted owl habitat use have been made in forests with a component of old-growth and mature forests consisting of western hemlock, Douglas-fir and western red cedar. However, the northern spotted owl has been observed to use a wide variety of habitat types and forest stand conditions, including managed stands, for nesting, feeding or roosting (USFWS 1992). In general, northern spotted owls preferentially use forests with greater complexity and structure. In the Western cascades, the home range of northern spotted owl pairs ranges in size from approximately 1,450 acres to 9,750 acres with a median home range size of 2,950 acres (USFWS 1992). Spotted owls do not build their own nests. They depend on suitable naturally occurring nest sites such as broken-top trees and cavities in older-age forests, abandoned raptor nests, squirrels nests and debris accumulations. Most northern spotted owl nest sites observed on public lands have been located in old-growth or mature forests (USFWS 1992). However, spotted owls are known to nest in managed stands, especially if residual old-growth characteristics are present. Owlets remain in the nest for three to five weeks and generally leave the nest before they can fly. They usually remain near the nest in nearby branches or on the ground where they are fed and tendered by both adults before dispersing in early fall (late September to early October) (USFWS 1992). Roosting habitat is typically areas of relatively dense vegetation (high canopy closure dominated by large-diameter trees). Spotted owls respond to variations in temperature and move within the canopy to find favorable microclimate conditions which are facilitated by multistoried stand structure of roost sites (USFWS 1992). Spotted owl foraging habitat is more varied but is generally characterized by high canopy closure and complex structure. Spotted owls are primarily nocturnal and eat small mammals, birds and insects. Both the woodrat (*Neotoma fuscipes* and *N. cinerea*) and the northern flying squirrel (*Glaucomys sabrinus*) compose the majority of the prey base of the spotted owl (USFWS 1992).

Habitat: Critical habitat is designated for the northern spotted owl solely on 6.9 million acres of federal lands (57 FR 1796). Areas managed by the U.S. Forest Service (USFS) in upper Eagle Creek watershed are part of the critical habitat designation for northern spotted owl. Northern spotted owls live in forests characterized by dense canopy closure of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops. Although they are known to nest, roost, and feed in a wide variety of habitat types, these owls prefer older forest stands with variety: multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Typically, forests do not attain these characteristics until they are at least 150 to 200 years old.

Conservation Measures: The listing of the northern spotted owl as threatened and the designation of critical habitat are helping to reduce habitat loss on federal lands. Although the need for timber necessitates continued harvesting, new forest management practices now stress restricted harvesting in old-growth forests and suggest alternate areas for harvest which are less preferred by spotted owls. Careful planning of timber sales and wise use of forest resources is necessary to halt the decline of the northern spotted owl and other old growth-associated species. The Northwest Forest Plan, created in 1994, creates a system of late-successional reserves (LSR) across the range of the species that are designed to provide suitable nesting habitat over the long term. The federal forest lands outside these reserves are managed to allow dispersal between the LSRs through riparian reserves and other land allocations.

Marbled Murrelet (*Brachyramphus marmoratus,* Threatened Species)

Status: The North American subspecies of marbled murrelet ranges from the Aleutian Islands and Southern Alaska south to central California, the largest portion of the population occurs in Alaska and British Columbia. Due to loss of older forests used for nesting sites, the species is declining. Current estimates indicate that the population has declined by 50% to 82%. Along the Oregon coast, recent surveys have shown a decline in murrelet numbers during the 1990's. Loss of viable nesting habitat is thought to be a primary factor responsible for an estimated annual 4% to 7% decline in marbled murrelet populations in Washington, Oregon, and California. It is unlikely that population numbers will increase rapidly due to the naturally low reproductive rate and the continued loss of nesting habitat. These factors also indicate that the recovery of the species is likely to take decades.

Habitat: The marbled murrelet is a small robin-sized diving seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends the majority of its time on the ocean roosting and feeding, but comes inland up to 80 kilometers (50 miles) to nest in forest stands with old growth forest characteristics. These dense shady forests are generally characterized by large trees with large branches or deformities for use as nest platforms. The listed population nests in stands varying in size from several acres to thousands of acres. However, larger, unfragmented stands of old growth appear to be the highest quality habitat for marbled murrelet nesting. Nesting stands are dominated by Douglas fir in Oregon and Washington and by old growth redwoods in California.

Conservation Measures: Although most murrelet nesting habitat on private lands has been decimated by logging, suitable habitat remains on Federal and State owned lands. Areas of critical habitat have been designated within the three-state area to protect habitat and promote the recovery of the species. Over the next 50 to 100 years, the protected areas on Federal lands should provide for an increase in suitable nesting habitat. Although timber continues to be harvested, timber sale programs on Federal lands require consultation with the U.S. Fish and Wildlife Service to review and assess the potential impacts of the timber harvests on the marbled murrelet. In 1997, the Fish and Wildlife Service approved a recovery plan for the marbled murrelet that specified actions necessary to halt the decline of the species in the three-state area.

Western Snowy Plover (*Charadrius alexandrinus nivosus,* Threatened Species)

The western snowy plover is a small shorebird distinguished from other plovers by its small size, pal brown upper parts, dark patches on either side of the upper breast, and dark gray to blackish legs. Snowy plovers weigh between 1.2 and 2 ounces. The are about 5.9 to 6 inches long. The western snowy plover is listed as threatened. Critical habitat has been designated at 28 areas along the coasts of California, Oregon and Washington. A recovery plan is being prepared.

Status: The Pacific coast population of the western snowy plover is defined as those individuals that nest beside or near tidal waters, and includes all nesting colonies on the mainland coasts, peninsulas, offshore islands, adjacent bays and estuaries form southern Washington to southern

Baja California, Mexico. Historic records indicate that western snowy plovers nested at 29 locations on the Oregon coast. Currently, only nine locations in Oregon support nesting western snowy plovers, a 69 percent reduction in active breeding locations.

As early as the 1970's, observers suspected a decline in plover numbers. The primary cause of decline is loss and degradation of habitat. The introduced European beachgrass (*Ammophila arenaria*) contributes to habitat loss by reducing the amount of open, sandy habitat and contributing to steepened beaches and increased habitat for predators. Urban development has reduced the available habitat for western snowy plovers while increasing the intensity of human use, resulting in increased disturbance to nesting plovers.

Habitat: The Pacific coast population of western snowy plovers breeds on coastal beaches from southern Washington to southern Baja California, Mexico. Plovers lay their eggs in shallow depressions in sandy or salty areas that generally do not have much vegetation. Because the sites they choose are in loose sand or soil, nesting habitat is constantly changing under the influence of wind, waves, storms and encroaching plants.

Conservation Measures: In the nine areas of the Oregon coast that are currently used for nesting by the snowy plover, seasonal restrictions on beach use are implemented in an effort to reduce disturbance to breeding plovers. Activities that may adversely affect plovers include sand deposition, spreading or leveling; beach cleaning; construction of breakwaters and jetties; dune stabilization/restoration using native and nonnative vegetation or fencing; driving of off-road vehicles in nesting areas or at night. Recreational activities near western snowy plover nests, such as picnicking or dog walking, may also result in abandonment of the nest by adult plovers. Trash or food left on the beach may attract predators.

Brown Pelican (*Pelecanus occidenta*, Endangered species)

Status: There are two geographically and genetically distinct regional populations or subspecies of brown pelican that occur in North America. They are the California brown pelican (*P. o. californicus*), ranging from California to Chile, and the eastern brown pelican (*P. o. carolinensis*), which occurs along the Atlantic and Gulf coasts, the Caribbean, and the Central and South American coasts. Consumption of pesticide-laden fish, lack of food, and disturbances by humans were responsible for a marked decline in reproductive success, and consequently a decline in numbers of both brown pelican subspecies in the 1960s and 1970s. The eastern brown pelican remains endangered. Current information indicates that the California brown pelican has sufficiently recovered as a result of restrictions on the use of certain types of pesticides (organochlorines), and this news has prompted a proposal to delist this subspecies. A final ruling on this action is pending.

Habitat: The brown pelican is a warm weather species that thrives near coasts and on islands. The California brown pelican generally uses the rocky islands along the California coast for their group or "colonial" nest sites. These islands typically feature steep, rocky slopes and little vegetation, and they must be without terrestrial predators or human disturbances. Nearby high-quality marine habitat is also essential. Brown pelicans rely in part on the actions of marine predators such as sharks, salmon, and dolphins to force schools of fish to the surface where they can catch them. Pelicans will only breed in areas and at times with enough food to support the breeding colony. Roosting and resting or "loafing" sites where brown pelicans can dry their feathers and rest without disturbance are also important.

Conservation Measures: In the early 1970s, the use of DDT was banned, and restrictions controlling the use of other pesticides were imposed in the United States. As a result, pelican reproduction improved. Sanctuaries, reserves, and natural areas have been established to protect nesting habitat and fledging areas from human disturbances and to preserve nearby marine resources. Reduction of contaminant levels, habitat protection, and conservation of food resources have led to the successful recovery of the California brown pelican population to self-sustaining levels, warranting the current proposal for delisting of this subspecies.

Oregon Silverspot Butterfly (*Speyeria zerene hippolyta*, Threatened Species)

The Oregon silverspot is a medium-sized, orange and brown butterfly with black veins and spots on the dorsal (upper) wing surface, and a yellowish sub-marginal band and bright metallic silver spots on the ventral (under-side) wing surface. This subspecies is distinguished from other subspecies of silverspot butterflies by a somewhat smaller size and darker coloration at the base of the wings. These are morphological adaptations for survival in a persistently wind and foggy environment.

Status: The historical range of this subspecies extends from the Long Beach Peninsula, Pacific County, Washington, south to Del Norte Count, California. All of these populations were restricted to the immediate coast, centered around salt-spray meadows, or within a few miles of the coastline in similar meadow-type habitat. At the time of listing the only viable population known was on the Siuslaw National Forest in Tillamook County, Oregon. Additional populations have since been discovered at Cascade Head, Bray Point and Clatsop Plains in Oregon, on the Long Beach Peninsula in Washington and in Del Norte County in California.

Habitat: The Oregon silverspot occupies three types of grassland habitat. One type consists of marine terrace and coastal headland salt-spray meadows (e.g., Cascade Head, Bray Point Rock Creek-Big Creek and portions of Del Norte sites). The second consists of stabilized dunes as found at the Long Beach Peninsula, Clatsop Plains, and the remainder of Del Norte. Both these habitats are strongly influenced by proximity to the ocean, mild temperatures, high rainfall, and persistent fog. The third habitat type consists on montane grasslands found on Mount Hebo and Fairview Mountains. Conditions at these sites include colder temperatures significant snow accumulations, less coastal fog, and no salt spray.

The most important feature of the habitat of the Oregon silverspot is the presence of the early blue violet. This plant is normally the only species on which the Oregon silverspot can successfully feed and develop as larva. This plant is a part of the salt-spray meadow vegetation and is an obligatory component of the butterfly’s habitat. Other features of optimum habitat include moderate grass cover, and a mixture of herbaceous plants used for nectaring by adults. Adults generally move out of the meadows into the fringe of conifers or brush for shelter, courtship and mating.

A.3) Analyze effects.

No take of USFWS listed species will occur or be adversely affected by operation of SAFE program hatcheries.

Bald eagles occasionally forage in the lower watershed during the winter months (USFS 1995). Adult hatchery fish in the North Fork and South Fork Klaskanine rivers and at Big Creek could potentially serve as a forage base for bald eagles.

A.4) Actions taken to minimize potential effects.

No take of USFWS listed species will occur or be adversely affected by operation of SAFE program hatcheries.

A.5) References.

Anthony, R.G. and F.B. Isaacs. 1989. Characteristics of bald eagle nest sites in Oregon. J. Wildl. Manag. 53:148-159.

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. N. Amer. Wildl. Nat. Res. Conf. 47:332-342.

Issacs, F.B., R.G. Anthony and D.P. Anderson. 2001. Bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River recovery zone, 1972 through 2001. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, OR, 34pp.

Lower Columbia Fish Recovery Board. Draft 2004. Lower Columbia Salmon and Steelhead Recover and Subbasin Plan, Technical Foundation Vol III Other Species. Lower Columbia Fish Recovery Board, Longview, Washington.

Oregon Department of Fish and Wildlife. 2003. Endangered Species Fact Sheet; Columbian White-tailed deer. Oregon Department of Fish and Wildlife http://oregonfwo.fws.gov/EndSpp/FactSheets/Mammals/deer.dwt.

Snow, C. 1981. Southern bald eagle and northern bald eagle, habitat management services for Endangered Species. Bureau of Land Management Report No. 5.

Stalmaster, M.V. 1987. The bald eagle. Universe Books, New York, NY. 227pp.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 42:506-513.

Steenhof, K. 1978. Management of wintering bald eagles. Eastern Energy and Land Use Team, Office of Biological Service, U.S.D.I. Fish and Wildlife Service, FWS/OBS/78/79. 59 pp.

U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Northern Spotted Owls (draft), 662pp.

U.S.D.A. Forest Service (USFS). 1977. Bald eagle habitat management guidelines. Pacific Southwest Region, San Francisco, CA. 60 pp.

U.S.D.A. Forest Service (USFS). 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington. Chapter 13 – Bald eagles. R6-F&WL-192-1985. U.S.D.A. Forest Service Pacific Northwest Region, Portland, Oregon. 332pp.

U.S.D.A. Forest Service (USFS). 1995. Eagle Creek watershed analysis. Pacific Northwest Region, Mt. Hood National Forest. 109pp.

Watson, J.W., M.G. Garrett and R.G. Anthony. 1991. Foraging ecology of bald eagles in the Columbia River estuary. J. Wildl. Manage. 55:492-499.