HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Sea Resources – Chinook River Type S Coho Salmon Recovery Program
Species or Hatchery Stock	Coho Salmon (Oncorhynchus kisutch)
Agency/Operator	Sea Resources, Inc.
Watershed and Region	Columbia Estuary Subbasin/Columbia River Estuary Province
Date Submitted	nya
Date Last Updated	August 12, 2004

Section 1: General Program Description

1.1 Name of hatchery or program.

Sea Resources Watershed Learning Center - Early Coho Salmon Recovery Program

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

Coho Salmon (Oncorhynchus kisutch)

ESA Status: ESA Status: One of 21 artificial propagation programs proposed for listing (NOAA 69 FR 33101; 6/14/2004).

1.3 Responsible organization and individuals.

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

Co-operators	Role
Washington Department of Fish & Wildlife	Technical Assistance, fish feed, virology, grants.
U.S. Fish & Wildlife Service	Support in Habitat Improvement Projects

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

Funding Sources
Federal and State Grants
Community Donations

Operational Information	Number
Full time equivalent staff	0.1
Annual operating cost (dollars)	$4,800

Above annual operating cost is estimated annual expense of the program activity.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Chinook River Type S Coho Salmon
Broodstock collection location (stream, RKm, subbasin)	Sea Resources Hatchery/Chinook River/RKm 7.7/Columbia Estuary Subbasin
Adult holding location (stream, RKm, subbasin)	Sea Resources Hatchery/Chinook River/RKm 7.7/Columbia Estuary Subbasin
Spawning location (stream, RKm, subbasin)	Sea Resources Hatchery/Chinook River/RKm 7.7/Columbia Estuary Subbasin
Incubation location (facility name, stream, RKm, subbasin)	Sea Resources Hatchery/Chinook River/RKm 7.7/Columbia Estuary Subbasin
Rearing location (facility name, stream, RKm, subbasin)	Sea Resources Hatchery/Chinook River/RKm 7.7/Columbia Estuary Subbasin

1.6 Type of program.

Integrated Recovery program that utilizes supplementation and re-introduction strategies.

1.7 Purpose (Goal) of program.

- Contribute to conservation, recovery and research of natural salmonids including historical coho in the Chinook River.
- Overall purpose of Sea Resources Watershed Learning Center is to build around the restoration of the Chinook watershed because it offers unprecedented educational opportunities for students and presents a way to involve the local community.
- Release up to 52,500 smolts into the system.
- To re-establish coho to an independent tributary near the Chinook River. The plans are to introduce 500 fry yearly into an unnamed independent tributary of the Columbia River upstream of the Chinook River (Peterson Coho Fry Project) in order to re-establish natural production. This limited program (3 years) is to take advantage of newly opened habitat due to a culvert replacement project, which now provides access to the stream. Future monitoring will be of adult presence.

1.8 Justification for the program.

In 1996, Sea Resources, a nonprofit educational organization, developed a comprehensive watershed recovery plan for the Chinook River basin (Dewsberry 1997). The plan has six parts: 1) to protect critical upland habitat from landslides and thereby protect the lower river from debris torrents in an effort to re-establish a more natural regime of sediment and organic matter movement through the watershed; 2) to reduce sediment inputs by repairing and stabilizing existing roads in the watershed and when possible to decommission unnecessary roads; 3) to protect and restore the valley floor by re-establishing a mature conifer dominated forest; 4) to restore the lower estuary by (a) removing or redesigning the tide gate located at the mouth of the Chinook River, (b) by limiting development in the lower portions of the watershed, (c) by re-establishing woody debris accumulations in the Chinook estuary and in Baker Bay, and (d) by encouraging beaver dam development in the lower river; 5) to use an existing hatchery to help supplement salmonid populations in the basin, and 6) to evaluate the effects of habitat improvements in upland, valley floor, stream channel, an estuarine areas on habitat characteristics and salmonid abundance (Dewsberry 1997).

The habitat restoration and evaluation work mentioned above and managed by Sea Resources will continue into the foreseeable future. Hence, the basin has the potential to provide a stable and high quality spawning, incubation, and early rearing refuge to Lower River Columbia River salmonids. Sea Resources operations have the support of the Co-managers and the USFWS.

1.9 List of program "Performance Standards".

The following plans and methods are proposed to collect data for each Performance Indicator: Migrants are captured with two screw traps, one full sized trap at the tidegate at the Highway 101 bridge, and one ½ screw trap at the Sea Resources facility. The purpose of these traps is to determine the overall salmonid production of the watershed and to better understand the life histories of the fish within the watershed. The traps are operated at least four times per week from January through June. Fish captured in the trap are identified, measured, weighed, and scale samples are removed, and released. On a weekly basis trap efficiencies tests are performed. To mark the fish to test trap efficiency we cut a small piece off of the caudal fin. The fish is released approximately ¼ mile upstream. No other marks or tags are applied to the fish.

Salmonid production is also monitored on a yearly basis through snorkel counts every June.

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

PROGRAM PERFORMANCE STANDARDS
1)Meet management and recovery objectives.
2)Minimize interaction with listed and candidate fish populations through proper broodstocking, rearing and release strategies.
3)Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.
4)Maximize survivals at all lifestages using disease control and disease prevention techniques.
5)Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.
6)Communicate effectively with other resource managers.
7)Comply with applicable state and federal permits, guidelines, and agreements.

PROGRAM PERFORMANCE INDICATORS FOR BENEFITS/RISKS

1)Collect adult coho salmon for hatchery broodstock. Release no more than 50,000 coho smolts at approximately 10-25 fish per pound.
2)Monitor adult collection trap at least five times per week, with never more than 48 hours between checks. Rear fish to 10-25 fish per pound for a spring of the following year release date. Release fish to coincide with natural smolt outmigration.
3)Utilize two-by-two factorial spawning methods. Collect broodstock to represent the timing and distribution of the run.
4)Comply with co-manager disease control policy.
5)Monitor NPDES.
6)Complete all necessary fish production paperwork (planting slips, monthly reports, etc.)

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

Collect up to 25 pair of adult coho salmon for hatchery broodstock for securing approximately 75,000 eggs.

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

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	52,500 FBD	10.0 – 15.0	Mid-April	Chinook River	7.7	Chinook	Columbia Estuary
Fry	500	250	Mid-April	Unnamed tributary (Peterson fry)		Chinook	Columbia Estuary

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

Stray or smolt-to-adult survival rates has not been estimated for this program. Escapement have ranged from 17 adults in 1998 to 575 in 2002 (Warren 2004).

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

Sea Resources Hatchery originally started in 1893 and continued until 1935. The modern day program was restarted in 1968 along with the hatchery operations.

1.14 Expected duration of program.

The project will function as a gene-banking project until the habitat in the watershed is restored enough to support a viable reproducing population of Coho without the aid of artificial propagation. No specific end-date has been established.

1.15 Watersheds targeted by program.

Columbia Estuary Subbasin/Columbia River Estuary Province

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

1.16.1 Brief Overview of Key Issues:

In 1996, Sea Resources initiated a new restoration effort in the Chinook River. The new strategy emphasized the re-establishment of lost or impaired watershed processes that shape and maintain the diversity of habitats required for all freshwater and estuary life stages of native salmon. This ecosystem approach to recovery de-emphasized the strong role the hatchery played in the past and, as a result, overall production has been reduced by nearly 90 percent. However, Sea Resources continues to explore the concept of using artificial production as a tool in salmon recovery. The artificial production component of Sea Resources' restoration effort is meant to be a temporary activity that will cease once viable self-sustaining populations are established in the Chinook River. Restoration actions to improve spawning and rearing habitat are ongoing. Once the restoration goal is met, the hatchery will be used for education and research purposes.

Sea Resources has also initiated an effort to intensely monitor the effectiveness of restoration actions, including use of the hatchery. It is hoped that information derived from monitoring work can be used to manage the hatchery in a way that is complementary to habitat restoration

work by minimizing the ecological risks often inherent in artificial production programs.

1.16.2 Potential Alternatives to the Current Program:

Alternative 1: None offered.

1.16.3 Potential Reforms and Investments:

Reform/Investment 1**:** In order for Sea Resources to better manage and apply the hatchery for recovery purposes it will need three essential improvements: 1) improvement of the incubation water supply by either developing a groundwater well system or a sand filtration system to remove excessive suspended sediments; 2) design and installation of a thermal marking system that will allow for the unique marking of incubating embryos and therefore complete necessary related monitoring tasks (e.g. fry-to-adult survival rates and relative contribution of hatchery and wild salmon to natural spawning); and 3) an upgraded incubation system to replace existing aging and outdated equipment. A modest investment in equipment would contribute greatly to Sea Resources' ability to sustain the artificial production component of its restoration program.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below indicate what the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harvest. The letters in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status indicate expected outcomes for the hatchery program and other strategies (including habitat protection and restoration).

	Biological Significance	Viability	Habitat
Current Status	M	M	M
Short-term Goal	M	M	M
Long-term Goal	M	H	H

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

Scientific collection permit – monitoring Permit 901 or 902 for incidental take of endangered species. Sea Resources is concurrently writing HGMPs to cover Chinook and chum programs.

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

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Chum (Sea Resources)- Integrated	U	U
Fall Chinook (Sea Resources)- Integrated	M	M
Coho- Hatchery and Natural (Proposed)	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

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.
Lower Columbia River Coho (*Oncorhynchus kisutch*) has been proposed as threatened on June 14, 2004.

Identify the ESA-listed population(s) that may be incidentally affected by the program.
Lower Columbia River fall Chinook salmon *(Oncorhychus tshawytscha*) are federally listed as "threatened" under the Endangered Species Act.

Columbia River chum salmon *(Oncorhychus keta*) - Mainstem Chum were listed as threatened under the ESA on March 25, 1999.

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

Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team to review population status within these ESU and develop critical and viable population thresholds.

Identify the ESA-listed population(s) that will be directly affected by the program.
Lower Columbia River Coho is currently a candidate for listing but has been proposed as threatened on June 14, 2004.

Status: NMFS concludes that the LCR coho ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. Twenty-one artificial propagation programs (including Sea Resources coho) are considered to be part of the ESU. NMFS has determined that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations. Historical hatchery fall chinook and coho returns to the Sea Resources Hatchery have been low, despite large releases of hatchery smolts. Prior to 1996, all fall Chinook and coho salmon captured at the hatchery were utilized for broodstock or surplused; no fish were returned to the river and allowed to spawn naturally. Beginning in 1996, approximately half of

the hatchery return has been allowed to spawn naturally in the Chinook River; competition with wild fall chinook or coho adults is likely to be limited because few wild fish are present. The current hatchery program is based on the amount of escapement allowed to spawn naturally above the Sea Resources facility and on the amount of available habitat.

Lower Columbia River fall chinook salmon within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.

Status: The Sea Resources Chinook population is believed to be similar to the fall Chinook in the Grays River. No genetic data is available to determine whether the Chinook River stock has diverged from the Grays River tule Chinook. Fall chinook are native to the Grays River. The natural spawners are now a mixed stock of composite production. Stock mixing very likely began when hatchery supplementation was initiated in 1947 (WDF et al. 1993). The majority of spawning takes place in a 3.6-mile area from the covered bridge on the mainstem (RM 10.7) to the Grays River Salmon Hatchery on the West Fork Grays (RM 1.2). Spawning occurs from late September to mid-November (WDF et al. 1993). In the early 1950s, there was an estimated escapement of 1,000 fall chinook to the Grays River (WDF 1951). Seining in 1979 captured few naturally-produced, fall Chinook juveniles. This evidence suggests that few natural fall chinook juveniles were being produced (WDF et al. 1993). Natural spawning escapements from 1967 to 1991 averaged 745 fish, with a low return of 147 in 1967 and a peak of 2,685 in 1978. Natural Grays River Chinook salmon stock status is rated depressed in 2002 because of a long-term negative trend and a short-term severe decline in escapements in 1997, 1998 and 2000. Generally, lower Columbia tule fall chinook stocks, including Grays fall chinook, experienced poor survival in the 1990s.

Columbia River chum salmon - Mainstem Chum were listed as threatened under the ESA on March 25, 1999.

Stock status is rated depressed in 2002 because of chronically low escapements. This is a native stock with composite production. A hatchery supplementation program designed to increase numbers of naturally spawning Grays River fall chum began at the WDFW Grays River Hatchery in 1998 (**SaSI** 2002).

The natural population targeted for recovery and supplementation is the Grays River chum salmon stock. As mentioned previously, chum salmon production in the Lower Columbia River has drastically declined over the past 50 years (WDF 1951; WDF et al. 1993). Many lower Columbia tributaries once produced chum, however, at present, significant natural production appears to be limited to three areas: Grays River, Hardy Creek, and Hamilton Creek. The latter two streams are located just below Bonneville Dam (Rkm 229 and 230, respectively) on the Washington-side of the river. Spawning ground counts made in these drainages since the late 1950's indicate that both streams possess stable populations of chum salmon (WDF et al. 1993). The Grays River population, on the other hand, is considered depressed due to a long-term negative trend in spawning ground escapements (WDF et al. 1993). Because of the generally low abundance of this species throughout the Columbia, NMFS listed Lower Columbia River chum salmon as a threatened species under ESA in early 1999.

The recovery and supplementation plan described in Part 1 calls for the re-introduction of Lower Columbia River chum (Grays River stock) into the Chinook basin. The Chinook River used to contain a native chum salmon population that was apparently extirpated several decades ago (WDF 1951). In the late 1980's, chum salmon from Bear Creek, a Willapa Bay population were transplanted into the Chinook River via a hatchery program run by Sea Resources. Initially adult returns back to the Chinook from this transplant were close to a thousand fish per year, however, recent returns have been low. For example, in 1997 and 1998 20 or less adults returned (Garth Gale pers. comm.) to the Sea Resources Hatchery. In 1998, it was decided that these non-native

chum should be removed to accommodate our effort to re-introduce native Lower Columbia River chum salmon back into the basin. Consequently, in 1999 all adult chum salmon returning to the Sea Resources Hatchery have been destroyed.

Recent stream enhancement work by the WDFW in Gorley Springs (RM 12) had been relatively successful until an upstream dike failed and the river changed course and now flows through the Gorley Springs channel. Other areas such as Crazy Johnson Creek can be quite productive if water flows are adequate. The lack of stable spawning habitat is considered the primary physical limitation on chum production today. Development of other spring-fed spawning areas such as Gorley Springs could improve subbasin chum production. Seasonal low flows sometimes restrict access of chum to preferred off-channel spawning areas, confining them to less stable mainstem reaches. Some mainstem reaches where chum spawn are subject to frequent channel shifts and bedload deposition or scour, all of which reduce intragravel survival. Adults migrate into the river from mid-October through November with peak spawner abundance occurring in late November. Scale analysis indicates 3- and 4-year-old fish are the dominant age classes. During low flow years, chum spawn primarily in the larger mainstem Grays River; during higher flows they can be found in larger numbers in the smaller tributaries.

Chum are believed to enter the river in October and November and reach their spawning peak in early November. Chum spawn in the mainstem Grays from the covered bridge to approximately 0.5 mile upstream of the West Fork confluence (approximately 4 miles). Tributary spawning occurs in the West Fork (RM 13.0), Crazy Johnson Creek (RM 13.3), and Gorley Creek (RM 12) during November and December (WDF et al. 1993). They are also reported to spawn in Fossil Creek (RM 12.4), and Hull Creek (RM 8.2) (Ames and Bergh 1971). In the 1970s, chum spawning index areas existed in Sweigiler Creek (RM 4.1 of the West Fork Grays) and in the South Fork Grays River (RM 17.7) (Jim Fisher and Associates 1999). Wahkiakum Conservation District reports chum spawning in Klints Creek (RM 11.9). In 1973, WDF reported chum presence in Seal Creek (RM 0.15 on Seal Slough) and Malone Creek (RM 2.1), but does not state whether they were spawning in these creeks (Smith et al 1954).

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

Describe hatchery activities: The following activities listed below are identified as general hatchery actions that are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999).

Broodstock Program:

Broodstock Collection: See HGMP section 7.0. Up to 25 pairs are taken. A number of fish can be partially live spawned and released for nutrient enhancement upstream. See take tables at the end of the document.

Genetic introgression: The program is intended to re-establish but not be permanent in nature. The collection of coho salmon brood stock will continue until significant habitat improvements have stabilized the dynamic river-flow patterns currently extant in the basin. There is no data to determine if current returns have diverged from the Grays River population (genetically or in life history characteristics), but the program collects adults from through out the run and is representative of the naturally spawning adults. Indirect take from genetic introgression is unknown.

Rearing Program

Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, hatchery

effluent, and intake compliance with impact on listed fish unknown but monitoring and maintenance are conducted along with staff observations. Indirect take from hatchery facilities is unknown.

Disease: Outbreaks in the hatchery may cause significant adult, egg, or juvenile mortality. Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the programs at Sea Resource Facilities. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994) chapter 5 have been instrumental in reducing disease outbreaks. Indirect take from disease are unknown.

Release Program

Hatchery Production/Density-Dependent Effects: The design of the program is intended to minimize the influence of any hatchery and density effects on the existing populations. The coho program is intended to accomplish additional spatial distribution at a minimal productivity level in lieu of habitat improvements while providing the research needed for future decisions. Indirect take is unknown.

Competition: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988) and if they do not migrate they can compete with wild fish. WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids." On station release in large systems may travel even more rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1998).
2) NMFS (2002) noted that ".where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."
3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."
4) Fresh (1997) noted that "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced

fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

5) Studies from Fuss (2000) on the Elochoman River and Riley (2004) on two Willapa Bay tributaries (Nemah and Forks Creek) indicate that hatchery reared coho and Chinook leave the systems within days or weeks.

Predation (Freshwater): Coho yearlings from this program may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs and the characteristics of the hatchery program (e.g.. release time, location, number released and size upon release). The site specific nature of predation and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of this specific hatchery release. WDFW is unaware of any studies that have empirically estimated the predation risks to listed juvenile Chinook or chum posed by the Sea Resources programs. In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented.

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Chinook River is a small rain fed tributary to the Columbia River. Volitional releases of fish can be timed for tidal back up into the Chinook River and also be during night time to ensure dispersion below the facility.

Dates of Releases: The release date can influence the likelihood that listed species are encountered. There is limited studies on migration timing of naturally produced Chinook but listed Chinook from the Lower Columbia ESU are believed to emigrate over a wide window from March through August (Lower Columbia Elochoman River Sub Basin Planning Report 2004). Chum are present in the mainstem Columbia from the Grays River and Sea Resources chum restoration programs. Sea Resources plans releases after the peak chum migration period.

Relative Body Size: Studies and opinions on size of predator/prey relationships vary greatly and although there is evidence that salmonids can prey upon fish up to 50% of their body length, most prey consumed is probably much smaller. Keeley and Grant (2001) suggest that the mean prey size for 100-200 mm fl salmonids is between 13-15% of predator body size. Salmonid predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length in aquarium environments (Pearsons et al. 1998). Artic char are well known as piscivorous predators, but recent studies suggest the maximum prey size is approximately 47% of their length (Finstad et al. 2002). The "33% of body length" criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger Chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the "33% of body length criterion" is valid for listed species until further data for this system can be collected.

Release Location and Release Type: The likelihood of predation may also be affected by the location and the type of release. The risk of predation may increase with the length of time that involves co-mingling. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release and the speed at which fish released from the program migrate. The Sea Resources Facility is low in the Chinook River and releases can be with tide influence downstream along with night releases to help disperse fish.

We have provided in this section a summary of empirical information a theoretical analysis of competition and predation interactions that may be relevant to the Elochoman Hatchery coho program.

Potential Sea Resources coho predation and competition effects on listed salmonids: Proposed release is up to 52,500 although the average release for the past two years is 2,352 fish at 23/lb (approximately 118-119 mm fl). Coho are reared for release as an active migrant based on time, size and past history. Due to yearling stage at release it is unlikely that yearlings would compete for the same food items as first year listed Chinook, chum or coho. Based on timing of release, most listed chum are likely to have emigrated before coho releases. At 23 fpp, predation would be fish 39 mm fl and under. Based on length frequencies from Abernathy Creek and Sea Resources/Grays River chum recovery programs, predation impact is unlikely.

- Abernathy Creek (WRIA 25) indicated lengths of 36mm – 40mm from March to April 25 with average size at 58 mm fl by mid-May. Also Mill Creek fall Chinook are 53 mm fl by May 12 (Hanratty pers comm. 2004).
- Besides releases occurring after chum emigration, mean lengths from the Grays River Hatchery and Sea Resources (Chinook River) Chum Recovery programs indicate chum releases as: 56.2 – 58.8 mm fl (in mid-March), 55.2 mm fl (late March), and 54.6 mm fl in mid-April (Lower Columbia Chum HGMP 2004). For the Duncan Creek and Ives Island Chum Recovery programs, fish are released at 1.0-1.5 grams or 50-55 mm fl on a staggered basis from mi-March through May (Bonneville Population of Columbia River Chum Salmon HGMP 2004). Chum from Duncan Creek appear to complete emigration by late April (Figure 1).

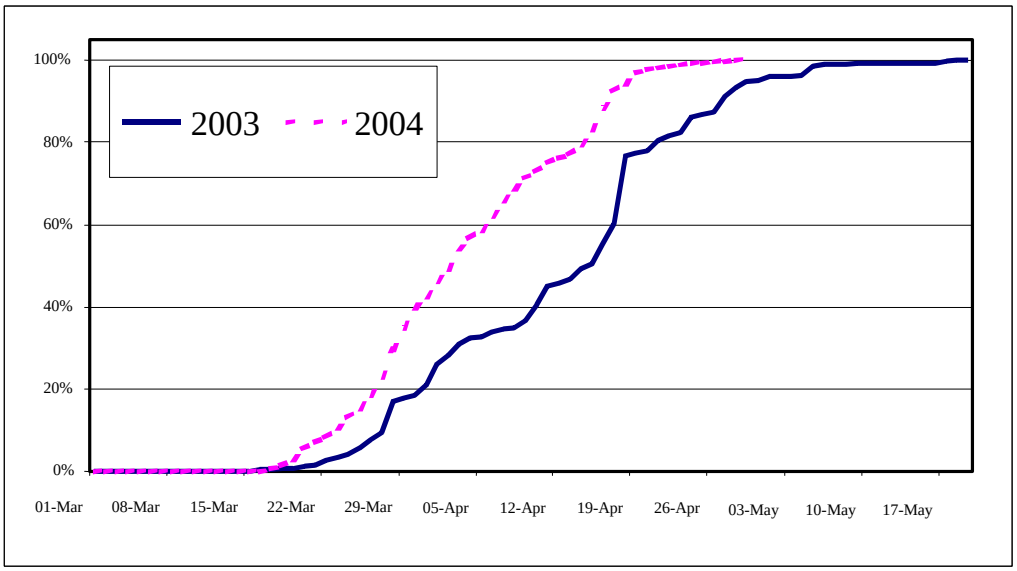

Figure 1. Emigration of listed chum from Duncan Creek Programs. The Grays River/Sea Resources Chum Restoration program is closely aligned with the Duncan Creek Program.

Listed coho (proposed):
Current lengths and data for proposed listed coho in the Chinook River is unknown. Depending on water temperatures, hatchery coho fry during the month of April can range from 42 – 40 mm fl and 50 mm fl in May (Elochoman Hatchery data 2001) Indirect take from predation and competition is unknown.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines.

- Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and at release.
- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population vacating with in a couple of days.
- Minimal residualism from WDFW coho programs following these guidelines has been indicated from snorkeling studies on the Elochoman River (Fuss 2000).

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once in the main stem, Witty et al. (1995) has concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. Evidence in estuarine and nearshore environments indicate that diets are often dominated by invertebrates. Durkin (1982) reported that diet of coho smolts (128-138 mm fl) in the Columbia River estuary was composed almost entirely of invertebrates without evidence of salmonids as prey. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean, in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring and evaluation and research programs: The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis Rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis and Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt-to-adult survival rates. Any take associated with monitoring activities

is unknown but all follow scientific protocols designed to minimize impact.

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).
In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. (See Take Tables at the end of this document for identified levels).

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.
Any additional mortality from this operation would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.
No data available

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 Sea Resources coho conservation program will be operated under the technical assistance of Washington State Department of Fish and Wildlife, US Fish and Wildlife Service and the Treaty Tribes. This program is consistent with the Columbia Basin System Planning Salmon and Steelhead Production Plan for salmon in the lower Columbia Sub-basin. Planners recommended that a combination of natural and hatchery production would be the optimal way to produce the most rapid sustainable improvement in salmonid runs. It assumed that the quickest way to rebuild the run would be to combine releases of an appropriate stock into improved habitat (WDF 1990). This approach is being applied in this program. For ESU-wide hatchery plans, the production of coho salmon from Sea Resources Facilities is consistent with:

- 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin
- 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin
- Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994)
- The *U.S. v. Oregon* Columbia River Fish Management Plan
- NWPPC Fish and Wildlife Program

For statewide hatchery plan and policies, hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. Sea Resources Program is closely aligned with these policies and technical assistance is provided. 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 Columbia hatchery operations with which the production of coho salmon from Sea Resources Hatchery is consistent with the following WDFW Policies*:*

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).

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).

Fish Health Policy in the Columbia Basin. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Policy Chapter 5, IHOT 1995).

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.

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

The recovery and supplementation program described in this HGMP is consistent with the following agreements and plans:

- The Sea Resources Chinook River Restoration and Recovery Plans
- The Columbia River Fish Management Plan
- U.S. vs. Oregon court decision
- Production Advisory Committee (PAC)
- Technical Advisory Committee (TAC)
- Integrated Hatchery Operations Team (IHOT)
- Pacific Northwest Fish Health Protection Committee (PNFHPC)
- In-River Agreements: State, Federal, and Tribal representatives
- Northwest Power Planning Council Sub Basin Plans
- Washington Department of Fish and Wildlife Wild Salmonid Policy

3.3 Relationship to harvest objectives.

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

The program has no harvest goal since it primary purpose at this time is stock recovery/supplementation and habitat restoration. Historically, exploitation rates of hatchery and wild fall chinook and coho were likely similar. Fall chinook and coho are an important target species in ocean and Columbia River commercial and recreational fisheries, as well as tributary recreational fisheries. Regulations for wild fish release have been in place for coho fisheries in recent years, and all coho released from the hatchery are adipose fin-clipped to allow for selective harvest. Specific hatchery-selective commercial and recreational fisheries in the lower Columbia target hatchery coho. Therefore, in recent years the exploitation rates of coho by commercial and recreational fisheries are higher for Sea Resources Hatchery coho than wild fish. Hatchery and wild fall chinook harvest rates remain similar and are constrained by ESA harvest limitations.

3.4 Relationship to habitat protection and recovery strategies.

In 1996, Sea Resources conducted a watershed analysis as part of the first stage of a restoration plan. This research was conducted by T.C. Dewberry. In the analysis, the dynamics of sediment and organic matter within the watershed was identified as the major limiting factor limiting salmonid production within the watershed. Sea Resources has been involved with many habitat improvement and protection efforts including road repair/bank stabilization in the upper watershed, bridge and culvert repairs and replacements, creating woody accumulation projects in the lower river, and native vegetation planting throughout the riparian areas of the watershed. Sea Resources is also a partner in a project with WDFW, Ducks Unlimited, USFWS, NRCS,WSU , and the Columbia Land Trust to restore 870 + acres of the lower Chinook River back to estuarine conditions. The potential benefits to these projects on natural production are expected to be significant. Reduction of sediment input in the upper watershed through stabilization of slopes, treeplanting, and culvert repair/replacement will dramatically reduce inputs of sediment, thus improving spawning success and trophic dynamic. The restoration of the lower Chinook River to

an estuary will greatly improve fish habitat. The removal of the tidegate under Highway 101 will allow saline tidal exchange which will extirpate non native species such as reed canary grass and centrarchids that are detrimental to salmonid production.

Sea Resources programs are consistent with area subbasin planning of Columbia River estuary tributaries (LCFRB Basin Planning Technical Volume 2 2004). Also consistent with WDFW conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP) which document barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Sea Resources coho program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) Salmonid and non-salmonid fishes or species that could negatively impact the program: Coho smolts can be preyed upon release through the entire migration corridor from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows (beginning at RM 4.0) and introduced spiny rays along the Columbia mainstem sloughs can predate on coho smolts. Also, avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons are predators. Mammals such as these can take a heavy toll on migrating smolts while harbor seals, river otters, sea lions and Orcas prey on returning adults.

(2) Salmonid and non-salmonid fishes or species that could be negatively impacted by the program: Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program. Other programs including chinook are released in the Chinook River system and natural production of resident and anadromous species could occur in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.). Accept for yearling stocks (coho), these species may serve as prey items during emigration through the basin. Hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Spawning adults originating from this program may provide a source of nutrients in oligotrohic coastal river systems 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 salmonids 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).

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. Coho smolts can be preyed upon release through the entire migration corridor from the river subbasin to the mainstem Columbia River, estuary and in the immediate ocean system by piscivorous salmon species. Northern pikeminnow, introduced spiny rays in the Columbia mainstem sloughs can predate on coho smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts and returning adults include: harbor seals, sea otters, sea lions and Orcas.

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 Sea Resources operation is operated entirely on water that is obtained from the Chinook River at a dam and intake 0.6 miles above the facility. The water is piped via gravity flow to the facility 0.6 miles downstream. The incubation room and raceways are supplied with gravity-fed Chinook River water which is delivered to the hatchery by a .9 km long by 38 cm diameter pipeline. A drop of 3 m occurs from the intake of the pipeline to the hatchery to provide the hatchery with almost 3 meters of head. Depending upon stream flows, and amount of in-water debris, the line can deliver up to 1,900 L of water/min to the hatchery.

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 facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit. All hatchery effluent from pond cleaning is discharged into a spare Burrows pond where the solids are allowed to settle out and are later used for fertilizer for native plant propagation. There is 1/8 in. screening on the hatchery water intake to prevent salmonid fry from entering the intake.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Barrier/Picket Weir with V-Trap for Capturing Adults	672	14.0	12.0	4.0	Seasonal Instream Flow
1	Instream Holding Area above Concrete Barrier/Picket Weir for Holding Adults	672	14.0	12.0	4.0	Seasonal Instream Flow

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

Fish are not transported, but are directly released from the Sea Resources rearing/acclimation units into the Chinook River. Transport equipment is not required for the program since all program activities are conducted on-site.

5.3 Broodstock holding and spawning facilities.

Broodstock may be held in one of two 12' x 12' holding pens, segregated by sex. Spawning is conducted at least twice per week in a primitive structure that provides shelter from the elements.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Barrier/Picket Weir with V-Trap for Capturing Adults	672	14.0	12.0	4.0	Seasonal Instream Flow
1	Instream Holding Area above Concrete Barrier/Picket Weir for Holding Adults	672	14.0	12.0	4.0	Seasonal Instream Flow

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Stacked Tray Incubation Units (2 half stacks- 10 trays total)	2	3	nya	5000	5000

5.5 Rearing facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
8	Fiberglass Raceways	256	16.0	4.0	4.0	30	nya	nya

5.6 Acclimation/release facilities.

Same as above, see section 5.5.

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

Significant mortality has occurred in the process of cleaning the sediment buildup in the Heath incubators. If the rubber stoppers are not secured properly they may pop out thus starving the trays below of water. Significant mortality also occurs during rearing due to bird predation, as Sea Resources has chosen not screen predators away from fingerling, even though kingfishers and herons take up to 25 percent of the coho over the course of the rearing cycle. Also cutthroat trout are able to access the ponds from the river via leaks that have occurred between the river and the Burrows Ponds. These leaks cannot be fixed because the river has aggraded over the years and the Burrows Ponds can no longer be completely drained.

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.

Staff person is available on-site 24/7. Water source is derived from the Chinook River via a single intake/pipeline to facility. Lost of the intake/pipeline would result in catastrophic loss of fish in program.

Section 6. Broodstock Origin and Identity

6.1 Source.

Since 2000, adults have been from returns of hatchery and natural fish.

6.2.1 History.

The following coho sources have been used in the Chinook River.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Chinook River Type S Coho	H	1996	Present
Chinook River Type S Coho	N	1968	Present
North Fork Lewis River Type S Coho (Speelyai Hatchery)	H	1992	1992
N.F. Toutle River Type S Coho (Toutle River Hatchery)	H	1994	1994
Elochoman River Type S Coho (Elochoman River Hatchery)	H	1996	1996

6.2.2 Annual size.

Escapement to the Chinook River has ranged from a high of 575 in 2002 to a low of 17 in 1998 (Warren 2004).

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

Past levels of natural fish have been based on the available escapement upstream from the Sea Resources facility. Staff will be maximizing natural available fish for the up coming year.

6.2.4 Genetic or ecological differences.

The program is collected from fish throughout the run and is representative of naturally spawning adults. Presently, there are no differences between hatchery fish and natural returns to the Chinook River.

6.2.5 Reasons for choosing.

The fish are representative of naturally spawning adults for supplementing the natural coho population.

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.

- Monitor adult collection trap at least five times per week, with never more than 48 hours between checks.
- Since 1996 50% or 50 pairs, whichever is greater, of the Sea Resources coho adults are released upstream to spawn naturally.

Section 7. Broodstock Collection

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

Adults only.

7.2 Collection or sampling design

Adult coho are captured at the Sea Resources facility from October through the last week of November with a weir trap. The weir trap captures the majority of the returning coho at low flows. During high flows there is a channel in which the coho can bypass the weir. Adults are randomly selected for broodstock from the spawning population over the entire run. The random selection of fish is representative of the population, and should assure the long-term fitness of the population components. Adults are seined and sorted for ripeness each day or every other day depending on daily returns. Un-ripe adults are transferred to adult holding structures above the weir/trap.

7.3 Identity.

The current returns are from early coho (Type S) programs. Past releases of S type coho in this system are N.F. Lewis, N.F.Toutle and the Grays River.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults): Up to 50 adults if needed.

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

Year	Females	Males *	Jacks*
2000	12	8 (19)	(3)
2001	6	6 (7)	(6)
2002	9	(12)	
2003	18	18	(5)

Note: Sea Resources staff partially live spawns males and jacks and releases fish upstream. Number in parenthesis indicates live spawned and releases.

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

Since 1996 one-half or 50 pairs, whichever is greater, of the Sea Resources coho adults are released upstream to spawn naturally. All hatchery origin coho are adipose fin clipped.

7.6 Fish transportation and holding methods.

Fish do not need to be transported.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete Barrier/Picket Weir with V-Trap for Capturing Adults	672	14.0	12.0	4.0	Seasonal Instream Flow
1	Instream Holding Area above Concrete Barrier/Picket Weir for Holding Adults	672	14.0	12.0	4.0	Seasonal Instream Flow

7.7 Describe fish health maintenance and sanitation procedures applied.

Fish are solely derived from Chinook River broodstock and associated eggs/juveniles. No fish transfer into the Chinook watershed have been employed since 1996. Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection and broodstock holding and disposal of carcasses.

7.8 Disposition of carcasses.

When the adult fish are spawned their carcasses are distributed throughout the river to provide critical nutrients to support productivity of the river's food web.

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.

- There is no data to determine if current returns have diverged from the Grays River population (genetically or in life history characteristics), but the program collects adults from through out the run timing and is representative of naturally spawning adults.
- The trap is checked a minimum of five times a week, with never more than 48 hours between checks, in order to minimize impacts to listed fish.
- All fish not needed for broodstocking are immediately passed upstream.
- Out-of-basin coho are not be used in the program.

Section 8. Mating

8.1 Selection method.

Spawners are chosen randomly from ripe fish on at least a twice-weekly basis throughout the entire run.

8.2 Males.

All jacks are either spawned or released upstream in proportion to the adult return.

8.3 Fertilization.

For small takes, Utilize two-by-two factorial spawning methods. Collect broodstock to represent the timing and distribution of the run.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

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

Listed fish are not included in the mating scheme.

Section 9. Incubation and Rearing.

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

Data is currently unavailable but a 90% egg-to-fry survival rate will be the goal.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Perfor-mance Std.	Fry-fingerling Survival (%)	Rearing Survival Perfor-mance Std.	Fingerling-Smolt Survival (%)
1990	12250	nya	nya	nya	nya	nya	nya
1991	140750	nya	nya	nya	nya	nya	nya
1992	0	nya	nya	nya	nya	nya	nya
1993	27000	nya	nya	nya	nya	nya	nya
1994	50000	nya	nya	nya	nya	nya	nya
1995	0	nya	nya	nya	nya	nya	nya
1996	12000	nya	nya	nya	nya	nya	nya
1997	32600	nya	nya	nya	nya	nya	nya
1998	13060	nya	nya	nya	nya	nya	nya
1999	61823	nya	nya	nya	nya	nya	nya
2000	55828	nya	nya	nya	nya	nya	nya
2001	30723	nya	nya	nya	nya	nya	nya
2002	32799						
2003	9603						

9.1.2 Cause for, and disposition of surplus egg takes.

Outside of securing enough eggs for approximately 50,000 fish for Sea Resources and 500 for the Peterson Fry Project, excess eggs are not taken.

9.1.3 Loading densities applied during incubation.

Eggs are loaded at approximately 50% of capacity in the Heath Trays.

9.1.4 Incubation conditions.

Sediment, temperature and dissolved oxygen are monitored.

9.1.5 Ponding.

After button up, fish are placed in rearing raceways for rearing.

9.1.6 Fish health maintenance and monitoring.

Temperature units are monitored. Information is noted onto Sea Resources forms, and electronically entered into the Sea Resources database. Dead/undeveloped eggs are disposed into dumpster/local landfill.

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 program is a recovery/supplementation program for the stock, and families in the program are not culled; all eggs/juveniles are required.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

Data is currently unavailable but a 90% fry to smolt survival rate will be the goal.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Perfor-mance Std.	Fry-fingerling Survival (%)	Rearing Survival Perfor-mance Std.	Fingerling-Smolt Survival (%)
1990	12250	nya	nya	nya	nya	nya	nya
1991	140750	nya	nya	nya	nya	nya	nya
1992	0	nya	nya	nya	nya	nya	nya
1993	27000	nya	nya	nya	nya	nya	nya
1994	50000	nya	nya	nya	nya	nya	nya
1995	0	nya	nya	nya	nya	nya	nya
1996	12000	nya	nya	nya	nya	nya	nya
1997	32600	nya	nya	nya	nya	nya	nya
1998	13060	nya	nya	nya	nya	nya	nya
1999	61823	nya	nya	nya	nya	nya	nya
2000	55828	nya	nya	nya	nya	nya	nya
2001	30723	nya	nya	nya	nya	nya	nya
2002	32799						
2003	9603						

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

The loading density goal for Sea Resources programs is to try to rear the fish at less than one-half a pound of fish per gallon per minute for the majority of their rearing period and thus never exceed the loading value recommended by Piper et al. (1982).

9.2.3 Fish rearing conditions.

Sea Resources has been monitoring water quality at eight sites within the Chinook watershed since June 2000. Measured parameters include water temperatures, salinity, conductivity, turbidity, pH, dissolved oxygen and flow. All physical parameters are measured at each site once per week from May 1 – September 30 and twice monthly from October 1 – April 30. Flow is measured five times per week at the Sea Resources facility. Fish in the program are fed diets at feeding rates specified by the manufacturer and WDFW to achieve specified size/wt at various milestones in the rearing cycle. Rearing units are cleaned at least once per week.

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.

Unavailable

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

Unavailable

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*).

Sea Resources Feed Rates:

Rearing Period	Food Type	Application Schedule (# feedings/day)	Feeding Rate Range (%B.W./Day)	Lbs. Fed Per gpm of Inflow	Feed Conversion
Feb-Mar	Moore Clark Nutra #0	8	2.5	0.06	1.0:1.36
Mar-Apr	Moore Clark Nutra #1	6	2.5	0.08	1.0:1.8

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

Fish health and disease condition will be continuously monitored in compliance with Co-manager Fish Health Policy standards (WDFW and WWTIT 1998).

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

The migratory state of the release population is determined by behavior , condition factor , physical appearance and other criteria.

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

Sea Resources is planning on using tree branches as cover over the rearing pond and is currently in the process of experimentation on the aquaculture of native amphipods to at least supplement our standard feed with a more natural feed. In addition, Sea Resources is going to install an underwater feeding system to feed our fish more naturally.

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.

- Fish are released at a specific time and release as prescribed in the program.
- The time of releases for program fish lies within the natural seasonal migratory pattern of Chinook River naturally produced stock.
- Fish are solely derived from Chinook River broodstock and associated eggs/juveniles. No fish transfers into the Chinook watershed have been employed since 1996.
- Fish are released directly into the Chinook River. The direct release of program fish lies within the natural outmigration window of naturally produced fish.

Section 10. Release

10.1 Proposed fish release levels.

For 2004, up to 52,500 sub-yearlings and yearlings can be released although releases in the past have been much smaller.

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

Fish are released from the Sea Resources Hatchery located at RKm 7.7 on the Chinook River. An option exists where fish can be trucked downstream approximately 3 Km from the Sea Resources Hatchery to reduce predation losses and expedite their movement into Baker Bay and toward the Pacific Ocean.

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

	Fingerling Release			Yearling Release		
Release Year	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1991	11600	nya	50	nya	nya	nya
1992	622300	nya	31	nya	nya	nya
1993	180000	nya	69	nya	nya	nya
1994	2000	nya	467	nya	nya	nya
1995	510000	nya	500	nya	nya	nya
1996	0	nya	nya	0	nya	nya
1997	47598	nya	250	nya	nya	nya
1998	nya	nya	nya	47099	nya	23
1999	nya	nya	nya	2289	nya	8.5
2000	0	nya	nya	0	nya	nya
2001	nya	nya	nya	28850	nya	29
2002	nya	nya	nya	3420	nya	22
2003				1,284		24
Avg	nya	nya	nya	nya	nya	nya

10.4 Actual dates of release and description of release protocols.

Releases are held until after the chum program and natural outmigration emigration period has occurred. Releases of coho occur in June (pers. comm.Garth Gale 2004).

10.5 Fish transportation procedures, if applicable.

Transport equipment is not required for the program since all program activities are conducted on-site.

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

Fish have been reared to a yearling phase at Sea Resources Hatchery and have been acclimated on Chinook River water.

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

Releases are mass marked (adipose fin-clipped).

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

The release goal of 52,500 is a maximum number. Additional eggs are not taken to cover any shortages due to incubation, rearing and predation losses.

10.9 Fish health certification procedures applied pre-release.

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

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

In the event of flooding, rearing fish will simply end up in the Chinook River, their intended destination. In the event of water system failure, fish may be released early into the Chinook River directly from the rearing ponds.

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.

- Fish are volitionally released at a size, life stage and historical time period that promotes rapid migration.
- Release numbers are based on the amount of natural spawners that have been utilizing the natural stream.
- Location of the hatchery releases are low in the Chinook River watershed.
- Fish are solely derived from Chinook River broodstock and associated eggs/juveniles. No fish transfer into the Chinook watershed have been employed since 1996.
- Smolt releases are usually done on a weekly basis throughout the aforementioned time period to lessen the effects of hatchery coho releases on the limited food resources of the lower Chinook River.
- Smolt can be released of varying sizes to reduce competition and predation impact.
- Releases are held to June to ensure that listed chum have vacated the system.
- Fry plants have been discontinued to eliminate sub-yearling competition in the Chinook River.

Section 11. Monitoring and Evaluation of Performance Indicators

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

Salmonids are captured with two screw traps. One full sized trap at the tidegate at the Highway 101 bridge, and one ½ screw trap at the Sea Resources facility. The purpose of these traps is to determine the overall salmonid production of the watershed and to better understand the life histories of the fish within the watershed. The traps are operated at least four times per week from January through June. Fish captured in the trap are identified, measured, weighed, and scale samples are removed, and released. On a weekly basis trap efficiency tests are performed. To mark the fish to test trap efficiency we cut a small piece off of the caudal fin and release the fish approximately ¼ mile upstream. No other marks or tags are applied to the fish.

Salmonid production is also monitored on a yearly basis through snorkel counts every June.

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

Staff is funded and available through annual grants to Sea Resources that support Chinook River habitat assessment/rehabilitation and stock assessment (hatchery and natural).

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.

Technical guidance form WDFW and Tribal Co-Managers

Section 12. Research

12.1 Objective or purpose.

(1) Determine factors that limit/effect production of coho in the Chinook River watershed. (2) Determine the productivity and carrying capacity of coho salmon in the Chinook River watershed.

12.2 Cooperating and funding agencies.

Sea Resources, Inc.
Washington Department of Fish and Wildlife
U.S. Fish and Wildlife Service

12.3 Principle investigator or project supervisor and staff.

Garth Gale, Sea Resources Fish Biologist
Robert Warren, Sea Resources Executive Director

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

Chinook River Chum Salmon

Chinook River Coho Salmon

Chinook River Fall Chinook Salmon

Chinook River Cutthroat Trout

Chinook River Steelhead Trout

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

Salmonids are captured with two screw traps. one full sized trap at the tidegate at the Highway 101 bridge, and one ½ screw trap at the Sea Resources facility. The purpose of these traps is to determine the overall salmonid production of the watershed and to better understand the life histories of the fish within the watershed. The traps are operated at least four times per week from January through June. Fish captured in the trap are identified, measured, weighed, and scale samples are removed, and released. On a weekly basis trap efficiencies are performed to determine the efficiency of the traps. To mark the fish to test trap efficiency we cut a small piece off of the caudal fin and release the fish approximately ¼ mile upstream. No other marks or tags are applied to the fish. Salmonid production is also monitored on a yearly basis through snorkel counts every June.

12.6 Dates or time periods in which research activity occurs.

January 1-June 30

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

Live fish are held in the livebox between trap checks, they are held in the live box for no more than 24 hours, and live fish are not transported from either trapping location.

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

Occasionally dead fish are found in the smolt traps. This mortality likely occurs because of the mechanical spinning action of the smolt traps.

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10 Alternative methods to achieve project objects.

None

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

Chinook River Coastal Cutthroat Trout

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.

Section 13. Attachments and Citations

13.1 Attachments and Citations

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Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Take Table 1. Estimated listed salmonid take levels by hatchery activity.

Chum

ESU/Population	Lower Columbia River Coho
Activity	Sea Resources – Chinook River Type S Coho Salmon Recovery Program
Location of hatchery activity	Sea Resources Hatchery
Dates of activity	September – October
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0-1*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	0	nya
Intentional lethal take (f)	0	0	0	nya
Unintentional lethal take (g)	0	0	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

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 2. Estimated listed salmonid take levels by hatchery activity.

Fall Chinook

ESU/Population	Lower Columbia River Chinook
Activity	Sea Resources – Chinook River Type S Coho Salmon Recovery Program
Location of hatchery activity	Sea Resources Hatchery
Dates of activity	September – October
Hatchery Program Operator	Sea Resources Facility

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0-1*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	0	nya
Intentional lethal take (f)	nya	nya	0	nya
Unintentional lethal take (g)	nya	nya	0	nya
Other take (specify) (h)	nya	nya	nya	nya

*Sea Resources operates a fall Chinook recovery program also. Trapping of Chinook is concurrent with this coho program.

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 3. Estimated listed salmonid take levels by hatchery activity.

Coho (Proposed)

ESU/Population	Lower Columbia River Coho
Activity	Sea Resources – Chinook River Type S Coho Salmon Recovery Program
Location of hatchery activity	Sea Resources Hatchery
Dates of activity	September – October
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	Up to 30*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	Up to 30*	nya
Intentional lethal take (f)	Up to 52,500*	Up to 52,500*	Up to 30*	nya
Unintentional lethal take (g)	Up to 4725*	Up to 4725*	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

*Sea Resources balances the program with escapement upstream.

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.