HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Dungeness Spring Chinook Program
Species or Hatchery Stock	Spring Chinook (*Oncorhynchus tshawytscha*) Dungeness River
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Dungeness River Puget Sound (Strait of Juan de Fuca)
Date Submitted	August 04, 2005
Date Last Updated	July 25, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Dungeness River Chinook program

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

Dungeness River Chinook (*Oncorhynchus tshawytscha*) - listed as "threatened" June 2005

1.3) Responsible organization and individuals

Name (and title):	Ron Warren, Region 6 Fish Program Manager Manuel Farinas, Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
Address:	600 Capitol Way North, Olympia, WA 98501-1091	
Telephone:	(360) 204-1204	(360) 249-1229
Fax:	(360) 664-0689	(360) 681-7823
Email:	**warrerrw@dfw.wa.gov**	**farinmaf@dfw.wa.gov**

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

In addition to WDFW, the Point-No-Point Treaty Tribe, U.S. Fish and Wildlife Service and the U.S. Forest Service are also involved in this restoration program.

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

Operational Information	Number
Annual operating cost (dollars)	$304,153
The above information for annual operating cost applies cumulatively to the Dungeness Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund - State and Wildlife Fund - State.	

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

Broodstock Collection (2004), Incubation, Rearing and Release:
Dungeness Hatchery: Dungeness River (18.0018) RM 10.5

Rearing and Release;
Hurd Creek Hatchery: Hurd Creek (18.0028) RM .2, tributary to Dungeness River (18.0028) at RM 3.

1.6) Type of program.

The captive brood program (isolated recovery) was phased out and replaced with the new supplementation (integrated recovery) program. The proposed integrated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery stock and local natural populations, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing programs as integrated, and NOAA's final listing determinations (64 FR 14308, June 28, 2005). Modification of the proposed strategy may occur as additional information is collected and analyzed.

1.7) Purpose (Goal) of program.

The goal of this program is the protection and restoration of the indigenous (spring) chinook salmon to a self-sustaining level (McElhany et al. 2000), without risk to extinction, in the Dungeness River watershed.

As per section 1.8, habitat conditions continue to place all salmonid stocks at great risk; therefore, the decision has been made to continue to supplement the Dungeness chinook population by collecting returning broodstock and producing up to 200,000 juveniles annually for release into the Dungeness River system.

1.8) Justification for the program.

The Dungeness River chinook returns have declined to critically low levels, leaving them at risk of extinction. The Dungeness Chinook Salmon Rebuilding Project was initiated in 1992 with the goal of providing a healthy, self-sustaining population that maintained the genetic characteristics of the existing chinook salmon stock. The main component of the project was a captive broodstock program. The project was designed to rebuild the extremely low run-size of chinook (<200/year) by releasing progeny from the captive brood into the Dungeness and Gray Wolf rivers. Although the co-managers' have recognized that some progress has been made towards chinook recovery in the Dungeness system through the captive broodstock program, it is very apparent that habitat restoration has not kept pace with the captive brood and harvest protection components of the rebuilding project. Habitat conditions continue to place all salmonid stocks at great risk; therefore, the decision has been made to continue to supplement the Dungeness chinook population by collecting returning broodstock and producing up to 200,000 juveniles annually for release into the Dungeness River system.

To minimize impacts on listed fish by WDFW facilities operation and the Dungeness chinook program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Dungeness chinook program.

Potential Hazard	**HGMP Reference**	**Risk Aversion Measures**
Water Withdrawal	4.2	Surface water rights are formalized through trust water right permits # 3518 - 1944 (25CFS) & S2-21709C-1973 (15CFS) for the Dungeness River and # S2-00568C - 1970 (8.5CFS) for Canyon Creek. Hurd Creek water rights are formalized through permit # G2-24026. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. The Dungeness River Hatchery intake was identified as a high-priority capitol project and Hatchery Scientific Review Group (HSRG) funds were committed to begin scoping, design and construction work for a new compliant intake system. The Hurd Creek facility withdrawal methods are adequately screened to minimize risk to listed fish. Surface water emergency backup supply has ESA compliant screens.
Effluent Discharge	4.2	To reduce the potential for adverse effects to receiving waters, hatchery effluent is monitored periodically, with results reported to the Washington Department of Ecology (WDOE). The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river (regulated through NPDES permit # WAG 13-1037). The Hurd Creek Hatchery produces a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.
Broodstock Collection & Adult Passage	5.1, 7.9, 2.2.3	There is no in-river rack on the Dungeness River that might prevent adults from passing upstream naturally. Any adults entering the off-channel pond are volunteers.
Disease Transmission	9.2.7	Co-Managers Fish Disease Policy. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	See sections 2.2.3 & 10.11

1.9) List of program "Performance Standards".

See section 1.10

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

Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Puget Sound Salmon Management Plan (*US v Washington*), the Shared Strategy for Salmon Recovery, production and harvest objectives.	Achieve annual escapement goal for the system of 925 spawners in three of four consecutive years and habitat improvements are accomplished that assure long-term productivity of this stock.	Survival and contribution to spawning population will be estimated for each brood year released.
Maintain outreach to enhance public understanding, participation and support of WDFW hatchery programs.	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off-station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity. Maintain effective population size.	Minimums of 112 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return.	Annual run timing, age and sex composition and return timing data are collected. Adhere to HSRG (2004) and WDFW spawning guidelines (WDFW 1983).
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts on natural and hatchery-origin fish.	Use CWT only index (all releases depending on egg take) for evaluation purposes.	Returning fish are sampled throughout their return for length, sex, and CWTs.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status and culture conditions.	WDFW Fish Health Section inspect adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or

		treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy.
	Inspection of adult brood-stock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to Co-managers Fish Health Disease Policy.

Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt size (8-10; 40 fish/lb) and released at a time that fosters rapid migration downstream.	Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and in-stream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria.	Agencies and tribes to provide up-to-date information monitor harvests.

1.11) Expected size of program.

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

Broodstock collections, from wild chinook salmon redd pumping, for this rebuilding program, ended in 1997 with the collection of 1997 brood eggs (6 brood years, 1992 through 1997). Since that time, eggs were derived from captive reared adults that resulted from the 1992 thru 1997 collection of eggs. In June of 2002, WDFW still had 412 Dungeness captive brood at Hurd Creek. In July of that year, 313 were shipped to Dungeness for spawning. The following July (2003), 66 mature adults were shipped from Hurd Creek to Dungeness. And finally, in October of 2003, there were 13 captive brood remaining at Hurd Creek.

In late summer of 2004, up to 112 adult chinook will be collected from the Dungeness River and spawned as a continued supplementation effort.

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

See 9.1.2 for further information.

As the Captive Brood egg source diminished (ending with the 2004 BY), the following release strategies were dropped in the approximate following order: option A, option C, option B and option D. Options E, F and then G were planned to continue with changes to location and numbers released. See table below.

Age Class	Maximum Number*	Size (fpp)**	Release Date	Location
Eggs				
Unfed Fry				
Fry	A. 200,000 (3) B. 400,000 (3) C. 200,000(2) D. 200,000 (3)	450 250 250 200	May June/July June/July June/July	Grey Wolf River Gray Wolf River Dungeness River Gray Wolf River
Fingerling	E. 100,000 (4)	40	May/June(6)	Gray Wolf River
Yearling	F. 100,000(1) G. 100,000(5)	8 to 10 8 to 10	April(6) April(6)	Dungeness River Hurd Creek

Planned fish releases from annual broodstock collection beginning with 2004 BY

Age Class	Maximum Number*	Size (fpp)**	Release Date	Location
Fingerling (Zero-age)	50,000 50,000	40	May/June	Dungeness R. Gray Wolf R.
Yearling	50,000 50,000	8-10 8-10	April April	Dungeness R. Hurd Creek

*Numbers in each release strategy may vary based on an on-going Dungeness supplementation evaluation. This was the initial production/release strategy of the program.
** See section 10.1 for fpp conversion to millimeters (mm) fork length.

(1) Dungeness River (18.0018) at Dungeness Hatchery RM 10.5, Dungeness River, Puget Sound.

(2) Dungeness River (18.0018) at various locations in the upper watershed, Dungeness River, Puget Sound

(3) Gray Wolf River (18.0048) at various locations in the upper watershed, Dungeness River, Puget Sound

(4) Gray Wolf River (18.0048) from the Gray Wolf Acclimation Pond RM 1.0, Dungeness River, Puget Sound

(5) Hurd Creek Hatchery (18.0028) in the lower Dungeness River.

(6) Release dates were in June in even years and in May in odd years to minimize potential predation impacts on even year brood of Dungeness River Pink salmon (old program).

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 1996 brood was the first year with significant releases (1997) of 421,000 fry and 1,353,000 fingerlings. Since chinook salmon in Puget Sound typically have a life span of 3 to 5 years, this brood would be expected to contribute primarily in the years 1999 through 2001. Results for 1997, 1998 and 99' releases indicate that the average fingerling smolt-to-adult survival rates were 0.018% released from acclimation ponds (Grey Wolf River) to ~1.05% for a yearling release from Hurd Creek Hatchery (a satellite station for the Dungeness Hatchery) in 1999. Despite these relatively low survival rates, preliminary results suggest that adult returns from the program comprised a significant percentage of the total number of spawners in natural spawning areas in 2000 (>50% of the 218 spawners) and 2001 (> 90% of the 453 spawners).

Wild spring chinook escapement goal is 925 and is based on the fair to poor habitat status outside the Olympic National Park and historic run size information. See section 2.2.2 for Dungeness River wild chinook escapements between 1986 and 2003.

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

The captive broodstock program was started in 1992 with the collection of wild origin eggs and fry from natural redds. Collection of wild origin eggs or fry continued through 1997 (6 brood years). Fish deriving from the collection process were reared as captive brood until they matured and were spawned.

A new supplementation program will begin with the collection of adult chinook from the river in 2004.

1.14) Expected duration of program.

Captive Broodstock Program:

Twelve years (2004, pending discussions of Technical Advisory Committee) as outlined in: *Dungeness River Chinook Salmon Rebuilding Project; Progress Report 1992-93; WDFW, Jamestown S'Klallam Tribe, USFWS Project Report Series #3, 1995*)

Adult Collection and Supplementation:

This program will continue until the desired annual escapement goal (925 spawners) is reached in three of four consecutive years and habitat improvements are accomplished that assure long-term productivity of this stock.

1.15) Watersheds targeted by program.

These chinook are destined for release solely into the Dungeness River watershed (WRIA 18).

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

The Dungeness River Chinook Technical Advisory Committee ("TAC") considered the duration of captive brood collection, i. e., how many years to collect wild brood. It was determined that wild brood collection would be undertaken for only 6 brood years (1992 through 1997) and would *end* after the 1997 wild stock return year. The 1998 brood year would not be collected as it would contain an unknown number of 2 and 3 year old returns which were derived from the 1992 and 1993 brood captive brood fish (which matured and produced the 1995 and 1996 brood hatchery progeny.) Likewise, future returning brood would not be collected, as it would contain unknown levels of hatchery origin fish. The TAC determined that there is too much risk of losing genetic diversity and genotype "swamping" by re-incorporating hatchery derived captive brood into the program. (A. Appleby, WDF&W, personal comm.). An alternate management decision, made by WDFW and the Jamestown S'Klallam Tribe (Bill Freymond, WDFW, personal comm.), was to continue supplementing this stock with progeny from adults collected from the river. Habitat improvements have not kept pace with the fish supplementation in the system and serious problems remain, especially in the lower river where 70% of the adults spawn. Unstable spawning and rearing habitat continues to be the result of channelization and diking for flood control, urban development, water withdrawals for irrigation and domestic use and pollution from agricultural and urban run-off (Herring, 1999). WDFW and the Jamestown S'Klallam Tribe agree that the risk of losing this stock due to unstable habitat is greater than the risk of losing genetic diversity by potentially incorporating some hatchery derived broodstock into the supplementation program.

As part of the Puget Sound Salmon Management Plan (PSSMP), a federal court order that describes the co-management responsibilities of WDFW and the tribes with regard to fishery management and artificial, this program change was agreed upon by the co-managers. The PSSMP explicitly says "no change may be made to the Equilibrium Brood Document (production goals) without prior agreement of the affected parties."

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

During 2004-05, WDFW is writing HGMP's to cover all stock/programs produced at the Dungeness facility for authorization under the 4(d) rule of the ESA.

Harvest management of chinook populations within Puget Sound is implemented through the draft Puget Sound Comprehensive Chinook Management Plan (PSCCMP) - Harvest Management Component (Puget Sound Indian Tribes and WDFW, March 2004).

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

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

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

Puget Sound chinook, specifically the Dungeness River population.

Adult Age Class Structure - Ages range from 2 to 6 year olds, predominately 4 year olds.

Sex Ratio - Unknown. Assumed to be 1.5 males to females when estimating the number of wild spawners from redd counts.

Size Range - Primarily from spawning ground surveys with a few hatchery recoveries (WDFW database, 1987-98). Samples ranged from 60 centimeters (cm) to 127 cm in length. The hatchery would have data relative to the size of captive brood.

Migrational Timing - Precise migrational timing is unknown, however, Ray Johnson, retired WDFW Fish Biologist, reports that during tagging studies for pink salmon in the early 1960's, chinook were captured "infrequently" during seining operations near the river mouth beginning around July 20 (Ray Johnson, pers. comm.).

Spawn Timing and Range - Spawning chinook have been observed in the mainstem Dungeness River up to RM 18.7 and up to RM 5.0 in the mainstem Gray Wolf River since 1986. Historical spawning range in the Gray Wolf is thought to be to approximately RM 9.5. Spawn timing in the lower river (RM 0-6.4) begins in September, ending in early October. From RM 6.4 to 10.8, spawning generally occurs from late August through September. In the Upper Dungeness River (RM 10.8-18.7), spawning usually begins in mid-August and ends in early September (Bill Freymond, WDFW, unpublished data).

Juvenile Life History - It is believed that the dominant juvenile life history pattern is to out-migrate as a sub-yearling with freshwater rearing time after emergence of around 5 to 8 months. However, chinook ranging in size from 6 to 10 centimeters were captured in a Jamestown S'Klallam's Life History study conducted in October, 1997 through March 1998, (Jamestown S'Klallam Tribe, March, 1998). Most were progeny of project- released fish. This may indicate a life history preference towards yearling migration in at least a portion of

juveniles, but this has not been verified. Smolt emigration timing has been measured by WDFW smolt traps from early June through early September (Dave Seiler, WDFW, unpublished data, 1997). Mainstem smolt traps have not been operated prior to June 11.

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

Bull trout are listed as threatened in the Dungeness system. Some competition between juvenile bull trout and the sub-yearling chinook may occur, but this has not been documented. Bull trout may actually benefit from large plants of chinook fry through increased prey availability. Indirect take is unknown. No take table for bull trout will be included in this HGMP.

Summer chum may be incidentally affected, but only 1 or 2 (on average) are seen in August when conducting chinook surveys (Bill Freymond, WDFW Regional Biologist, personal communication).

2.2.2) <u>Status of ESA-listed salmonid population(s) affected by the program.</u>

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

Preliminary critical and viable population thresholds under ESA have been determined by the Co-manager's (Puget Sound) Technical Review Team (PSTRT) to be at 500 and 925, respectively (PSTRT 2003). NOAA Fisheries thresholds are undetermined at this time. The SaSI report (draft, WDFW unpublished 2002) determined that status of the Dungeness River chinook population was "critical".

Critical and viable population thresholds under ESA have not been determined for summer chum as described in the Summer Chum Salmon Conservation Initiative (2000). The SaSI report determined the status of the summer chum population to be "unknown".

The SaSI report determined that the status of the Upper Dungeness bull trout/dolly varden to be "healthy" and the Dungeness/Gray Wolf stock was "unknown".

- 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.

<u>Progeny to parent ratios</u> - There is no progeny to parent ratios or survival by life-stage data for Dungeness River wild chinook. The returns of 1999 were the first 4 year-old adult returns to the river but due to the small release numbers (13,000 fingerlings), the returns were not expected to be significant. 2000 was the first return of 4 year olds from a plant of 1.8 million fish. They were not trapped, but were allowed to spawn naturally. Carcass counts and otolith samples / mark samples; will be utilized to estimate the total survival to return of progeny of captive brood adults.

- 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.

Table2. Most recent 12 year estimates of annual spawning abundance estimates - The following table provides spawning escapement estimates for wild chinook salmon in the Dungeness River system for 1986-2003 (Bill Freymond, WDFW).

Dungeness River System Wild Chinook Escapements, 1986-2004.	
Year	**Escapement**
1986	238
1987	100
1988	335
1989	88
1990	310
1991	163
1992	153
1993	43
1994	65
1995	163
1996	183
1997	50
1998	110
1999	75
2000	218
2001	453
2002	633
2003	640
2004	1,014

The wild chinook annual escapement goal is 925.

- 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.

Data from 2000 returns indicated that a majority of spawners (+ or - 90%) were of hatchery origin. The percentages of hatchery-origin (HOR) and listed natural-origin fish (NOR) on the spawning grounds for 2001, 2002, 2003 and 2004 are the following:

Year	HOR	NOR
2001	96%	4%
2002	82%	18%
2003	81%	19%
2004	81%	19%

Source: WDFW (Bill Freymond)

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

- 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.

Broodstock Collection:
Broodstock collection directed at odd year fall-run pink salmon (not occurring at this time) has the potential to take listed spring/summer chinook through migrational delay, capture, handling and upstream release during trap operation in the lower mainstem from early August through mid- September. The pink weir would be installed at RM 0.4. The trap design will allow chinook to be released upstream without handling. The trap will be manned 24 hours per day to facilitate the immediate release of the listed Dungeness River chinook.

Broodstock collection will be directed at chinook adults starting in 2004. The preferred live adult chinook in-river capture methods will include: 1) capture at the Dungeness Hatchery trap (pond); 2) installing a trap at the Dungeness Hatchery outlet stream; 3) hoop trap in upper river near hatchery; 4) fish wheel or 5) the pink salmon weir that is in lower river in odd years. Backup in-river egg collection methods will include: 1) gaffing, snagging or netting adults from redds and/or 2) pumping eggs from redds.

For the Captive Brood, held at Hurd Creek, there was a low risk of "take" of adult broodstock by loss from disease or water system failure. There was also a low risk of loss during transport to the Dungeness Hatchery for final maturity in July and August. There was a low risk of natural pre-spawning mortality and unintentional loss potential associated with adult spawning, egg incubation, and fry to fingerling rearing. All captive brood spawners were kill-spawned for the purpose of gamete collection and mating. Normal hatchery related mortality had no net negative impact on the stock as the majority of the fish survived to be released into the system. For the 1993 to '96 brood, fish which were reared in the South Puget Sound Net Pens, the green egg to eyed egg losses were very high and ranged from 16.9% to 58.2%. This is compared with the freshwater counterpart that had "normal" green egg to eyed egg losses of less than 5%. The saltwater portion of this program was discontinued as a result.

The risk of within population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program. Also, by limiting the length of the captive broodstock program to the 1992 through 1997 broods, adverse genetic or ecological effects to listed natural fish were minimized

Entrainment Effects:
The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. In the past it was operated only on an intermittent basis, in the late summer when the low flow channel abandons the side of the river where the screened gravity intake is located. To avoid possible "take" concerns, this intake has not been operated since 1999. The Dungeness River Hatchery intake was identified as a high-priority capitol project for the 2001-03 fiscal biennium. Effective February 2001, Hatchery Scientific Review Group (HSRG) funds were committed to begin scoping, design and construction work for a new compliant intake system. A private consultant firm was hired to begin the preliminary project scoping work. The take risk is low now as the siphon intake will be operated only on an emergency basis at times when winter icing conditions or late summer low flows put the Dungeness River Chinook stock recovery program, located at the hatchery, at risk or make operation of the other gravity intakes impossible or ineffective.

The Canyon Creek intake is not equipped with a fish ladder. The Hatchery Scientific Review Group (HSRG) recommended that the hatchery look for alternate warmer water sources to facilitate achieving proper time and size of release of the program fish. If an alternate water supply was found, the HSRG recommended that the Canyon Creek intake be removed or remodeled to allow fish passage into Canyon Creek. Two test wells drilled in 2002 proved unsuccessful in achieving that goal. Thus, no practical source of warm water has yet to be identified. In the interim, Hurd Creek Hatchery has been used to accelerate a portion of the program fish. And since this review in 2001, the Co-managers have determined that chinook would be unlikely to use the habitat above the intake on Canyon Creek; therefore, the value of developing fish passage would be minimal for chinook. However, coho and steelhead would benefit from access to the upstream habitat so WDFW hired a consultant to evaluate three options: removal of the barrier, a pool and chute fishway, and a vertical slot fish way. The preferred alternative was construction of a fishway (the two are still being evaluated). WDFW has begun to implement a preliminary design that includes a new intake and is currently seeking funding for the final design.

Predation/Competition:
Juvenile releases of fingerling and yearling spring chinook smolts will take place in May/June and April, respectively. It is believed that the juvenile life history pattern that is dominate is to out-migrate as a sub-yearling with freshwater rearing time, after emergence, of around 5 to 8 months. Chinook, however, ranging in size from 6 to 10 centimeters, were captured in a Jamestown S'Klallam's Life History study conducted in October of 1997 through March 1998, (Jamestown S'Klallam Tribe, March 1998). Most were progeny of project-released fish. This may indicate a life history preference towards yearling migration in at least a portion of juveniles, but this has not been verified. Hatchery-produced yearling and sub-yearling smolts emigrate seaward soon after liberation, minimizing the potential for predation of wild fish (Steward and Bjornn 1990). Sub-yearling chinook released into the Dungeness River at RM 10.5 during June and July in 1996 and 1997 reached the mouth of the river in two to seven days (Dungeness Hatchery liberation and smolt trapping data from Dave Seiler, WDFW, March 1998). With the exception of short term contact with wild fish in mainstem areas as they migrate downstream, interaction that might lead to predation is minimized

through the release of smolts (sub-yearling and yearling). Also, WDFW smolt traps have measured emigration timing from early June through early September (Dave Seiler, WDFW, unpublished data, 1997). From this initial baseline data, releasing the juveniles from April to June would mimic the emigration patterns of the natural-origin fish. In recent literature review of chinook salmon food habits and feeding ecology in Pacific Northwest marine waters, Buckley (1999) concluded that cannibalism and intra-generic predation by chinook salmon are rare events.

Disease Effects:
The risk of disease transmission to the wild portion of the spring chinook population is low. Transmission of hatchery-origin diseases from the hatchery to wild fish in areas where they co-occur is an unlikely event. Although hatchery populations can be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990).

Summer chum may be incidentally affected, but only 1 or 2 (on average) are seen in August when conducting chinook surveys (Bill Freymond, WDFW personal communication).

In addition, see sections 12.4, 12.5, 12.8 and 12.9 for a research related "take" using mature captive broodstock.

Note: See 6.2.3 for information regarding the initial "take". I. E. the original egg collection from wild redds to secure brood for the captive brood program.

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

See "take" table 1.

- 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.

NOAA Fisheries, TAC and appropriate co-managers will be informed as early as possible. The actions, which result in unexpectedly high take levels, will cease as quickly as possible.

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 Captive Broodstock hatchery program was operated consistent with the Dungeness River Chinook Salmon Rebuilding Project Progress Report, 1992-93. The Jamestown S'Klallam Tribe and WDFW have developed a new supplementation program to begin in 2004 with the collection of adult broodstock from the river. Fish production is consistent with the current Future Brood Document. Hatchery operation and fish production goals are reviewed and adjusted as needed by the Dungeness Chinook Technical Advisory Committee annually. (See section 2.1 for further discussion)

The Summer Chum Salmon Conservation Initiative (2000).

The Dungeness Hatchery spring chinook salmon program HGMP is included as one of 29 WDFW-managed plans under the co-managers' Resource Management Plan (RMP) for Puget Sound region chinook salmon hatcheries. This HGMP is in alignment with the RMP, which serves as the overarching comprehensive plan for state and tribal chinook salmon hatchery operations in the region.

As affirmed in the co-managers' RMP, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be used to maintain genetic variability within the hatchery populations (Seidel 1983).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group. This report provides a detailed description of the HSRG's scientific framework, tools and resources developed for evaluating hatchery programs, the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (2004).

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release from each hatchery. It is designed to foster development of locally adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limiting the spread of fish pathogens between and within watersheds. (WDFW, NWIFC, USFWS 1998).

National Pollutant Discharge Elimination System Permit Requirements. This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

In 1999, several PS and coastal stocks were listed as threatened under the federal Endangered Species Act (ESA). State, tribal and federal managers need to ensure that their hatcheries do not present a risk to listed species. Through this Hatchery Reform Project, the managers have sought to go beyond merely complying with ESA directives. The new approach is to reform hatchery programs to provide benefits to wild salmon recovery and sustainable fisheries. Hatchery management decisions will be based on system-wide, scientific recommendations, providing an important model that can be replicated in other areas.

In addition, the Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governements, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan (see section 3.4 for more details).

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

In June 1995, WDFW, Jamestown S'Klallam Tribe, USFWS, and USFS developed a Memorandum of Understanding (MOU) jointly. This document sets forth the objectives and methods of operation for this program. The goals were established in an agreement entitled "Chinook Salmon Rebuilding Project in the Dungeness River", signed by all parties on June 14, 1994. The HGMP is a direct reflection of these plans and agreements. A plan for the adult broodstock collection/supplementation program is currently in draft form, soon to be finalized by WDFW and the Jamestown S'Klallam Tribe.

This hatchery, as well as other WDFW hatcheries within the Puget Sound Chinook ESU, operates under *U.S. v Washington* that provides the legal framework for coordinating these

programs, defining artificial production objectives, and maintaining treaty Indian fishing rights through the court-ordered Puget Sound Salmon Management Plan (1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs (two brood documents are reviewed and agreed to annually. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are collected). WDFW and the Jamestown S'Klallam Tribe have developed an agreed upon an approach, as described in: *Dungeness River Chinook Salmon Rebuilding Project; Progress Report 1992-93; WDFW, Jamestown S'Klallam Tribe, USFWS Project Report Series #3, 1995*).

Two additional processes that involve co-managers include the "Annual Management Framework Plans" and "Salmon Run Status" reports for the Strait of Juan de Fuca, and the "Annual Winter and Summer Steelhead Forecasts and Management Recommendations", both are authored by the PNPTC, WDFW and Makah Tribe.

3.3) Relationship to harvest objectives.

No harvest is presently directed on this stock. Although some of the adults were tagged as juveniles (coded-wire tag and/or adipose-fin clip) in the past, there are currently no external marks that might identify these fish for selective fisheries. Terminal fisheries for all species have been curtailed in the Dungeness River and marine areas in the proximity of the Dungeness River to minimize direct or incidental impacts, due to harvest, on chinook. Harvest opportunity is the long-range objective, both direct and indirect, when recovery at Maximum Sustainable Yield (MSY) levels is attained.

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.

There is no targeted fishery on this stock at this time and only low levels of incidental harvest are permitted in southern U.S. fisheries. Preseason forecasts in recent years have indicated that the Dungeness River chinook stock remains at critical abundance levels (<500 adult spawners). With this forecast of critical abundance, the plan (Puget Sound Comprehensive Chinook Management Plan) limits southern U.S. fisheries to an incidental exploitation rate not to exceed 6%. Actual run sizes have been greater than 500 with escapements of more than 600 adults in each of 2002 and 2003. When escapements are forecasted to be greater than 500 chinook, incidental exploitation rates on Dungeness chinook in southern U.S. waters will be limited to not exceed 10%.

WDFW run reconstruction data shows harvest for the past 12 years.

Year	Area 6D Catch
1988	5
1989	1
1990	0
1991	19
1992	1
1993	1
1994-99	0

3.4) Relationship to habitat protection and recovery strategies.

Long-term recovery of this stock will be largely dependent upon the ability to restore fish habitat in the Dungeness River. Habitat problems include water removal for irrigation; dikes in the lower river, scouring and poor gravel recruitment or gravel aggradations. These result in poor spawning and rearing habitat for salmon. The captive brood and now the new supplementation program will protect the population from further decline by removing them from many of the root causes of their decline. Without significant habitat improvement, the Dungeness River chinook are not expected to achieve full recovery and will require long-term supplementation (see section 1.8).

The Co-managers have participated together with Clallam County, local landowners (including irrigators) and other local entities in the habitat restoration planning efforts (see below). This team (Dungeness River Management Team (DRMT)) has overseen extensive research on the limiting factors affecting chinook and other salmonid species in the Dungeness River. It has developed plans for restoration and has been implementing several projects including acquisition of lands and removal of dikes to expand the floodplain, management and reduction of water diversions, and various other habitat improvement programs (draft Dungeness River chapter to the Shared Strategy's Puget Sound Recovery Plan 2004, Jamestown S'Klallam Tribe 2003).

The Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan.

Shared Strategy

The Shared Strategy is based on the conviction that:
1) People in Puget Sound have the creativity, knowledge, and motivation to find lasting solutions to complex ecological, economic, and cultural challenges;
2) Watershed groups that represent diverse communities are essential to the success of salmon recovery;
3) Effective stewardship occurs only when all levels of government coordinate their efforts;
4) The health and vitality of Puget Sound depends on timely planning for ecosystem health and strong local and regional economies; and
5) The health of salmon are an indicator of the health of our region salmon recovery will benefit both human and natural communities.
The 5-Step Shared Strategy
1) Identify what should be in a recovery plan and assess how current efforts can support the plan.
2) Set recovery targets and ranges for each watershed.
3) Identify actions needed at the watershed level to meet targets.
4) Determine if identified actions add up to recovery. If not, identify needed adjustments.
5) Finalize the plan and actions and commitment necessary for successful implementation.

Salmon Recovery Funding Board

Composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). SRFB has helped finance over 500 projects. The Board supports salmon recovery by funding habitat protection and restoration projects. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities

Lead entities are voluntary organizations under contract with the Washington State Department of Fish and Wildlife (WDFW). Lead entities define their geographic scope and are encouraged to largely match watershed boundaries. Lead entities are essential in ensuring the best projects are proposed to the Board for funding in its annual grant process.

All lead entities have a set of technical experts that assist in development of strategies, and identification and prioritization of projects. The lead entity citizen committee is responsible under state law for developing the final prioritized project list and submitting it to the SRFB for funding consideration. Lead entity technical experts and citizen committees perform important unique and complementary roles. Local technical experts are often the most knowledgeable about watershed, habitat and fish conditions. Their expertise is invaluable to ensure priorities and projects are based on ecological conditions and processes. They also can be the best judges of the technical merits and certainty of project technical success. Citizen committees are critical to ensure that priorities and projects have the necessary community support for success. They are often the best judges of current levels of community interests in salmon recovery and how to increase community support over time with the implementation of habitat projects. The complementary roles of both lead entity technical experts and citizen committees is essential to ensure the best projects are proposed for salmon recovery and that the projects will increase the technical and community support for an expanded and ever increasing effectiveness of lead entities at the local and regional level. (http://www.iac.wa.gov/srfb/leadentities.htm)

The Lead Entity (LE) that includes the Dungeness River watershed is the North Olympic Peninsula LE (NOPLE). NOPLE's geographic area encompasses 8,051 salmon river and coastal miles located within 90 independent watersheds and 2 unique coastal systems over 2,330 square miles with management under two counties (Clallam & Jefferson), three cities (Sequim, Port Angeles and Forks), five native tribes (Jamestown S'Klallam, Lower Elwha, Makah, Quileute and Hoh), 3.5 WRIA's (20, 19, 18 and part of 17), a National Park, a National Forest, a Marine Sanctuary, extensive State trust lands, large private timber companies, and, of course, individual ownership.

3.5) Ecological interactions.

(1) Salmonid and non-salmonid fishes or other species that could negatively impact the program.

Negative impacts by fishes and other species on the Dungeness Hatchery chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Dungeness chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile chinook through predation include the following:

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons
- Mammalian predators, including mink, river otters, harbor seals, and sea lions

Rearing and migrating adult chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Dungeness River to the detriment of population abundance and the program's success in restoration. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Dungeness spring chinook
- Summer chum salmon
- Pink salmon

3) Salmonid and non-salmonid fishes or other species that could positively impact the program.

Fish species that could positively impact the program may include chinook salmon and other salmonid species present in the Dungeness River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the chinook during their downstream migration in freshwater. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating chinook. Coho and chinook adults that return to the river may provide a source of nutrients and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). With integrated spawning and any carcass seeding efforts, 500-1,000 adult chinook carcasses could contribute, assuming average size of adult chinook is 12 pounds, approximately 6,000-12,000 pounds of marine derived nutrients to organisms in the river.

4) Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.

Freshwater and marine fish species that prey on juvenile fish could be positively impacted by the chinook program. Nutrients provided by decaying chinook carcasses might also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Chinook, pink and summer chum salmon
- Steelhead
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

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.

The water source for this program is surface water from the Dungeness River. A total of 9,409 gpm is used for incubation and rearing. It is the same as the natal water used by the natural spawning population. It is of good quality except during times of flooding when it becomes quite silty due to upriver slides. A second intake on Canyon Creek, a Dungeness River tributary, is used routinely but is especially valuable in the event the Dungeness becomes excessively silty or clogged with anchor ice. The Canyon Creek intake is not equipped with a fish ladder. The Dungeness is a very cold water system, prone to icing in the winter, thus slowing growth of the fish.

The Hatchery Scientific Review Group (HSRG) recommended that the hatchery look for alternate warmer water sources to facilitate achieving proper time and size of release of the program fish. If an alternate water supply is found the HSRG recommended that the Canyon Creek intake be removed or remodeled to allow fish passage into Canyon Creek. Two test wells drilled in 2002 proved unsuccessful in achieving that goal. In the interim, Hurd Creek Hatchery will be used to accelerate a portion of the program fish. A consulting firm has been hired to scope possible water supply options for the hatchery.

The Hurd Creek hatchery, located 4 miles north of Sequim, Washington, is supplied with well water and water withdrawn form Hurd Creek, a tributary to the Dungeness River. Water from five (5) wells provides incubation and rearing supply for Hurd Creek. Water quality is excellent, requiring only passage through a de-nitro tower to improve dissolved oxygen content. Hurd Creek surface water is available as an emergency back up supply.

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

The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. In the past it was operated only on an intermittent basis, in the late summer when the low flow channel abandons the side of the river where the screened gravity intake is located. To avoid possible "take" concerns, this intake has not been operated since 1999. The Dungeness River Hatchery intake was identified as a high-priority capitol project and Hatchery Scientific Review Group (HSRG) funds were committed to begin scoping, design and construction work for a new compliant intake system. A private consultant firm was hired to begin the preliminary project scoping work. In the interim, the siphon intake will be operated only on an emergency basis and at times when winter icing conditions or late summer low flows put the Dungeness River Chinook recovery program, located at the hatchery, at risk or makes operation of the other gravity intakes impossible or ineffective.

All hatcheries in the Puget Sound region are constrained by water withdrawal permits issued by Washington Department of Ecology. These permits specify the allowable level of surface

or ground water that may be withdrawn to rear fish while safeguarding natural migration and production areas for anadromous fish. The usage of surface water from the Dungeness River is regulated under the following permits:
Water right permit # 3518 - 1944 (25CFS)
" # S2-21709C - 1973 (15CFS)
A second intake, on Canyon Creek, a Dungeness River tributary, is used routinely but is especially valuable in the event the Dungeness becomes excessively silty or clogged with anchor ice. Its' permit # is:
Water right permit # S2-00568C - 1970 (8.5CFS)

To reduce the potential for adverse effects to receiving waters, hatchery effluent is monitored periodically, with results reported to the Washington Department of Ecology (WDOE). The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river (regulated through NPDES permit # WAG 13-1037).

The Hurd Creek facility withdrawal methods (wells, screened intakes) will not lead to injury or mortality to listed fish because they are supplied by infiltration and are adequately screened to minimize risk to listed fish. Surface water emergency backup supply has ESA compliant screens. The hatchery is permitted (water right permit # G2-24026) for the withdrawal of 6.4 cubic feet per second (cfs) of water from these sources. The Hurd Creek Hatchery produces a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Dungeness Hatchery has an off-channel adult pond. There is no in-river rack on the Dungeness River that might prevent adults from passing upstream naturally. All fish to the hatchery trap are volunteers and are primarily hatchery coho. During the captive brood program, any adult spring chinook volunteering to the trap was returned to the river above the outfall, or hauled and released into the upper watershed to spawn naturally, or because of a male shortage, some males were live-spawned with captive broodstock females before being returned to the river (2003 only). Scales were taken from live spawned males and they were PIT tagged before being released back into the river. The intent was that all adults that returned to the river were allowed to spawn naturally.

Beginning in 2004, adult chinook will be collected from the Dungeness Hatchery trap (pond) and from the hatchery outlet stream and used as adult broodstock as part of the continued supplementation program.

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

The Dungeness Complex has four tanker trucks: a 1200 gallon, 900, 700 and a 400 gallon tank used for fish transport.

5.3) Broodstock holding and spawning facilities.

Hurd Creek reared the captive broodstock in 20-foot diameter fiberglass circular ponds. They were transferred to the Dungeness Hatchery for spawning. They were transferred when they began to show the external signs of sexual maturation: color or morphology. They were normally transferred in late July or early August. The fish were held for several weeks to up to two months prior to spawning in 10' X 100' concrete raceways.

Broodstock that are collected live in 2004, and in subsequent years, will be held until ripe at the Dungeness Hatchery in 10' X 100' concrete raceways. Broodstock gaffed from redds in the river will be spawned on-site and eggs transferred to the Dungeness/Hurd Creek facility.

5.4) Incubation facilities.

Incubation at Dungeness consists of 72 stacks of vertical (FAL) vertical incubators.

5.5) Rearing facilities.

Dungeness has 10 standard 10' X 100' concrete raceways, 16 indoor 16' fiberglass starter ponds and a ½ acre dirt pond. Hurd Creek has 40' fiberglass raceways, 4' and 10' fiberglass circular ponds and various dirt ponds. The Gray Wolf pond is a natural dirt pond setting.

5.6) Acclimation/release facilities.

Chinook yearlings are currently reared and released from the Dungeness Hatchery. Hurd Creek acclimates and releases yearlings on site. The Gray Wolf pond is a natural setting acclimation pond for upriver releases of progeny from captive brood and supplemented chinook. All other chinook are released without acclimation. See 1.11.2 for detailed release information.

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

NA

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.

The hatcheries are staffed full-time, with 24-hour stand-by, and equipped with many low-water alarms that help prevent catastrophic fish loss resulting from any type of water system failure. Pumping power would be provided with an emergency backup generator (at Hurd Creek only), equipped with an auto start, in the event of loss of normal power. The generator is capable of providing power to all hatchery components indefinitely, with fuel supplied as needed. Onsite fuel storage capacity is 1490 gallons, a seven-day supply at full generator load. Further, a surface water backup supply from Hurd Creek can be supplied to the 20 foot rearing ponds in the unlikely event of total loss of all power sources.

Dungeness Hatchery uses gravity-fed water from 3 different sources. Any of these can be used in the event of another's failure.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

Broodstock is native to the Dungeness River and was collected from the river, via redd pumping during the 1992-1997 brood years. Mature captive broods have provided the only egg source since 1996. See 6.2.3 below.

In 2004, broodstock will be collected from naturally returning adults in the Dungeness River.

6.2) Supporting information.

6.2.1) History.

The Dungeness River chinook population consists of a wild chinook stock that is considered to be native in origin and is listed as "critical" in the 1992 Washington State Salmon and Steelhead Stock Inventory (SASSI) (WDFW et al., 1992). The Dungeness Wild Chinook Restoration Committee and SASSI participants concluded it is likely there is a single chinook salmon stock in the Dungeness Basin. The impact of past releases of non-native chinook stocks into the Dungeness River between 1966 and 1972 is unknown.

6.2.2) Annual size.

Native broodstock will not be collected for the remainder of the captive broodstock program. The sole source of eggs will be from the Captive Brood adults held at Hurd Creek. The source of eggs, beginning in 2004, will be from naturally returning adult chinook collected from the river and the Dungeness Hatchery trap.

One of the best estimates of past stock size comes from old hatchery records. From the 1930s to 1981 an anadromous broodstock program existed at the Dungeness Salmon Hatchery. During the 1940's and 50's, a return of about 300 fish per year was reported returning to the hatchery. A peak of 1,305 fish was recorded in 1959 but dropped in following years and remained low. During that time Dungeness chinook were spawned, incubated, reared and released back into the Dungeness River without sustainable increases being noted in adult returns.

The 1995 to 1999 average of the natural spawning population has been around 114 fish; sex ratios are not known. The captive brood population averaged from 1,000-1,500 fish (all age classes) during the past 2 complete spawn years (1998 and 1999). The number of females has been between 500 and 730. See section 1.11.1 for recent captive brood numbers.

Sex ratio of the captive spawning population was 1:1 from 1995-99. The ratio has ranged from 0.29 to 0.36 male per female in 2000-02. Jacks and adult males volunteering to the hatchery trap are used.

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

The captive brood program originally acquired naturally spawned eggs from the river. These were groups of pre-emergent fry, or eyed eggs (families) that were extracted from known chinook redds using a hydraulic redd sampler. The following table summarized the egg and fry collection activities and disposition of the fish:

Table 3. Hurd Creek/Dungeness Chinook Broodstock

Brood Year	Initial Take (fry)	Initial Take (eggs)	Egg Incubation Loss	Pre-tag Fry Loss	Return to River	Return to Saltwater	Freshwater Tagged	2 year loss	Jacks
92	5469			935	840	0	3694	32	621
93	1607			87	0	733	787	7	106
94	2327	1584	85	95	1341	1185	1205	79	133
95	71	6047	201	38	3493	1197	1189	6	127
96	0	4130	392	55	1878	612	1193	10	189
97	0	1751	119	53	390	0	1189	5	104

Brood Year	3 year loss	3 year spawners		3 yr Mature Mortality*		4 year loss	4 year spawners		4 yr Mature Mortality*	
		Males	Females	Males	Females		Males	Females	Males	Females
92	676	162	9	0	0	96	306	514	?	?
93	45	24	6	0	0	17	102	188	0	0
94	42	216	7	12	2	23	111	343	2	14
95	25	83	7	5	1	8	173	259	11	12
96	27	170	38	39	2					
97										

Brood Year	5 year loss	5 year spawners		5 yr Mature Mortality*		6 year loss	6 year spawners		6 yr Mature Mortality*	
		Males	Females	Males	Females		Males	Females	Males	Females
92	131	237	471	?	?	11	38	28	1	3
93	53	48	85	5	20	11	19	27	0	3
94	15	49	102	4	16					
95										
96										
97										

Brood Year	7 year loss	7 year spawners	7 yr Mature Mortality*		
		Males	Females	Males	Females
92	0	0	0	114	244
93					
94					
95					
96					
97					
*Mature mortality accounts for mature fish that are not fit to spawn, surplus to needs, or died prior to spawning. 1992 Brood mature mortality is high due to transfer of bright fish from Hurd Creek to Dungeness during a water shortage at Hurd Creek.					

Table 4. Eggs and Fry Collected and Families Represented

Year	Number of Eggs / Fry Collected	Number of Families
1992	5,469 fry	19
1993	1,607 fry	12
1994	2,327 fry 1,584 eggs	15
1995	71 fry 6,047 eggs	40
1996	4,130 eggs	46
1997	1,751 eggs	9

In brood years '94 thru '97 all surplus live fry in excess of the Goal of 1200 fish for the captive brood program were returned to the river, at the original location of their collection.

6.2.4) Genetic or ecological differences.

Since considerable care was taken to achieve a representative number of families, it is expected that the brood source will have no genetic differences from the natural spawning population. Progeny of the captive brood program that were released into the natural environment may exhibit behavioral differences since the fish are reared in artificial conditions. Limited genetic data are available for the “wild” population. However, additional samples are collected each year. Captive brood spawning peaks approximately 1-2 weeks later than wild fish.

6.2.5) Reasons for choosing.

Native stock.

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.

The risk of within population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program. Also, by limiting the length of the captive broodstock program to the 1992 through 1997 broods, adverse genetic or ecological effects to listed natural fish were minimized.

SECTION 7. BROODSTOCK COLLECTION

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

The life stage collected to develop the captive broodstock program was eyed eggs and pre-emergent fry (1992-1997). Beginning with the 2004 BY, adults will be collected and spawned artificially to develop zero-age and yearling plants in future years.

7.2) Collection or sampling design.

Broodstock collection for the Captive Broodstock program began in 1992 and was terminated in 1997. The original life stage targeted in 1992 was pre-emergent fry. Eyed eggs were collected from 1993 to 1997. The method of extracting the eggs and fry was by use of a hydraulic jet of water injected into the gravel substrate. Prior to egg extraction, chinook redds were identified for later collection efforts. Temperature units (TU's) were monitored with the goal of collecting eggs with 500 to 750 TU's of development ("eyed eggs") from each redd. The number of eggs to be collected from each redd was determined by the number of redds identified. The ultimate goal was to have approximately 1200 captive brood adult spawners, after normal rearing loss for 2 to 5 years, representing as many family groups possible (one redd = one family group). Typically, about 50% of the nests were "false" redds and produced no eggs. Commonly, 60 to 100 eggs were collected from each true redd. Collection efforts were stopped when the target number of eggs was collected. The range of eggs or fry collected was from 90 to 288 per redd with the average being 163 per redd. There was no known mortality associated with the egg or fry collection.

In 2004, adults will be collected from the volunteer trap or the river. Collection options are: trapping, spawning the last 13 captive broodstock, gaffing, snagging or netting. Fertilized eggs will be held at the Hurd Creek facility. Rearing will take place at both facilities. A projected egg per female is approximately 4,000. The goal is to collect up to 222,000 eggs from about 56 females.

7.3) Identity.

The Dungeness River has been determined to be one distinct population (SASSI '92).

7.4) Proposed number to be collected:

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

In the later years of the captive broodstock project (2000-02), the sex ratio in the captive brood population averaged 0.33 males per female.

The sex ratio goal for adult collection in 2004 is 1:1 and up to 112 adults. The goal is to collect up to 222,000 eggs from about 56 females.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: (These are the number of captive broodstock used for spawning in this program (includes mortalities)).

See section 6.2.3.

Captive Broodstock Spawned:

Year	Adults Females	Adults Males	Adults Jacks	Eggs	Juveniles released
1996	527	323	224	1,889,630	1,774,536
1997	876	729	146	2,565,000	2,049,895
1998	592	600	217	2,030,600	1,775,152
1999	332	608	355	2,148,800	1,447,175
2000	633	299		2,525,000	2,084,780
2001	399	272		1,596,000	1,247,850
2002	166	101		625,800	
2003	17	19		50,000	

*See section 1.11.1 for more recent numbers of captive brood remaining/used for spawning.

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

There is no surplus for this program.

7.6) Fish transportation and holding methods.

Adults in the captive broodstock program were transported from the Hurd Creek Hatchery to the Dungeness Hatchery. The fish were transported when they exhibited external signs (color and morphology) of maturation, normally in late July to early August. Transit took about an hour from the time of initial loading to unloading. As a buffer, to minimize hauling stress, rock salt was added to the hauling water to achieve a 5% saltwater solution. At Dungeness, female adults were injected with 20mg/kg erythromycin for Bacterial Kidney Disease (BKD) control and all fish were injected with 20mg/kg oxytetracycline for gram-negative enteric bacteria control. Adults were treated daily with 167 parts per million (ppm) formalin for *Saprolegnia* fungus control. Most fish were hauled about one month prior to spawning. The fish were treated with formalin three times per week at a rate of 1:6000 drip for one hour. On alternate days the fish were treated with copper sulfate at 1 ppm for a one-hour drip.

Live adults collected in 2004, and subsequent years, will be transported to the Hurd Creek Hatchery where they will be held in circular tanks until ripe. Eggs taken from adults spawned on the river will be also taken to the Hurd Creek facility. Prophylactic treatments for live adults will be the same as stated in the paragraph above for the captive broodstock adults. No copper sulfate will be used in the future. Formalin will be used for daily fungus control.

7.7) Describe fish health maintenance and sanitation procedures applied.
See section 7.6

7.8) Disposition of carcasses.

All carcasses are distributed back to the Dungeness River watershed for nutrient enhancement.

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.

As many family groups as possible were collected to maximize the genetic diversity within the Captive Broodstock and to minimize the risk of inbreeding. Pumping the eyed eggs from redds had no known negative effects on either the eggs withdrawn or the eggs remaining in the gravel. The number of eggs withdrawn from each redd was a small portion of the total egg mass deposited by the wild female.

Genetic diversity was maximized in the captive broodstock program. The progeny from that program, returning as adults to the river in the next few years, should be equally genetically diverse. Adults collected in 2004, and in subsequent years to be used for continued supplementation, should also represent that same genetic diversity.

SECTION 8. MATING

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

Note: This section refers to both the spawning of the "Captive Brood Reared Adults" and wild adults that are captured.

8.1) Selection method.

All available spawners are utilized and are chosen, at random and without consideration for age or size, as they become mature.

8.2) Males.

In the first four years of the project (1995-99), individual males were spawned with single females (paired matings). No gametes were pooled prior to fertilization. Since 2000, the male to female ratio averaged 0.33:1, one male was used to fertilize multiple females. All captive brood fish were killed prior to spawning. In 2003, any males that volunteered to the hatchery trap were live spawned with captive brood females, scale sampled, PIT tagged and returned to the river. See section 1.11.1 for more recent numbers of captive brood remaining/used for spawning.

A 1:1 ratio of males to females will be the goal of the continued supplementation program beginning in 2004.

8.3) Fertilization.

In 1995-99 fish were spawned at a 1:1 sex ratio. Gametes were not pooled until the eggs and sperm had set for several minutes. Fertilized gametes were then pooled into female pools of three for incubation. This is the goal of the continued supplementation program to begin in 2004.

Since 2000, the spawning sex ratio averaged 0.33:1 male per female in the captive broodstock program.

8.4) Cryopreserved gametes.

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.

Geneticists working with the TAC determined that the factorial mating scheme was not necessary due to the large numbers of families, large numbers of spawners, and the variety in spawning year classes (2's, 3's, 4's, 5's and some 6's). The family and age of each parent fish was determined after the matings occurred.

Genetic diversity was maximized in the captive broodstock program. The progeny from that program, returning as adults to the river in the next few years, should be equally genetically diverse. Adults collected in 2004, and in subsequent years to be used for continued supplementation, should also represent that same genetic diversity and run timing.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Year	1995-1999 Dungeness Chinook Egg Data					
	Eggs Taken	Egg Loss	% Egg Loss	Fry Loss	% Fry Loss	Fry Ponded
1995	42,803	9,914	23.16	11,797	35.9	21,092
1996	1,889,630	92,130	4.88	83,000	4.6	1,714,500
1997 FW	2,371,800	170,400	7.18	53,100	2.4	2,148,300
1997 SW *	193,200	84,500	43.74	12,100	11.1	96,600
1998 FW	1,970,600	109,200	5.54	41,061	2.2	1,820,339
1998 SW *	60,000	19,000	31.67	2,100	5.1	38,900
1999 FW	1,549,200	130,700	8.44	70,400	5.0	1,348,100
1999 SW *	599,600	251,900	42.01	60,400	17.4	287,300

*Some captive broods were originally reared in seawater (SW = seawater) pens at Squaxin Island. This strategy was abandoned due to excessive egg loss.

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

All available adults will be spawned and all available eggs will be cultured. All fry surplus to the release needs as specified in section 10.1 shall be cultured at the Dungeness Hatchery for release into the Dungeness River. Fish that exceed the full rearing capabilities of the Dungeness River Hatchery will be planted into Dungeness River or Gray Wolf River sites as agreed upon by the Dungeness River Technical Team.

9.1.3) Loading densities applied during incubation.

The eggs are put down to hatch, in vertical incubators with artificial substrate, at 7,500 per tray. Flow is set at 4 gallons per minute (gpm) per ½ stack. Egg size has varied between 1,590 and 5,172 eggs per pound.

9.1.4) Incubation conditions.

Incubation is done in vertical stack incubators. The ambient river water is clarified in a settling pond. Temperatures range between 32 and 45 degrees Fahrenheit. Dissolved oxygen is saturated at approximately 11 ppm. Eggs and/or fry in the incubators are monitored daily for the correct rearing parameters.

9.1.5) Ponding.

Button-up fry are force-ponded when yolk is approximately 95-100% absorbed. This is done with a visual check of a dozen fry. Temperature units at this time are approximately 1,700 TU's.

9.1.6) Fish health maintenance and monitoring.

The fish/eggs at Dungeness are monitored by a WDFW Fish Health Specialist on a routine basis. Eggs are treated daily with a formalin drip at 1667 ppm for fungus prevention. Dead eggs are either hand picked or salt dipped.

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.

The Dungeness Hatchery has a settling pond that filters out the majority of the silt. The eggs (collected from a diverse group of families) are watched daily to insure that there are no silt problems occurring. The incoming water is alarmed in various places to insure all the water needs are met. Temperature and flow are monitored and any dead eggs are picked and discarded to prevent any potential fungus transmission.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Captive Brood:

Redd pumped eyed egg to fry survival from 1994-1997 averaged 93.75%.

Progeny of Captive Brood:

Green to eyed egg survival = 93.45% for fresh water and 58.33% for salt water.
Survival from ponding to release averaged 97.1% for brood years 1995 to 1998.

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

All fish at either the Dungeness Hatchery or Gray Wolf pond are reared within the loading guidelines set forth in the Co-managers Salmonid Disease Control Policy (1998) and Piper's Fish Hatchery Management Manual (1982).

9.2.3) Fish rearing conditions

Captive brood family units were kept separate until large enough to tag (about 200 fish/lb.). Family sizes were equalized (to the extent possible) when reducing the population to the 1,200 fish limited for the rearing program. All families were then combined into one unit. Initially, due to the experimental nature of freshwater captive brood rearing for chinook, the seawater survival rates observed in the White River captive brood program were used to estimate expected survival rates for this program. The survival rates were much better than expected for all freshwater life stages.

In 1993, 94 and 95, 50% of the Dungeness River Captive Broodstock were reared in saltwater net pens at the South Sound Net Pen (SSNP) site. The survival of this portion of fish reared in saltwater was equal to other captive broods reared at SSNP (White River Chinook). However, the marine-reared Captive Brood egg loss was higher than the fresh water egg loss, averaging 41.7% to the eyed stage and fry loss at 18.8% (1997-1999 data, see section 9.1.1). As the goal of this program is to achieve the highest possible egg and fry survival, within biological norms, the saltwater rearing portion of this program was discontinued.

As of April 24, 2001 there were approximately 300+ captive broodstock on hand at Hurd Creek. These were to be 5 and 6 year old fish in 2002. At that time, it was not possible to assess the sex ratio of these fish. Based on past maturation rates and history it was expected that a majority of the fish would mature in 2002 with a potential egg production of 400,000 to 500,000 eggs. The balance was spawned in 2003.

Progeny were reared in 10' X 100' standard ponds that were cleaned weekly. Water parameters were the same as 9.1.4 above. Losses were picked and recorded daily. The area Fish Pathologist on a monthly basis examined fish unless needed otherwise.

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.

Not available.

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

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*).

Feed types used were Bioproducts and Skretting. Fish were fed according to the feed manufacturers recommendations and the expertise of the Fish Specialists. Overall food conversions varied between .75 and 1.5 depending on the feed used and the size of the fish. Captive broods were fed a broodstock formulation.

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

The fish are monitored on a monthly basis by the area Fish Health Specialist or as needed. Disease treatments are prescribed by the Fish Health Specialist as needed.

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

External cues (silver color) and behavioral changes (migration urges) were/are used to determine the degree of smoltification of the chinook.

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

Progeny of captive brood were reared using several different approaches prior to release. Some were reared to smolts using standard 10' X 100' raceways. Others were planted as fed fry into available habitat as deemed appropriate by the TAC. In addition, an acclimation pond, located on Gray Wolf River (a major Dungeness River tributary above the hatchery), was used for both short-term rearing of fingerlings and rearing of migrant smolts.

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.

As is noted in 9.2.9, several rearing methods were employed. In the event that one method failed as a productive enhancement tool, the other rearing method(s) acted as a potential enhancement back up.

As a standard, the chinook will be reared to sub-yearling (fingerling) and yearling smolt size (from supplementation program, 2004 BY) to mimic the natural fish migration habits and to minimize the risk of domestication.

As indicated by Steward and Bjornn (1990), hatchery populations can be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, but there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

As the Captive Brood egg source diminished (ending with the 2004 BY), the following release strategies were dropped in the approximate following order: option A, option C, option B and option D. Options E, F and then G were planned to continue with changes to location and numbers released. See table below.

Age Class	Maximum Number*	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry	A. 200,000 (3) B. 400,000 (3) C. 200,000(2) D. 200,000 (3)	450 250 250 200	May June/July June/July June/July	Grey Wolf River Gray Wolf River Dungeness River Gray Wolf River
Fingerling	E. 100,000 (4)	40	May/June(6)	Gray Wolf River
Yearling	F. 100,000(1) G. 100,000(5)	8 to 10 8 to 10	April(6) April(6)	Dungeness River Hurd Creek

(450 fpp ~ 47 mm fork length, 250 fpp ~ 56 mm fork length, 200 fpp ~ 60 mm fork length, 40fpp ~ 99 mm fork length, 10 fpp ~160 mm fork length, 8 fpp ~171 mm fork length)

Planned fish releases from annual broodstock collection beginning with 2004 BY

Age Class	Maximum Number*	Size (fpp)	Release Date**	Location
Fingerling (Zero-age)	50,000 50,000	40	May/June	Dungeness R. Gray Wolf R.
Yearling	50,000 50,000	8-10 8-10	April April	Dungeness R. Hurd Creek

*Numbers in each release strategy may vary based on an on-going Dungeness supplementation evaluation. This was the initial production/release strategy of the program.

**(6) Release dates for the newly modified supplementation project (above table) for yearlings and accelerated zeros will be in April, May or early June. Yearling smolts will be released primarily in April when they show signs of strongest smoltification.

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:
Release point:
Major watershed:
Basin or Region:
(1) Dungeness River (18.0018) at Dungeness Hatchery RM 10.5, Dungeness River, Puget Sound.

(2) Dungeness River (18.0018) at various locations in the upper watershed, Dungeness River, Puget Sound

(3) Gray Wolf River (18.0048) at various locations in the upper watershed, Dungeness River, Puget Sound

(4) Gray Wolf River (18.0048) from the Gray Wolf Acclimation Pond RM 1.0, Dungeness River, Puget Sound

(5) Hurd Creek Hatchery (18.0028) in the lower Dungeness River.

Marks applied to each group:

All rearing strategies will be differentially identified with internal indicators. They are:

A, B and D: Otolith mark only. No adipose clip.

C, E, F and G: blank or coded-wire tags only. No adipose clip.

Note: See section 10.1 and 10.2 "Proposed Fish Release Levels" for the specific rearing and release goals for each group.

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

Release	Eggs/	Avg size	Fry	Avg size fpp	Fingerling	Avg size fpp	Yearling	Avg
1996					13,013	123		
1997			1,774,536	212				
1998			577,500	428	1,472,395	141		
1999			1,775,152	185			**56,075	6
2000			146,304	320	1,354,812	130		
2001			555,380	380	1,529,400	114		
2002			831,100	255	309,300	56		
2003					578,928	62	107,450	9
Average			943,329	297	876,308	104	81,762	7.5

Note: ** These fish had originally been programmed to be planted into Morse Creek, a sub-unit of the GDU (genetic diversity unit) and a separate tributary of the Straits of Juan De Fuca.

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

1996	Smolts	6/24, 8/30
1997	Fry	6/24, 6/30, 7/9, 8/8
1997	Smolts	7/14, 7/21, 8/1, 8/8
1998	Fry	5/5, 5/12, 5/18, 6/12, 6/18, 7/6
1998	Smolts	7/20, 7/25, 8/1, 8/8
1999	Fry	6/1, 6/21, 6/29, 7/6
1999	Smolts	8/3, 8/6, 8/11, 8/20
1999	Yearlings	8/17 thru 8/27 volitional
2000	Fry	5/30 thru 8/23
2000	Smolts	6/26 thru 8/23
2001	Fry	2/01 thru 9/23
2001	Smolts	7/6 thru 9/6
2002	Fingerlings	5/30, 10/02
2002	Fry	6/19, 7/01
2002	Yearlings	5/04, 5/31
2003	Yearlings	5/15-5/16
2003	Fingerlings	5/13-5/14, 5/25-5/26, 10/8-10/9
2004	Yearlings	4/1, 4/12-4/13

These dates were chosen based on the size of the fish, their condition, the program release dates and the tagging operation. The fry releases were forced and the smolt releases were volitional then forced. Some releases were made directly into the river and others were made from the Gray Wolf acclimation site. See section 10.6.

Releases of progeny from adult collections (beginning in 2004) will consist of zero-age (fingerling) smolts in the late spring/early summer (2005) and yearlings in the spring.

10.5) Fish transportation procedures, if applicable.

The fish were hauled in tank trucks for up to one hour. They were hauled in ambient river water with salt added at the recommended rate of 0.5%. Salt acts as a buffering mechanism to reduce hauling-related stress. Tank loadings did not exceed the .33 pounds per gallon of water. Supplemental oxygen is added at the rate of 3.5 to 5 liters per minute.

The same standards will be used for the 2004 adult collection.

10.6) Acclimation procedures

All fish released via the Gray Wolf acclimation pond site receive two to four weeks of acclimation at Gray Wolf. All Hurd Creek and Dungeness Hatchery yearlings were reared entirely on Hurd Creek or Dungeness Hatchery water throughout rearing.

The same standards will be used for the 2004 adult collection progeny.

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

All juvenile fish released are marked with a coded-wire tag, an otolith mark, or blank wire tags. Each planting strategy is identified with a distinct otolith mark, coded wire tags or blank wire tags to allow for separate evaluation of each particular strategy. Please see section 10.2 for further definition of the marking and tagging protocol.

All releases from the supplementation program beginning in 2004 will be CWT'd only. <u>No adipose fin clips will be applied (as in the earlier stages of the program) since the Dungeness chinook program was implemented to increase the number of spawners, not provide fishing opportunities.</u>

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

NA

10.9) Fish health certification procedures applied pre-release.

Whenever abnormal behavior or mortality is observed, staff contacts the Area Fish Health Specialist. The fish health specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Health Policy (1998). All fish are examined for general condition and health as well as presence of "reportable pathogens" as defined in the disease control guidelines, within 1 to 3 weeks prior to release. A Fish Health Specialist prior to release checks fish as per the Co-managers Fish Health Policy.

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

Due to flooding or drought conditions, ponds may be drained and fish released directly into the river at the hatchery and acclimation sites to prevent fish loss.

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.

All sub-yearling and yearling smolts (from supplementation program) shall be released in a manner that minimizes domestication and mimics the natural out-migration patterns of wild Dungeness River chinook. Yearling smolts that are released primarily in April will emigrate quickly seaward soon after liberation, minimizing the potential for competition with any listed natural-origin chinook (Steward and Bjornn 1990). Sub-yearling chinook released into the Dungeness River at RM 10.5 (Dungeness Hatchery) reached the mouth of the river in two to seven days (Dungeness Hatchery liberation and smolt trapping data from D. Seiler, WDFW, March 1998). Steward and Bjornn (1990) also concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearlings) may have different food and habitat preferences than natural-origin chinook, and that hatchery fish will be unlikely to out-compete the listed fish.

To minimize the possible adverse interactions and ecological effects to pink salmon juveniles, all accelerated reared smolts will be released on or after June 1. This release date also minimizes the effect to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in July to August.

In addition, a rearing parameter of the program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). Such fish would be less likely to residualize in fresh water and interact with listed wild fish. The average CV for release years' 1996-2002 was 9.14%.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Note: See section 1.10 for Monitoring and Evaluation.

The purpose of a monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Note: WDFW has requested funding through the Hatchery Scientific Review Group (HSRG) process to monitor juvenile/smolt migration in the Dungeness River system. This is in response to the HSRG's recommendation to describe the life history patterns of Dungeness chinook; their distribution, abundance and migratory movements. A screw trap and staff to run it are the key elements of the request. The trap would be operated from April through September each year. The trap would expect to catch thousands of chinook migrants as well as other species. In 1997, a screw trap fished the lower Dungeness River from June 11 to September 8 and caught 62,867 zero-age chinook (1.774 million were released that same year). No funds have been appropriated at this time.

Each planting strategy is identified with distinct otolith marks, coded wire tags or blank wire tags to allow for evaluation of each particular rearing and release strategy. WDFW shall monitor the chinook salmon escapement to the Dungeness River to estimate the number of tagged, untagged, and otolith marked fish escaping to the river each year. This monitoring will allow for assessment of the status of the target population and the success of the program in achieving restoration objectives.

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

See section 1.10 "Monitoring and Evaluation Plan" and section 11.1

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

Funding and resources are currently committed to monitor and evaluate this program via the TAC, WDFW and the Co-Managers and as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002 and update, March 31, 2004). Staffing and fiscal resources are limited though and WDFW funding is not available to expand either monitoring or evaluation of this program.

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

Monitoring and evaluation will be undertaken in a manner that does not result in an unauthorized take of listed chinook in the Dungeness River.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Imperiled salmon (*Oncorhynchus spp*.) populations in the Pacific Northwest are increasingly being brought into captive culture environments for stock conservation or recovery. Captive populations of chinook salmon (*O. tshawytscha*) are established by removing eggs or juveniles from their natal habitats and culturing them to adulthood to bypass high juvenile to adult mortality (Waples and Do 1994; Flagg et al. 1995). When sexually mature, the adults in a captive culture program may be used in two different ways. Conventional captive broodstock programs rely on artificial spawning of the captively reared adults to produce large numbers of offspring for further culture, or release into the wild. Alternatively, some programs release captively reared adults back into their natal streams to spawn naturally. This captive rearing and release strategy provides the opportunity for natural and sexual selection (see van Den Berge and Gross 1989; Fleming and Gross 1994) to occur on the spawning grounds, and thereby reduces the potential for genetic change associated with artificial spawning of the adults and hatchery propagation of the progeny. Previous studies have suggested that captively reared adults do not have the same level of breeding success as wild adults (Berejikian et al. 1997). Thus, there is a need to improve culture technology in attempts to achieve the maximum reproductive performance possible from captively reared salmon. The breeding behavior and success studies will generate important information which can be used in developing recovery guidelines for ESA-listed chinook populations. Research on the efficacy of this strategy relative to more conventional smolt-release strategies is critical in developing sound recovery guidelines. The project outlined below provides a rare opportunity to evaluate comparative success of two rearing regimes, and thereby more fully evaluate the efficacy of adult rearing and release strategy.

This research project is designed to minimize adverse impacts and maximize benefits from the research information by doing the following: 1) The offspring of naturally spawning captive broodstock will be returned to the Dungeness Hatchery for rearing and release, 2) natural spawning and incubation will lessen the opportunity for genetic impacts of captive culture on the population, 3) strict disease prevention measures have and will continue to be taken throughout the study, and 4) research results will lead to improvement of captive broodstock technologies, thereby benefiting this and other captive populations listed under ESA.

12.2) Cooperating and funding agencies.

The research is being conducted by the National Marine Fisheries Service, Resource Enhancement and Utilization Technologies Division, located at the Manchester Research Station (MRS). Cooperating agencies include the Washington Department of Fish and Wildlife and the Jamestown S'Klallam Tribe. Funding for the research is provided by the Bonneville Power Administration.

12.3) Principal investigator:

Dr. Barry A. Berejikian, NMFS. Associate Investigators include: E. Paul Tezak, Dr. William Fairgrieve, Thomas Flagg, and Anita LaRae.

12.4) Status of stock (In addition to the information provided below, refer to section 2.2.1 2.2.2 and 2.2.3)

The Dungeness spring chinook salmon captive broodstock population is currently listed as "threatened" under ESA. The majority of fish in this population were cultured at the WDFW Hurd Creek Hatchery. WDFW's program involved egg collections from natural spawners, full-term captive culture, artificial spawning of captive brood adults, incubation of the embryos, and rearing and release of sub-yearling smolts.

On 20 April 1998 (prior to listing), 231 Dungeness spring chinook captive broodstock (brood year 1996) were transported to the Manchester Research Station for rearing in seawater. At that time, the fish were made available for research and evaluation of captive broodstock technologies by NOAA Fisheries scientists. The fish were cultured on filtered, UV sterilized seawater. The fish were held in 4 separate rearing tanks (4-m in diameter). Each tank received 110 L/minute of filtered, UV-sterilized seawater (this same water supply was used to culture 6 other chinook salmon populations listed as "endangered" under ESA, which were annually returned from the Manchester facility to their natal or ancestral streams in Oregon and Idaho).

The water velocity in two of the tanks was increased by 2 horsepower pumps with variable speed controllers to maintain maximum current velocities of 1 fish body length/second (adjusted monthly). Velocities in the other two tanks were not increased. In early July of 1998, the maturing fish were transported to two freshwater holding tanks at the Manchester Research Station. The majority of fish were expected to mature in August/September 2000.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied. (See 2.2.3)

In late August 2000, maturing adults were anesthetized, weighed, and measured. A Peterson Disk tag was attached to each fish for individual identification. Reproductive behavior experiments were conducted in a quasi-natural stream channel at the Manchester Research Station. The sidewalls and floor of the channel (45 m long by 6 m wide overall) were constructed of concrete at a constant 3% gradient. The water depth (25 - 35 cm), velocity (up to 0.5 m/s), gravel size (3 - 8 cm), gravel depth, and temperature (approximately 10 C) were within the documented range of natural spawning habitat for the species (Burner 1951, Briggs 1953). The channel uses well water (80 L/minute) that was re-circulated at a flow rate of approximately 6,250 L/minute.

Upon maturity, the chinook salmon were placed into the spawning channel for natural spawning. The reproductive behavior of all fish placed in the channel was monitored following pre-established protocols (Berejikian et al. in press). In 1997, Dungeness River

captively reared chinook salmon spawned successfully in the same channel and exhibited high egg-to-fry survival (~ 65% green-egg-to-emergence). The naturally spawned embryos were left in the gravel undisturbed and water temperatures were manipulated to mimic temperatures in the Dungeness River. This ensured natural fry emergence timing.

12.6) Dates or time period in which research activity occurs

Reproductive behavior experiments began in late August and terminated in late September 2000. Embryos incubated in the gravel from late August through late February. Emergent fry were collected in early March 2001 and returned to the Dungeness River following tagging by state and tribal personnel.

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

For adult culture and spawning methods, see 12.4 and 12.5. Once spawning had been completed, the embryos were allowed to incubate in the gravel and emerge naturally. After emergence, fry were periodically seined out of the channel and placed into holding tanks supplied with well water, and fed. The fry were transported and released into the Dungeness River. The otolith strontium/calcium ratios reflecting a maternal seawater-rearing environment will distinguish these fish from other fish produced from the Dungeness Captive Broodstock and from wild fish. Transport time to the Dungeness River was approximately 2.5 hours.

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

Fish naturally spawning in the stream channel may produce fewer fry than if the same fish were to be spawned artificially. For example, females spawning in the channel may not deposit all of their eggs, some eggs may not be fertilized, and some embryos may not survive to emergence. It is important to note, however, that egg fertilization and viability can vary widely during artificial spawning as well. The reproductive success of fish spawning in the protected stream channel environment is likely much higher than it would be in the wild. Previous experiments in this stream channel with the same population indicated that of the eggs deposited by females, and estimated 65% produced viable fry, which is much higher than would be expected in natural streams (Berejikian et al., submitted).

One of the main concerns in artificial propagation program is domestication selection and the relaxation of selective pressures on the fish (Busack and Currens, 1995). Reintroducing captively reared populations back into the natural environment as mature adults (instead of the artificially cultured progeny that may have derived from them) may reduce the potential for unnatural genetic selection (Reisenbichler 1996). Therefore, the natural and sexual selection pressures acting on spawning adults, incubating embryos and emerging fry in the spawning channel should increase the ultimate fitness of these fish (i.e., their own ability to reproduce) relative to those spawned artificially at the Dungeness Hatchery.

A small amount (<0.1% based on previous studies) of mortality may occur as the fish are seined out of the stream channel. We expect that this mortality will be no more than might occur during conventional hatchery sampling.

Note: As of February 2001, there were 50 non-mature adult Dungeness chinook from the 1996 brood left at the NMFS Manchester Research Station. There is not adequate space to hold these adults at the research station beyond April 2001, as well as at the WDFW Dungeness Hatchery. These fish were 5-year-old adults averaging about 15 pounds each. It is assumed that the majority of these fish were females since only 8 of the 40 fish used in the spawning channel experiment at Manchester were ripe males. Transferring 40+ females to Dungeness exacerbated the imbalance of females to males that the project was already experiencing.

In April of 2001, the 50 adult bright chinook were hauled and released directly into the saltwater of Dungeness Bay where they have the benefit of being close to their native river. It is assumed that all of the adults would mature and those that survived would begin entering the river in August or September to spawn naturally.

12.9) Level and take of listed fish

If the 50 adults mentioned above were transferred from the NMFS Manchester Research Station (saltwater) to the WDFW Dungeness Hatchery (freshwater), 100% mortality was predicted. If the 50 were released directly into saltwater in Dungeness Bay, mortality was expected to be minimal.

12.10) Alternative methods to achieve project objectives.

The only alternative that would have achieved a portion of the project objectives would have been to release the adults directly into the Dungeness River and monitor their breeding behavior in the river rather than in the stream channel. This would have resulted in a much poorer behavioral evaluation of breeding success. It would also have likely decreased the reproductive success of the fish because the incubating embryos would not have received the protection from adverse environmental conditions (e.g., streambed scour or entombment of redds) that was provided in the stream channel.

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

There was no expected mortality of similar or related species beyond that which may be described in other sections of this HGMP.

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.

In order to minimize the potential for disease transfer from this captive broodstock to chinook salmon in the Dungeness River, the following precautions were taken: 1) the fish were being held on filtered UV-sterilized seawater, which had been approved for the culture of ESA-listed chinook and sockeye salmon; 2) prior to introducing the adults, the entire stream channel and freshwater holding facility were disinfected with chlorine; 3) the adults and their offspring were held entirely on pathogen-free well water and 4) adult pathogen screening would be conducted following co-manager guidelines.

Allowing captively reared populations to spawn naturally reduced the time in which it is exposed to the hatchery environment, and thereby, reduced the potential for unintentional deleterious genetic change. Spawners in the stream channel were able to compete intra-sexually for spawning sites (females) and for mates (males). Both sexes may have exhibited inter-sexual selection (i.e., mate choice: Foote and Larkin 1988; Foote 1989; Berejikian in press). Both types of inter- and intra-sexual selection were important in maintaining reproductive fitness of the population. Developing embryos in the gravel will also undergo natural selection during incubation and emergence. It was impossible to exactly quantify the effects of natural vs. artificial spawning. However, based on existing scientific information, it was concluded that the studies involving natural spawning have conservation benefits, which will outweigh any potential production by not artificially spawning the adults (also not 100% successful).

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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

Chinook

ESU/Population	Puget Sound Chinook *(Oncorhynchus tshawytscha)*
Activity	Dungeness Spring Chinook Program
Location of hatchery activity	Dungeness Hatchery RM 10.5, Dungeness River Hurd Creek Hatchery RM .2 Hurd Creek
Dates of activity	Fingerlings- April-May Yearlings- May-May of next year
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)			Unknown*	
Unintentional lethal take (g)	Less than 7%	Less than 3%	Unknown	
Other take (indirect, unintentional) (h)				

* Wild take unknown, fish are mostly coded-wire tagged only (CWT'd) returns from the captive brood program. Total broodstock is up to 112 adults.

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

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

Chum

ESU/Population	Hood Canal Summer Chum *(Oncorhynchus keta)*
Activity	Dungeness Spring Chinook Program
Location of hatchery activity	Dungeness Hatchery RM 10.5, Dungeness River Hurd Creek Hatchery RM .2 Hurd Creek
Dates of activity	Fingerlings- May-May Yearlings- May-May of next year
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)			Unknown	
Intentional lethal take (f)				
Unintentional lethal take (g)				
Other take (indirect, unintentional) (h)		Unknown		

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