ENTRIX

HATCHERY AND GENETIC MANAGEMENT PLANS FOR RUSSIAN RIVER FISH PRODUCTION FACILITIES COHO SALMON AND STEELHEAD

Prepared for:

U.S. Army Corps of Engineers
San Francisco, California

National Marine Fisheries Service
Santa Rosa, California

California Department of Fish and Game
Sacramento, California

Prepared by:

FISHPRO, INC.
Portland, Oregon

In association with:

ENTRIX, INC.
Walnut Creek, California

September 13, 2002

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BKD	bacterial kidney disease
BO	biological opinion
CDFG	California Department of Fish and Game
cfs	cubic feet per second
CCC	Central California Coast
CRWG	Coho Recovery Work Group
CVFF	Coyote Valley Fish Facility
DCFH	Don Clausen Fish Hatchery
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWS	Emergency Water Supply
gpm	gallons per minute
GIS	Geographic Information System
HGMP	Hatchery and Genetic Management Plan
M&E	Monitoring and Evaluation Plan
MEPS	minimum effective population size
MOU	Memorandum of Understanding
MSL	mean sea level
NGVD	National Geodetic Vertical Datum
NPPC	Northwest Power Planning Council
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PG&E	Pacific Gas and Electric
RRCSRP	Russian River Coho Salmon Recovery Program
RWQCB	North Coast Regional Water Quality Control Board
SAR	smolt-to-adult return
SCWA	Sonoma County Water Agency
SEC	Steiner Environmental Consulting

TOC	Technical Oversight Committee
TRT	Technical Recovery Team
USACE	U.S. Army Corps of Engineers
USGS	Unites States Geological Survey
WSE	water surface elevation
YOY	young of the year

1.0
INTRODUCTION

The Don Clausen Fish Hatchery (DCFH) and Coyote Valley Fish Facility (CVFF) are existing fish production facilities located in the Russian River basin of northern California. The facilities are owned by the U.S. Army Corps of Engineers (USACE), and operated by the California Department of Fish and Game (CDFG) under a cooperative agreement with the USACE. Like all anadromous fish hatcheries in California, the Russian River facilities were developed to mitigate for the loss of spawning and rearing habitat resulting from the construction of dams (CDFG and NMFS 2001). Fish production goals for DCFH were established in 1974 to compensate for the estimated loss of steelhead and coho salmon production behind the Warm Springs Dam, and additional fish production capabilities were included in the hatchery program goals to enhance harvest opportunities for Chinook salmon and coho salmon (USFWS 1978). Fish production goals for CVFF were established in 1984 to compensate for the estimated loss of steelhead production behind Coyote Valley Dam (USACE 1986). The DCFH and CVFF facilities went into service in 1980 and 1992, respectively.

Between 1996 and 1999, the wild populations of steelhead, coho salmon, and Chinook salmon that include those found in the Russian River basin were listed as threatened under the Federal Endangered Species Act (ESA). (Hatchery-produced fish of these species were not included in the listing.) Federal agencies such as USACE are required under the ESA to consult with the Secretary of Commerce to insure that their actions are not likely to jeopardize the continued existence of protected species or adversely modify or destroy critical habitat. Since hatchery operations have the potential to adversely affect these protected populations, the Russian River hatchery activities have been included in an ESA Section 7 consultation between USACE, the Sonoma County Water Agency (SCWA) and the National Marine Fisheries Service (NMFS).

The Section 7 consultation is evaluating existing hatchery operations as well as alternative programs that have the potential to reduce effects on protected salmonids within the Russian River basin. At present, it is very difficult to quantitatively assess the effects of hatchery operations, since there are few data available regarding natural production in the basin and limited information regarding hatchery performance. As a consequence, three concurrent components were developed to assist in the evaluation and selection of a preferred hatchery program alternative. The following provides a brief description of the objectives for each component:

- A Monitoring and Evaluation (M&E) Plan (FishPro, Inc. and ENTRIX, Inc. 2002) provides a framework for activities necessary to detect and evaluate the success of the hatchery program and any impairment of the recovery of protected populations.

- A Benefit / Risk Analysis (BRA) (FishPro, Inc. and ENTRIX, Inc. 2002) assesses whether artificial propagation is an appropriate method to use to supplement natural populations of steelhead, coho salmon and Chinook salmon. The assessment was based on existing information regarding population status within the basin and simultaneously identifies critical uncertainties to be addressed through future monitoring and evaluation efforts.

- A Hatchery and Genetic Management Plan (HGMP) provides a single, comprehensive source of information regarding the proposed hatchery program for each species. It is anticipated that the HGMP will provide the basis for co-management discussion and decisions regarding implementation of a revised hatchery production program within the Russian River basin.

NMFS anticipates using HGMPs to evaluate take associated with hatchery operations pursuant to its 4(d) rules for coho salmon, steelhead, and Chinook salmon for hatcheries with approved HGMPs. Therefore, an HGMP for Russian River fish production facilities has been developed for the NMFS, CDFG, and USACE to support the ESA Section 7 consultation process.

This document presents a draft HGMP for steelhead and coho salmon for the Russian River fish production facilities. Presentation is in the standard NMFS format for an HGMP. No hatchery production for Chinook salmon is proposed at this time.

A definition of terms referenced in the HGMP template is provided in Appendix 1.

2.1 GENERAL PROGRAM DESCRIPTION

2.1.1 NAME OF HATCHERY OR PROGRAM

Don Clausen Fish Hatchery (DCFH) Steelhead Program.

2.1.2 SPECIES AND POPULATION (OR STOCK) UNDER PROPAGATION, AND ESA STATUS

Steelhead Trout (*Oncorhynchus mykiss*), Russian River Hatchery Stock. This hatchery steelhead stock is not listed under the Endangered Species Act (ESA), as the threatened Central California Coast (CCC) steelhead ESU excludes all hatchery stock.

2.1.3 RESPONSIBLE ORGANIZATION AND INDIVIDUALS

Lead Contact

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On-site Operations Lead

Name (and title):	E. Royce Gunter, Jr., Senior Hatchery Supervisor
Agency:	California Department of Fish and Game
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Other agencies, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

None.

2.1.4 FUNDING SOURCE, STAFFING LEVEL, AND ANNUAL HATCHERY PROGRAM OPERATIONAL COSTS

The DCFH steelhead program is funded by the U.S. Army Corps of Engineers (USACE), San Francisco District. Operations and maintenance activities for the program are conducted by the California Department of Fish and Game (CDFG). The staffing level includes:

- seven permanent positions, consisting of one Senior Hatchery Supervisor, one Fish Hatchery Manager I, four Fish and Wildlife Technicians and one Office Technician; and

- four temporary positions.

The annual budget for the DCFH program in recent years has averaged around $1,150,000 dollars. This value includes the budgets for both the coho and steelhead programs conducted at DCFH, and it also includes approximately $400,000 expended annually for the steelhead satellite program conducted at the Coyote Valley Fish Facility (CVFF).

2.1.5 LOCATION(S) OF HATCHERY AND ASSOCIATED FACILITIES

Main facility: The DCFH (also referred to as the Warm Springs Fish Hatchery) is located on Dry Creek at the base of Warm Springs Dam, within the Sonoma County portion of the Russian River basin of northern California. The hatchery is located approximately 14.4 miles upstream of the confluence of Dry Creek and the mainstem Russian River, which in turn is approximately 33 miles upstream of the mouth of the Russian River. The GIS coordinates of DCFH are:

038° 43’ 9.05” N

123° 00’ 9.45” W

Elevation: 206 feet

Satellite facility: The CVFF is a satellite facility for the steelhead program at DCFH located on the East Fork Russian River at the base of Coyote Valley Dam, within the Mendocino County portion of the Russian River basin of northern California. CVFF is located approximately one mile upstream of the confluence of the West Fork and East Fork branches of the Russian River, which in turn is approximately 96 miles upstream of the mouth of the Russian River. The GIS coordinates of CVFF are:

039° 11’ 51.26” N

123° 11’ 3.95” W

Elevation: 633 feet

2.1.6 TYPE OF PROGRAM

The DCFH steelhead program is an “Isolated Harvest” program, based on the definitions provided in Attachment 1 of the HGMP template (see Appendix 1). The definition states that an isolated harvest program is a "project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population."

2.1.7 Purpose (Goal) of Program

The purpose of this program is mitigation, to compensate for lost habitat capacity of naturally-producing steelhead resulting from the construction of the Warm Springs and Coyote Valley dams. The program uses artificially-produced steelhead to provide harvest opportunities and a source for program broodstock.

2.1.8 Justification for the Program.

The justification for the "harvest" component of this isolated harvest program is to compensate for the loss of steelhead populations that occurred to allow for the development of the Lake Sonoma Project and the Lake Mendocino Project. It has been estimated that prior to the construction of Warm Springs Dam, the subbasin supported a run of approximately 8,000 steelhead (CDFG 1970). (However, insufficient data exist to support these estimates.) In the development of the mitigation goals for DCFH, it was stated that approximately 75 percent of the steelhead (6,000) were believed to spawn in sections of Dry Creek and its tributaries that are now upstream of the dam (CDFG 1970). The remaining 2,000 steelhead were assumed to contribute to the recreational fishery (USFWS 1978). In similar fashion, the size of the adult steelhead run into the upper Russian River sub-basin was never quantitatively estimated. Nonetheless, in the process of determining mitigation goals for the Lake Mendocino Project, it was estimated that the sub-basin upstream from Coyote Valley Dam supported a run of 4,000 steelhead prior to construction of the dam.

In basic theory, a mitigation program is intended to replace lost production capacity with a comparable production capacity located in one or more hatchery facility. In the case of the DCFH and CVFF anadromous salmonid mitigation programs, this lost production capacity occurs only for those portions of the life cycle that involves spawning, egg incubation, and freshwater rearing. As a consequence, an implication of any anadromous mitigation program is that habitat quality and capacity associated with the remaining life stages (*i.e.* with mainstem migration and ocean rearing) must be sufficient to support the program production levels. Furthermore, today's environmental policies and management principles will generally require that the mitigation releases produce no effect to any natural populations, especially those threatened and endangered species given special protection under the ESA.

The justification for the "isolated" component of this isolated harvest program lies in the current uncertainty regarding genetic divergence that may have occurred between the natural and hatchery stocks within the Russian River basin. Research regarding the genetic stock structure of Central California Coastal steelhead (including both natural and hatchery stocks of the Russian River basin) is underway at both the National Marine Fisheries Service (NMFS) Santa Cruz Laboratory (NMFS 2000) and at Sonoma State University (2000). In the recent review of California's anadromous salmonid hatcheries, it was recommended that until the appropriate "founding stock" can be identified that would be most appropriate for an integrated harvest program, the DCFH and CVFF steelhead program should continue to operate as an isolated program (CDFG and NMFS 2001).

2.1.9 List of Program "Performance Standards"

The following performance standards have been adapted from a list developed by the Northwest Power Planning Council (NPPC) as means of assessing the benefits and risks of artificial production programs (NPPC 1999). Only those standards that are relevant to an isolated harvest program (such as the DCFH and CVFF steelhead program) are included in the list.

Performance Standards Addressing Benefits of the Program

B1. Provide a predictable and stable opportunity for harvest.

B2. Provide fish for harvest in a manner that eliminates effects on wild populations.

B3. Fulfill mitigation/policy obligations.

B4. Achieve within-hatchery performance standards.

B5. Enhance local, state, regional, and national economies.

Performance Standards Addressing Risks of the Program

R1. Implement a harvest management plan to protect weak populations where mixed population fisheries exist.

R2. Assess detrimental genetic effects among hatchery vs. wild where interaction exists.

R3. Assure there is a predictable egg supply to avoid poor programming of hatchery production.

R4. Evaluate habitat use and potential detrimental ecological interactions.

R5. Assure that program does not exceed the carrying capacity of fluvial, lacustrine, estuarine, and ocean habitats.

R6. Evaluate effect on life history traits of wild and hatchery fish, from harvest and spawning escapement.

R7. Avoid disease transfer from hatchery to wild fish.

R8. Assure that production cost of program does not outweigh the benefit.

R9. Assure that cost effectiveness of hatchery does not rank lower than other actions in subregion or subbasin.

2.1.10 LIST OF PROGRAM "PERFORMANCE INDICATORS," DESIGNATED BY "BENEFITS" AND "RISKS"

2.1.10.1 "Performance Indicators" Addressing Benefits

The following performance indicators have been recommended by the NPPC as means of assessing the performance standards addressing hatchery benefits (NPPC 1999). Only those indicators that are relevant to an isolated harvest program are included in the list.

Performance Standard B1: Provide a predictable and stable opportunity for recreational harvest.

Performance Indicators:

B1A. The program will implement data collection and analysis to assess contribution to the recreational fishery. After five years of data collection, the analysis will be expanded to provide an annual assessment of whether the fishery has an increasing, stable, or decreasing trend line. Data collections will assess:

- catch / unit effort / year
- catch #'s / harvest / year
- units of effort / year
- established baseline at Year One, compare with 5 year survey

Performance Standard B2: Provide fish for harvest in a manner that eliminates impacts on wild populations.

Performance Indicators:

B2A. Develop harvest management plan for hatchery fish.

B2B. Compute ratio of wild fish to harvest.

- Evaluate trend analysis of past/present hatchery contributions to harvest.
- Define an upper maximum ratio of wild fish allowed in the harvest.

B2C. Document total harvest of hatchery fish.

- Use appropriate techniques of selective harvest and rearing by separation in time, space, gear and hatchery fish identification, where appropriate.

B2D. Determine that total harvest of wild steelhead does not exceed upper maximum of absolute number of wild fish.

B2E. Assure that hatchery broodstock goals are met 4 out of 5 years ± 10 percent.

Performance Standard B3: Fulfill mitigation goals.

Performance Indicator:

B3A. Mitigation goals of the hatchery are met.

This performance indicator warrants discussion between the USACE and relevant fisheries agencies including CDFG and NMFS. The existing mitigation agreements developed for both DCFH and CVFF includes goals for both juvenile releases and adult returns, yet these two goals may be in conflict with one another due to environmental conditions that are beyond the control of the hatchery. Furthermore, the mitigation agreements include production goals for Chinook and coho enhancement that have been discontinued under an interim operating agreement. The mitigation goals of the USACE should be formally revised to reflect the current program and to provide objectives that are realistic and feasible under today's environmental and regulatory conditions. Without this action, it will not be possible to provide a concise measure that indicates fulfillment of the mitigation goals.

Performance Standard B4: Achieve within-hatchery performance standards.

B4A. Hatchery performance standards established in the DCFH / CVFF Management Plan are achieved.

B4B. Relevant state-wide hatchery performance standards are achieved at DCFH and CVFF.

Performance Standard B5: Enhance local, state, regional, and national economies.

Performance Indicators:

B5A. Establish increasing trend in the value of harvest by documenting:

- sport fisheries value
- opportunity or angler days translated to dollars
- production cost of hatchery fish harvested

B5B. Develop an overall economic impact assessment to compute direct, indirect and induced effects from Russian River hatchery production.

2.1.10.2 "Performance Indicators" Addressing Risks

The following performance indicators have been recommended by the NPPC as means of assessing the performance standards addressing hatchery risks (NPPC 1999). Only those indicators that are relevant to an isolated harvest program are included in the list.

Performance Standard R1: Implement a harvest management plan to protect weak populations where mixed population fisheries exist.

Performance Indicators:

R1A. Assure that maximum allowable effect to weak populations is not exceeded in 4 out of 5 years by ±10 percent.

R1B. Monitor life history characteristics of weak populations for change from baseline by comparing at year 1 with 5-year survey or after one generation.

R1C. Evaluate maintenance of unique life history characteristics by comparing baseline at year 1 with a 5-year survey, or after one generation. Characteristics to be measured:

a. Age composition

b. Fecundity (#, and size)

c. Body size (size, length, weight, age, maturity index)

d. Sex ratio

e. Juvenile migration timing

f. Adult run timing

g. Distribution and straying

h. Time and location of spawning

i. Food habits

R1D. Document that natural population escapement goal not adversely affected in 4 out of 5 years ± 10 percent for specific species and populations.

Performance Standard R2: Assess detrimental genetic impacts among hatchery vs. wild where interaction exists.

Performance Indicators:

R2A. Initially, it is assumed that stray rate is a surrogate for a thorough and more complex measurement of genetic effect.

1. Evaluate hatchery population against standard stray rate (<5 percent non-indigenous populations; <20 percent indigenous populations – NMFS standard).

R2B. More specific measurements to be implemented on a selected basis:

1. Experimental design for evaluating genetic effects in consultation with NMFS.
2. Measure introgression by comparing allele frequencies between hatchery and wild.
3. Implement an appropriate experimental design to quantitatively measure outbreeding depression.
4. Conduct M&E on selected basis at a specific hatchery and/or on selected species.

Performance Standard R3: Assure there is a predictable egg supply to avoid poor programming of hatchery production.

Performance Indicators:

R3A. Achieve egg take goal in 4 out of 5 years.

Performance Standard R4: Evaluate habitat use and potential detrimental ecological interactions.

Performance Indicators:

R4A. For selected tributaries – conduct comparative evaluation of stocked areas with unstocked areas by measuring some of these parameters:

1. Evaluate emigration rate of stocked steelhead and naturally-reproducing anadromous populations.
2. Conduct comparative evaluation of rearing densities (# / m2) by habitat before and after stocking.
3. Compute growth rate, condition factor, and survival of 1 above.
4. Evaluate direct intra- and inter-specific competitive interaction between stocked steelhead and wild fish.
5. Conduct snorkel surveys to quantify microhabitat partitioning by species.
6. Compute prey composition in diet of 1 above.
7. Determine predation rate on stocked steelhead by fish, and by birds and mammals if believed to be significant.

R4B. Implement tributary M&E plan by subbasin, and extrapolate to other subbasins in the basin.

R4C. Develop M&E plan for estuary and near shore marine habitat, implementing experimental design recommended by NMFS.

Performance Standard R5: Assure that program does not exceed the carrying capacity of fluvial, lacustrine, estuarine, and ocean habitats.

Performance Indicators:

R5A. Develop an appropriate freshwater M&E plan.

1. Conduct snorkel survey to quantify microhabitat partitioning.
2. Evaluate emigration rate, growth, food habits, condition factor, and survival rate.
3. Conduct control vs. treatment carrying capacity evaluation, estimating #/m2 by year class by habitat type.

R5B. Develop a reservoir, estuarine, and ocean research, monitoring, and evaluation plan.

Performance Standard R6: Evaluate impact on life history traits of wild and hatchery fish, from harvest and spawning escapement.

Performance Indicators:

R6A. Document stable or increasing trend of redd counts as index of natural spawning.

R6B. Document stable or increasing numbers of adult fish.

R6C. Document hatchery spawner to recruit ratio equal to or greater than 1.

Performance Standard R7: Avoid disease transfer from hatchery to wild fish.

Performance Indicators:

R7A. Establish comparative annual sampling of disease in hatchery and wild populations.

R7B. Comply with CDFG standards and NMFS guidelines.

R7C. Apply disease standards to stocking activities, including acclimation ponds and direct releases.

R7D. Evaluate incidence of drug resistant pathogens by comparing to baseline in year 1 to survey every five years.

Performance Standard R8: Assure that production cost of program does not outweigh the benefit.

Performance Indicators:

R8A. Evaluate trends in the ratio of hatchery juvenile production cost to the cost of juvenile production from habitat projects. A target ratio is equal to or less than 1 in 4 out of 5 years ± 10 percent.

Performance Standard R9: Assure that cost effectiveness of hatchery does not rank lower than other actions in subregion or subbasin.

Performance Indicators:

R9A. Develop cost effective methods of producing benefits to recreation fishery such as:

1. Cost per angler day.
    a. Habitat and fish passage compared to hatchery.
    b. Self-sustaining population compared to continuing artificial production.
2. Cost per experience (economic assessment).
3. Cost per fish harvested in the recreational fishery.

R9B. Achieve highest numerical ratio of returning adults per cost of action (habitat, passage, hatchery).

R9C. Achieve highest ratio of intrinsic social value (satisfaction survey) of returning adults per cost of action.

2.1.11 Expected Size of Program

2.1.11.1 Proposed Annual Broodstock Collection Level (Maximum Number of Adult Fish)

Broodstock	DCFH	CVFF
Females	180	120
Males (including jacks)	540	360

2.1.11.2 Proposed Annual Fish Release Levels (Maximum Number) by Lifestage and Location

Life Stage	Release Location	Annual Release Level
Eyed Eggs	NA	0
Unfed Fry	NA	0
Fry	NA	0
Fingerling	NA	0
Yearling - DCFH	Dry Creek (Yoakim Bridge)	300,000
Yearling - CVFF	E. Fork Russian River (CVFF)	200,000

2.1.12 CURRENT PROGRAM PERFORMANCE, INCLUDING ESTIMATED SMOLT-TO-ADULT SURVIVAL RATES, ADULT PRODUCTION LEVELS, AND ESCAPEMENT LEVELS. INDICATE THE SOURCE OF THESE DATA.

The only data currently available to evaluate performance is the adult returns to each hatchery; harvest and stray rates are unknown. The estimated smolt-to-adult return (SAR) values presented below assume a rigid 3-year age at return. Three values of fingerling to yearling survival are presented, since no data are known that measured this parameter; however, fingerling releases were discontinued in 1999. Existing mitigation agreements define goals for yearling releases (300,000 at DCFH and 200,000 at CVFF) as well as adult escapement go that assume a 2 percent SAR (6,000 adults to DCFH and 4,000 adults to CVFF). Actual steelhead escapement to DCFH and CVFF suggests the SAR for the Russian River system is more likely to be near 1 percent.

DCFH Steelhead Fingerling			**DCFH Steelhead Yearling**			**DCFH Steelhead Adults**		**Estimated SAR for Given Ratio of Fingerling: Yearling Survival**		
Release Year	**No. Released**	**Probable Rtrn Yr**	**Release Year**	**No. Released**	**Probable Rtrn Yr**	**Return Year**	**Adult Return**	**5%**	**10%**	**25%**
85/86	539,157	88/89	86/87	237,753	88/89	88/89	891	0.3%	0.3%	0.2%
86/87	1,316,469	89/90	87/88	224,963	89/90	89/90	703	0.2%	0.2%	0.1%
87/88	720,579	90/91	88/89	233,979	90/91	90/91	423	0.2%	0.1%	0.1%
88/89	578,780	91/92	89/90	212,769	91/92	91/92	1,591	0.7%	0.6%	0.4%
89/90	347,347	92/93	90/91	243,881	92/93	92/93	2,669	1.0%	1.0%	0.8%
90/91	121,326	93/94	91/92	335,181	93/94	93/94	1,760	0.5%	0.5%	0.5%
91/92	1,188,663	94/95	92/93	321,890	94/95	94/95	8,100	2.1%	1.8%	1.3%
92/93	1,249,521	95/96	93/94	355,164	95/96	95/96	4,105	1.0%	0.9%	0.6%
93/94	627,730	96/97	94/95	309,458	96/97	96/97	3,648	1.1%	1.0%	0.8%
94/95	397,455	97/98	95/96	316,758	97/98	97/98	1,344	0.4%	0.4%	0.3%
95/96	134,000	98/99	96/97	312,388	98/99	98/99	2,236	0.7%	0.7%	0.6%
96/97	279,088	99/00	97/98	348,734	99/00	99/00	3,314	0.9%	0.9%	0.8%
97/98	119,681	00/01	98/99	341,339	00/01	00/01	3,480	1.0%	1.0%	0.9%
98/99	210,832	01/02	99/00	300,000	01/02	01/02	4,120	1.3%	1.3%	1.2%
99/00	0	02/03	00/01	336,320	02/03	02/03	(future)	-	-	-
Avg:	522,042	-	Avg:	295,372	-	Avg:	2,497	0.8%	0.7%	0.6%

CVFF Steelhead Fingerling			CVFF Steelhead Yearling			CVFF Steelhead Adults		Estimated SAR for Given Ratio of Fingerling: Yearling Survival		
Release Year	**No. Released**	**Probable Rtrn Yr**	**Release Year**	**No. Released**	**Probable Rtrn Yr**	**Return Year**	**Adult Return**	**5%**	**10%**	**25%**
-	-	-	-	-	-	92/93	310	-	-	-
-	-	-	-	-	-	93/94	440	-	-	-
-	0	-	92/93	165,469	94/95	94/95	2,210	1.3%	1.3%	1.3%
92/93	0	95/96	93/94	213,872	95/96	95/96	2,115	1.0%	1.0%	1.0%
93/94	227,313	96/97	94/95	235,416	96/97	96/97	3,735	1.5%	1.4%	1.3%
94/95	107,667	97/98	95/96	224,702	97/98	97/98	1,559	0.7%	0.7%	0.6%
95/96	76,670	98/99	96/97	206,333	98/99	98/99	1,596	0.8%	0.7%	0.7%
96/97	122,188	99/00	97/98	242,438	99/00	99/00	2,270	0.9%	0.9%	0.8%
97/98	110,981	00/01	98/99	231,320	00/01	00/01	1,928	0.8%	0.8%	0.7%
98/99	164,770	01/02	99/00	229,451	01/02	01/02	3,345	1.4%	1.4%	1.2%
99/00	0	02/03	00/01	211,801	02/03	02/03	(future)	-	-	-
Avg:	101,199		Avg:	217,867		Avg:	2,255	1.0%	0.9%	0.9%

2.1.13 DATE PROGRAM STARTED (YEARS IN OPERATION), OR IS EXPECTED TO START

The DCFH steelhead program began in 1980. The CVFF program began in 1992.

2.1.14 EXPECTED DURATION OF PROGRAM

The design and construction of DCFH was an original component of the Warm Springs Dam Project. The hatchery at Warm Springs Dam was originally proposed as a part of the project in USACE Design Memorandum No. 12 Fish and Wildlife Facilities, dated December 1972 (USACE 1972). Following recommendations by USFWS and the CDFG, hatchery operations were revised by Supplement No. 1 to Design Memorandum No. 12 in December 1974 (USACE 1974). It is unknown whether an explicit duration period was defined in the mitigation obligation.

Development of CVFF arose from Section 95 of Public Law 93-251, which directed USACE to compensate for fish losses on the Russian River attributed to the operation of Coyote Valley Dam facilities in Mendocino County. This mitigation was accomplished in part by modification and expansion of DCFH, along with new facilities at CVFF. Again, it is unknown whether an explicit duration period was defined in the mitigation obligation.

Currently CDFG operates both DCFH and CVFF under amendment No. 3 to Cooperative Agreement DACW05-82-A-0066 as amended September 30, 1991 (USACE and CDFG, 1991). The period of this agreement began in October 1991 and extended through September 1999, with yearly extensions being granted thereafter.

2.1.15 WATERSHEDS TARGETED BY PROGRAM

The program occurs entirely in the Russian River watershed.

2.1.16 INDICATE ALTERNATIVE ACTIONS CONSIDERED FOR ATTAINING PROGRAM GOALS, AND REASONS WHY THOSE ACTIONS ARE NOT BEING PROPOSED.

The goals for DCFH and CVFF mitigation program were developed to compensate for the permanent loss of spawning habitat and production capacity. Any alternative actions that would attempt to add a comparable production to remaining habitat areas would risk exceeding the habitat carrying capacity of those areas. Greater information is required regarding the abundance and population trends of listed populations before recommending actions that would integrate with these populations.

2.2 PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS

2.2.1 LIST ALL ESA PERMITS OR AUTHORIZATIONS IN HAND FOR THE HATCHERY PROGRAM

The DCFH and CVFF facilities are owned by the USACE, and operated by the CDFG under a cooperative agreement with the USACE. Since hatchery operations have the potential to affect protected populations of coho, Chinook and steelhead, Russian River hatchery activities have been included in an ESA Section 7 consultation between NMFS, USACE and the SWCA. In addition, since Russian River hatchery activities are part of the State's anadromous fish hatchery program, they are included in the statewide ESA Section 10 consultation between NMFS and CDFG.

2.2.2 PROVIDE DESCRIPTIONS, STATUS, AND PROJECTED TAKE ACTIONS AND LEVELS FOR ESA-LISTED NATURAL POPULATIONS IN THE TARGET AREA

2.2.2.1 Description of ESA-Listed Salmonid Population(s) Affected by the Program

In the target area consisting of the freshwater limits of the Russian River basin, there are three ESA-listed salmonid populations affected by the program:

- CCC steelhead
- CCC coho
- California Coast Chinook

The following descriptions include information specific to the Russian River populations of these species, where available.

<u>Russian River Steelhead</u>

Steelhead occupy all of the major tributaries and most of the smaller ones in the Russian River watershed. Many of the minor tributaries may provide spawning or rearing habitat under specific hydrologic conditions. Steelhead use the lower and middle mainstem Russian River primarily for migration to and from spawning and nursery areas in the tributaries and the mainstem above Cloverdale. The majority of spawning and rearing habitat for steelhead occurs in the tributaries. However, juvenile rearing has been documented in the mainstem.

Adult steelhead generally begin returning to the Russian River in November or December, with the first heavy rains of the season. Steelhead continue to enter and migrate upstream into March or April. Adults have been observed in the Russian River during all months (S. White, SCWA, pers. comm. 1999). However, the peak migration period tends to be January through March.

Flow conditions are suitable for upstream migration in most of the Russian River and larger tributaries during the majority of the spawning period in most years. Sandbars blocking the river mouth in some years may delay entry into the river. However, during the times the sand bar is closed, the flow is probably too low and water temperature may be too high to provide suitable conditions for migrating adults further up the river (CDFG 1991).

Most spawning takes place from January through April, depending on the time of freshwater entry. Steelhead spawn and rear in tributaries from Jenner Creek near the mouth, to upper basin streams including Forsythe, Mariposa, Rocky, Fisher and Corral creeks. Steelhead usually spawn in the tributaries, where fish ascend as high as flows allow (USACE 1982). Gravel and streamflow conditions suitable for spawning are prevalent in the Russian River mainstem and tributaries (Winzler and Kelly Consulting Engineers [Winzler and Kelly] 1978), although gravel mining and sedimentation have diminished gravel quality and quantity in many areas of the mainstem. In the lower and middle mainstem (downstream of Cloverdale) and the lower reaches of tributaries, water temperatures exceed 55°F by April in some years (Winzler and Kelly 1978), which may limit the survival of eggs and fry in these areas.

After hatching, steelhead spend from one to four years in freshwater. Steelhead in other streams in this ESU either migrate to ocean after the first year (as yearlings) or spend an additional year in the stream and emigrate at age 2+ (Shapovalov and Taft 1954), and steelhead in the Russian River Basin exhibit similar behavior. Fry and juvenile steelhead are extremely adaptable in their habitat selection. Requirements for steelhead rearing include adequate cover, food supply, and water temperatures. The mainstem above Cloverdale and upper reaches of the tributaries provide the most suitable habitat, as these areas generally have excellent cover, adequate food supply, and suitable water temperatures for fry and juvenile rearing. The lower sections of the tributaries provide less cover, as the streams are often wide and shallow and have little riparian vegetation, and water temperatures are often too warm to support steelhead. In the summer, these areas can dry up completely. Available cover has been reduced in much of the mainstem and many tributaries because of loss of riparian vegetation and changes in stream morphology.

Emigration usually occurs between February and June, depending on flow and water temperatures. Excessively high water temperatures in late spring may inhibit smoltification in late migrants.

<u>Russian River Coho</u>

Coho salmon are much less abundant than steelhead in the Russian River basin. Historically, spawning occurred in approximately 32 tributaries of the Russian River, including Dry Creek (CDFG 2002). In wet years, coho salmon have been seen as far upstream as Forsythe Creek in Redwood Valley. The DCFH produced and released an average of about 70,000 yearling coho salmon each year between 1980 and 1998. The hatchery has not produced coho salmon since the 1998 release.

The coho salmon life history is quite rigid, with a relatively fixed three-year life cycle. Most coho salmon enter the Russian River in November and December and spawn in December and January. Spawning and rearing occur in tributaries to the lower Russian River. The most upstream tributaries with coho salmon populations include Forsythe, Mariposa, Rocky, Fisher, and Corral creeks. The mainstem serves primarily as a passage corridor between the ocean and the tributary habitat.

After hatching, young coho salmon will spend about one year in freshwater before becoming smolts and migrating to the ocean. Freshwater habitat requirements for coho salmon rearing include adequate cover, food supply, and water temperatures. Primary habitat for coho salmon includes pools with extensive cover. Outmigration takes place in late winter and spring. Coho salmon live in the ocean for about a year and a half, return as three-year-olds to spawn, and then die. Factors that may limit juvenile coho salmon production are high summer water temperatures and poor summer and winter habitat quality.

Russian River Chinook

There is some debate whether Chinook salmon used the Russian River historically, though there are reports that local tribes harvested Chinook salmon regularly in the upper portions of the East Fork drainage prior to construction of Coyote Valley Dam (NMFS 2001). Chinook salmon of hatchery origin were planted in the watershed up through 1998 (CDFG 1998b). The total run of Chinook salmon present in the basin was believed to be small. SCWA video monitoring at the Mirabel Rubber Dam has provided the most recent data. Sampling during the 2000 study period extended late enough into the season to document the end of the Chinook run and to provide positive identification of 1,322 adult Chinook. A partial run count of 1,299 adult Chinook through November 13, 2001 (monitoring ceased prior to the end of the run) suggests that the 2001 run was substantially larger (S. White, SCWA, pers. comm. January 8, 2002).

Historic spawning distribution is uncertain, but suitable habitat formerly existed in the upper mainstem and in low gradient tributaries. Chinook salmon currently spawn in the mainstem and larger tributaries, including Dry Creek. Chinook spawning was observed well downstream of Dry Creek in November 2002, but this is not believed to be the primary spawning area (S. White, SCWA, pers. comm. 2002). Chinook salmon tissue samples were collected in 2000 by SCWA, CDFG and NMFS from the mainstem, Forsythe, Feliz and Dry creeks, and there were anecdotal reports of Chinook salmon in the Big Sulphur system.

Adult Chinook salmon begin returning to the Russian River as early as late August, with most spawning occurring after late November. Chinook salmon may continue to enter the river through December and spawn into January (S. White, SCWA, pers. comm. December 10, 1999).

Unlike steelhead and coho salmon, the young Chinook salmon begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, usually ranges from two to four months, but occasionally Chinook salmon juveniles will spend one year in fresh water (Myers *et al*. 1998). Chinook salmon move downstream from February through June). Ocean residence can be from one to seven years, but most Chinook salmon return to the Russian River as two- to four-year-old adults. Chinook salmon die soon after spawning.

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

Since the existing steelhead program is an isolated program, there should be no direct affects on any of the ESA-listed populations.

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

All three ESA-listed populations (steelhead, coho and Chinook) have potential to be affected by the steelhead program.

2.2.2.2 Status of ESA-Listed Salmonid Population(S) Affected by the Program

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

There are insufficient quantitative data to provide statistical evidence of abundance level relative to the definitions for critical population threshold and viable population threshold for any of the three listed Russian River populations.

The status of CCC steelhead is uncertain, since little information exists on present run sizes of trends for this ESU. However, given the substantial rates of decline for stocks where data do exist, it is anticipated that the majority of natural production in this ESU is not self-sustaining (NMFS 2001).

The most recent status review for the CCC coho salmon ESU states "The CCC ESU is presently in danger of extinction. The condition of coho salmon populations in this ESU is worse than indicated by previous reviews." (NMFS 2001).

The status of CC Chinook is uncertain since estimates of absolute population abundance are not available for most populations in the ESU. Trends in Chinook abundance are mixed for those populations that have been monitored, though in general the trends tend to be more negative in streams that are farther south along the coast (NMFS 2001).

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

No data are available for any of the three listed Russian River populations providing progeny-to-parent ratios, survival data by life-stage, or other quantitative measures of productivity.

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

Between the period of 1995 and 2000, CDFG surveys resulted in the identification of 159 salmonid redds within 32 surveyed tributaries; these surveys did not identify the species of the redds. During the 1999-2000 spawning season, six steelhead redds were identified by CDFG in Dry Creek (CDFG 2000).

Adult salmonids were counted using video monitoring at existing adult ladders at Mirabel Dam during the period of 1999 through 2001. Results of the monitoring are shown in the following table. (Identification of the total days of video monitoring is intended to reflect the fact that there may have been periods of inactivity between the first and last day of monitoring.) Sampling during the 2000 study period extended late enough into the season to provide positive identification of 532 steelhead. Hatchery-reared steelhead accounted for 47 percent of this return (as indicated by clearly clipped adipose fins). Wild steelhead accounted for 21 percent of the return. The wild or hatchery status of the remaining 28 percent could not be distinguished as it was difficult to determine whether the adipose fins had been clipped or not.

Study Period	First Day of Video Monitoring	Last Day of Video Monitoring	Total Days of Video Monitoring	Adults Counted				
				Adult Chinook	Adult Wild Steelhead	Adult Hatchery Steelhead	Adult Steelhead (origin unknown)	Unidentified Adult Salmonid
1999	May 20	Nov 14	182	205	0	0	0	98
2000	May 12	Jan 10	237	1,322	110	252	170	188
2001	Aug 7	Nov 13	99	1,299	0	0	0	84

Source: Chase *et al*. 2000; Chase *et al*. 2001; SCWA 2001

Juvenile steelhead and Chinook were collected in screw traps during the period of 1999 to 2001. Results indicated that the number of wild steelhead smolts was substantially greater than the count of hatchery steelhead smolts during each year of monitoring, although this may be a reflection of a study period that occurs primarily after the latest (mid-April) release dates of hatchery smolts. Results also indicated there were substantial numbers of young-of-the-year steelhead migrating downstream in comparison to smolts.

Study Period	First Day of Trap Operation	Last Day of Trap Operation	Total Days of Trap Operation	Juvenile Counts			
				Steelhead Hatchery Smolts	Steelhead Wild Smolts	Steelhead Wild Young-of-Year	Chinook Wild Smolts
1999	Apr 21	May 29	19.5	31	107	69	193
2000	Apr 8	Jun 29	82	68	134	763	1,361
2001	Apr 20	Jun 7	47	8	53	150	3,722

Source: Chase *et al*. 2000; Chase *et al*. 2001; SCWA 2001

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

No surveys have ever been conducted in the Russian River with regard to the proportion of hatchery-origin and natural-origin fish on natural spawning grounds.

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

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

The collection of hatchery steelhead broodstock at the DCFH and CVFF ladders and traps has a "low" potential to harass or harm listed natural steelhead, coho and Chinook through capture, sorting and release operations. Ladders and traps are normally operated from October 1 to April 31. The DCFH and CVFF ladders and traps are located at the upstream terminus of their respective stream locations, and there is little biological incentive that would attract the listed populations into these facilities. Nonetheless, for those listed fish that do enter the ladder and trap, the capture, sorting and release methods and devices may lead to injury of listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury.

The release of hatchery steelhead smolts in Dry Creek and the East Fork Russian River has a "low" potential to harass or harm listed natural steelhead, coho and Chinook through competition and predation, during smolt emigration. Releases normally occur between mid-January and late April and the smolts are believed to reach the estuary within a few weeks of release. The releases may lead to injury of listed fish through direct predation or competition for food.

Though not directly a hatchery activity, angling for Russian River hatchery steelhead is considered here. Based on the relative number of person-hours expended in recreational fishing as compared to other hatchery activities, the authors of this report estimate there is a "moderate" potential of harassing or harming listed natural steelhead, coho and Chinook through bycatch. The angling season on the Russian River below the confluence with the East Branch is open all year. However, gear is restricted to artificial lures with barbless hooks between April 1 and October 31, and barbless hooks only between November 1 and March 31. The capture, handling and release resulting from unintentional angler catch of listed species may lead to direct mortality, or delayed mortality as a result of injury.

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

Information regarding past take associated with the hatchery steelhead program has not been documented and is unknown.

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

See Table 1 on page 2-67 of this HGMP.

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.

Operation of the juvenile screw trap will be terminated early if the observed mortality of handled listed fish exceeds a total of 25 fish.

2.3 RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

2.3.1 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 CDFG is currently developing a comprehensive Basin Fisheries Restoration Plan for the Russian River. The draft document was released for input in August 2002 (CDFG 2002). The steelhead hatchery program at DCFH and CVFF is consistent with recommendations made by CDFG biologists as related to the contents of the draft restoration plan.

2.3.2 LIST ALL EXISTING COOPERATIVE AGREEMENTS, MEMORANDA OF UNDERSTANDING, MEMORANDA OF AGREEMENT, OR OTHER MANAGEMENT PLANS OR COURT ORDERS UNDER WHICH PROGRAM OPERATES.

As described previously in Section 2.1.14, the following agreements were part of the development of the steelhead mitigation program at DCFH and CVFF:

- Design Memorandum No. 12 Fish and Wildlife Facilities (USACE 1972)
- Supplement No. 1 to Design Memorandum No. 12 (USACE 1974)
- Section 95 of Public Law 93-251

Currently CDFG operates both DCFH and CVFF under Amendment No. 3 to Cooperative Agreement DACW05-82-A-0066 as amended September 30, 1991 (USACE and CDFG, 1991). The initial period of this amendment began in October 1991 and extended through September 1999. Since 1999 the facilities have operated on an annual operation agreement that references the amendment.

A draft HGMP for the DCFH steelhead program was submitted by CDFG to NMFS in December 2000 (CDFG 2000). The draft plan is currently under review by NMFS.

The USACE, SCWA, and NMFS have entered into a Memorandum of Understanding (MOU) that established a framework for the consultation and conference required by the ESA with respect to the activities of the USACE and SCWA that may directly or indirectly affect coho salmon, steelhead and Chinook salmon in the Russian River.

The NMFS, USACE, CDFG, California Resources Agency, California Environmental Protection Agency, California Water Resources Control Board, North Coast Region of the California Regional Water Quality Control Board, California Regional Water Quality Control Board, Bodega Marine Laboratory, University of California at Davis, County of Sonoma, County of Marin, County of Mendocino, SCWA, North Bay Watershed Association, Russian River Watershed Association, and FISHNET 4C have entered into a MOU that established a framework for coordination and cooperation among the parties in order to advance and further the recovery planning process and the activities of the parties to this MOU relating to the recovery planning process.

As noted above in 2.3.1, the steelhead program is consistent with the Russian River Basin Fisheries Restoration Plan (CDFG 2002).

2.3.3 Relationship to Harvest Objectives

Artificial production and harvest management for steelhead have been integrated through implementation of selective harvest measures. All hatchery steelhead released statewide (including those released by DCFH and CVFF) are marked by clipping the adipose fin, giving anglers the ability to distinguish between hatchery-reared and naturally-produced fish. Angling regulations allow harvest only of marked hatchery steelhead, and all fish captured that have an intact adipose fin must be returned to the water unharmed. As discussed in the Steelhead Restoration and Management Plan for California, CDFG believes this strategy can contribute to a reduction in direct fishing mortality to listed steelhead, coho and Chinook (CDFG 1996). However, there is likely to be some level of indirect mortality arising from injury during capture, handling and release. There are no quantitative estimates for the take level associated with steelhead angling in the Russian River.

2.3.3.1 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 are no quantitative data for harvest levels and rates of Russian River steelhead. In 1997, CDFG conducted a sport fishing punch card program that generated data that could be useful to such an analysis, but the Department has had insufficient funding to date to process that data.

In the development of the mitigation goals for DCFH, the USFWS suggested that approximately 2,000 steelhead would be made available by the program to contribute to the recreational fishery (USFWS 1978). It can be assumed that some portion of the CVFF mitigation production was also expected to contribute to the fishery. It is not known what benefit has actually accrued from the program.

2.3.4 Relationship to Habitat Protection and Recovery Strategies

<u>Factors Affecting Natural Production</u>

There are several varied factors believed to be affecting the natural production of steelhead, coho and Chinook in the Russian River basin. The major factor is most likely the loss or sever decrease in quality and function of essential habitat, resulting from anthropogenic watershed disturbances caused by agriculture, logging, gravel mining, urban development, water diversion, road construction, erosion and flood control, dam building, and grazing (NMFS 2001a; CDFG 2002). With the recent implementation of selective harvest regulations, it is unlikely that harvest is a significant factor. Potential effects from Russian River hatchery operations are believed to be minimal, especially with implementation of CDFG policies in the late 1990's restricting inter-basin fish transfers (FishPro and ENTRIX 2000).

Habitat Protection Efforts

Ongoing habitat restoration activities have been initiated in the Russian River basin at many locations downstream of the Warm Springs Dam and Coyote Valley Dam. All survey activities have been carried in accordance with techniques outlined in the California Salmonid Stream Habitat Restoration Manual (CDFG 1998). CDFG and SWCA completed stream habitat surveys for approximately 60 percent of the Russian River watershed by the spring of 2001. The remaining surveys will be completed by the end of the summer of 2003. Survey data have been utilized in preparing the Draft Russian River Basin Fisheries Restoration Plan (CDFG 2002). Once finalized, the document will list priorities for restoration. On going watershed programs are funded by State and Federal agencies.

2.3.5 Ecological Interactions

Organisms that Could Negatively Impact Program

Organisms that have the greatest potential to cause significant negative effects to the DCFH and CVFF steelhead program are predators (fish, birds and marine mammals) that consume steelhead smolts. Common steelhead predators include the Sacramento pikeminnow, largemouth bass, and avian predators.

Organisms that Could Be Negatively Impacted by Program

The DCFH and CVFF steelhead program has potential to cause negative effects to other species through a variety of factors common to artificial propagation facilities in general. While these factors are not believed to occur at DCFH or CVFF at any significant level, the mechanisms for potential negative impact include:

- competition for food and rearing habitat
- predation
- disease transfer
- influencing outmigration behavior of natural populations
- harvest bycatch
- artificial selection
- loss of diversity
- inbreeding depression

The anticipated level of effects to various species (and especially to protected species) is discussed below. For a more detailed discussion, please see the document entitled *Hatcheries and Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities* (FishPro and ENTRIX 2002).

<u>Organisms that Could Positively Impact Program</u>

The DCFH and CVFF steelhead program is operated as an isolated harvest program, and there are no significant opportunities envisioned in which organisms could benefit the out-migration of smolts or upstream migration of adults destined for the hatchery.

<u>Organisms that Could Be Positively Impacted by Program</u>

If the population level of wild Russian River steelhead is below the critical population threshold, then any escapement of hatchery steelhead could contribute to the abundance of the wild population and reduce the risk of inbreeding depression or loss of rare alleles within the wild population.

2.4 WATER SOURCE

2.4.1 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.

<u>DCFH Water Source</u>

Surface water is obtained for hatchery use from the stilling basin of the Warm Springs Dam. The water released from Lake Sonoma can be taken from four different intake portals, each at a different elevation in the lake, so that in the summer water can be mixed to optimize water temperature for successful hatchery operations (between 48 and 58°F). Three of the intake portals are located in the wall of the dam, while the fourth portal is generally referred to as the service gates. The highest portal is currently inoperable.

Water enters the hatchery inlet structure from an opening in the right wall of the outlet works stilling basin and flows through a combination of open channels with pipe flow to the hatchery. Water flows by a 42-inch pipe to an aeration structure near the hatchery building. The aeration structure consists of a concrete basin, containing about 24,000 cubic feet of water, with five mechanical surface aerators that degas and oxygenate the water. Water enters the aeration basin through an inlet chamber and exits through an outlet chamber to the hatchery raceways. At the aeration structure, water is aerated to increase dissolved oxygen levels in the water and allowed to settle. The water then passes through a screening process, at which point and can be routed to the hatchery building for further water treatment and use in incubation and early rearing, or to the rearing raceways for use without additional water treatment. (Generally, eggs and fry require better water quality conditions than fingerling and yearlings.)

In treating water for use in the incubators and start tanks, water from the aeration structure outlet chamber is pumped through sand and charcoal pressure filters and ultraviolet sterilization units. Additionally, if water temperatures are greater than 56°F, some of the treated water will be passed through chillers. The capacity of the water treatment system is 200 gallons per minute (gpm).

The total hatchery water demand for full capacity fish production operations is 25 cubic feet per second (cfs). When broodstock collection and holding operations are occurring, the demand increases to approximately 35 cfs, to provide flows to attract adult fish migrating upstream and to provide flows to maintain the fish in holding ponds once they enter the hatchery. Minimum releases from Lake Sonoma are set at 80 cfs in typical water years and 25 cfs under drought conditions. Since it is possible to divert all releases through the hatchery, there has consequently not been a problem to obtain all flow necessary to maintain hatchery operations.

Water can be released from four different intake portals, each at a different elevation (depth) within Lake Sonoma. Water can be released directly from the bottom of the dam (elevation 220 feet mean sea level [MSL]), and at elevations of 350, 390 and 430 feet MSL. (As mentioned previously, the highest portal is not functional.) During late summer and early fall, Lake Sonoma becomes thermally stratified (*i.e.*, the warmer water tends to stay at the top of the lake, and the colder water stays at the bottom of the lake), and consequently water of varying temperature is available for release at different depths (elevations) within the lake. The portal from which water is released is determined by the hatchery manager based on water temperatures within Lake Sonoma. However, according to R. Gunter, Hatchery Supervisor, turbidity levels in the lower levels of the lake are too high to be used in the hatchery. As a result, only the two intermediate portals are typically used to provide water for the hatchery and for downstream releases. If turbidity is increased, the efficiency of the UV that is designed to kill any biological organisms not removed by the sand filter is reduced. The water supply system is equipped with a chiller to compensate for excessively warm water temperatures, should they occur.

An emergency water supply system was constructed in 1992 to be used to supply a sufficient quantity of water to the hatchery when the outlet works and power plant are not operating. When emergency water supply is needed, hatchery personnel contact the local USACE office to request activation of the system. Flow to the hatchery can be controlled by the energy dissipation valve in the stilling well at the dam. Water can be drawn from the reservoir as long as the water surface elevation is above 350 feet NGVD (National Geodetic Vertical Datum). USACE personnel follow procedures to fill the Emergency Water Supply (EWS) pipeline with water from the stilling well. The EWS pipeline can be left unwatered between uses or remain full, in standby mode, in case of unforeseen emergency water supply requirements. A standby generator is available to provide power for operations during a power outage.

The emergency water supply to the hatchery is typically in fully charged condition, and could be available immediately. However, hatchery staff are required to contact USACE to open the valve for access to the EWS pipeline, which could delay implementation. The aeration ponds can supply sufficient water to the raceways for only 8 to 10 minutes while the emergency water supply system is being implemented. Longer delays could affect the survival of the juvenile fish. Other emergency sources of water, though not as reliable as the EWS system, are available. Wells E and F, downstream of the hatchery complex along Dry Creek, were originally provided as an emergency water source. The wells are capable of supplying the hatchery with approximately 2 to 3 cfs for a short period of time. (In 1997 only one well was operational and provided the hatchery with 1.55 cfs). If no other options are available, and survival of the fish is threatened, the fish can be released into the settling basins for later retrieval, or released directly into Dry Creek.

Water supply to the expansion raceways was modified in design from the original raceways to improve production capacity. Whereas the original raceway system is supplied with water from three sources (the aeration structure, non-chilled treated water, and chilled treated water), the new raceway systems receive water only from the aeration structure. In the original raceways, water passed from the raceways to a recirculation system utilizing air-lift tubes, but the high incidence of disease which followed resulted in its use being discontinued. In the expansion raceways, the water passes from the raceways to a 36-inch drainpipe which carries it to the settling basin. Therefore, water is continually delivered to the raceway from the aeration structure, rather than having to recirculate back through the system.

A new water supply is being proposed for the DCFH hatchery that would tap into the existing wet well and provide two pipelines capable of delivering 50 cfs each of gravity flow reservoir water to the DCFH facilities. The new supply will eliminate the need for the emergency water supply system and the existing emergency supply pipeline would be subsequently removed, thereby removing a dam safety issue. Design of the new water supply line is being completed in late 2002.

<u>CVFF Water Source</u>

Surface water is supplied to the CVFF by the City of Ukiah, which operates the Lake Mendocino Hydroelectric Power Plant. Under normal operating conditions when the plant is generating power, the CVFF water supply is supplied by gravity flow by diverting a portion of water from the power plant penstock. The water is subsequently piped through a valve vault and flow meter and then to the fish-rearing facilities. At the facilities, the supply water is discharged into a degassing tower and aerated. The degassing tower consists of two packed-column aerators, which are used to remove excess nitrogen and increase dissolved oxygen levels in the water.

When the power plant is not operating or as an alternative source, water for the CVFF facilities can be pumped from the stilling well located at the dam outlet works. The pumped water enters a pipeline leading to the CVFF valve vault, and from that point follows the same routing to the fish-rearing facilities. There is a portable emergency generator installed to run the pumps in the event of a power outage. If for any reason the generator or pumps fail and the facility is left with no water supply, the fish rearing in the raceways can be released directly to the river.

The pumped water supply system has been in continuous operation at CVFF since 1998 when some tunnel maintenance was initiated. However, by the end of 2002, the gravity flow water supply system is scheduled to resume operation.

<u>NPDES Permits</u>

The NPDES permit for DCFH is #CA0024350 / I.D. No. 1B84034050N.

The NPDES permit for CVFF is #CA0024791 / I.D. No. 1B91043NMEN.

The DCFH and CVFF have been in compliance with the NPDES permits.

2.4.2 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.

(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.")

The intake of the water supply system for DCFH is located in the reservoir upstream of the dam, while the normal diversion point for CVFF water occurs in the stilling basin at the dam outlet works. In both of these cases, protected species are not present. There is no fish passage upstream of the dams.

Settling basins have been installed at both DCFH and CVFF to assure that hatchery effluent discharges comply with the discharge standards and conditions of their respective NPDES permits. The discharge standards were established by the Regional Water Quality Control Board (RWQCB) based on designated beneficial uses for the subject waters. In Dry Creek and the Russian River, these beneficial uses include coldwater fish life, which reflects the general water quality requirements for the listed steelhead, coho and Chinook. The discharge standards for DCFH and CVFF are as follows.

Parameter	Effluent Limit (Daily Maximum)
Total Suspended Solids	15 mg/L
Total Settleable Solids	0.2 mL/L/hr
pH	within 0.5 of receiving waters
Salinity (chloride)	250 mg/L
Temperature	no measurable change to receiving water
Turbidity	no increase > 20% of background
Dissolved Oxygen	> 7.0 mg/L
Flow – DCFH	15.5 million gallons/day
Flow – CVFF	7.11 million gallons/day

Compliance is monitored by sampling the facility effluent two times per month, with results submitted in a monthly report to the RWQCB. It is further stipulated that sampling occur during cleaning operations, since this is the aspect of fish production that is most likely to produce poor water quality conditions. At DCFH, it is prohibited to discharge detectable levels of chemicals used for the treatment or control of disease, other than salt (sodium chloride).

Both DCFH and CVFF have been in continuous compliance with their NPDES permit requirements. During times of high turbidity in the influent water, the hatchery may actually discharge water less turbid than that received, thereby benefiting the receiving waters. The dissolved oxygen level in the receiving waters during times of low flows may drop below the 7mg/L limit and therefore may benefit from the hatchery maintaining an effluent limit that is greater than 7mg/L. Effluent from the hatchery will contribute to the total load of solids in the receiving waters. The settleable and suspended solid level discharged are slightly higher than incoming water, but are within the limits of the NPDES permits.

2.5 FACILITIES

2.5.1 BROODSTOCK COLLECTION FACILITIES (OR METHODS)

DCFH Facilities

Adult hatchery steelhead returning to DCFH enter the facility via a fish ladder located at the base of the dam, at the upstream terminus of Dry Creek. The fish ladder is trapezoidal in shape, with removable stoplogs which provide one-foot elevation lifts for each fish ladder section. By jumping or swimming from section to section, the fish can reach the top of the ladder. At the top of the fish ladder, fish move through an upper fishway into a crowder channel. The crowder channel is 125 feet long, 4 feet wide, and 8 feet deep, with a normal water depth of about 3.5 feet. As they enter the crowder channel, fish pass through a pivoting bar gate which prohibits fish from returning down the ladder.

CVFF Facilities

Adult hatchery steelhead returning to CVFF enter the facility via a fish ladder. The fish ladder consists of an entry pool, two ladder sections, a resting pool between the ladder sections, and an upper fish way leading to the spawning area and raceways. At the top end of the fish ladder is a channel that allows fish to rest before crossing over a finger weir which prevents them from returning downstream. From the weir, the fish pass through a hinged vertical bar rack which allows the fish to swim upstream. When the fish passes the bar rack, the rack closes and the fish is confined to an adult fish holding area.

A fish barrier was installed on the East Fork Russian River just upstream of the ladder entrance as part of the original facility construction in 1992. However, the barrier no longer exists as it was washed out in 1993 or 1994. There has not been any problem with fish recruitment into the ladder without the barrier, most likely since the river terminates at the outlet works about 0.25 miles upstream of the ladder.

Collection Methods

Broodstock for the DCFH program are collected from fish returning to the DCFH ladder and trap, and broodstock for the CVFF program are collected from fish returning to the CVFF ladder and trap. Currently, steelhead broodstock are collected systematically across the entire adult return with weekly capture goals formulated by a 9 to 11 year mean for each species. In an attempt to increase genetic diversity, more individuals are spawned than are necessary to achieve production goals. Surplus eggs are then randomly destroyed to avoid surplus production.

2.5.2 FISH TRANSPORTATION EQUIPMENT (DESCRIPTION OF PEN, TANK TRUCK, OR CONTAINER USED)

Fish transport for the DCFH and CVFF steelhead program is used for the following activities:

- transfer of eggs from CVFF to DCFH
- transfer of juvenile steelhead from DCFH to CVFF

- release of DCFH juveniles in Dry Creek
- return of wild fish and excess male broodstock to appropriate release points

Two primary transport trucks are used for DCFH and CVFF operations: an 800 gallon tank truck and a 1200 gallon tank truck. Each tank truck is outfitted with four fresh flow aerators and a twin oxygen bottle / air stone assembly for oxygenation. The trucks are not outfitted with temperature control. (The transit time for DCFH/CVFF fish transport activities generally ranges between 20 minutes and 45 minutes of travel, and as a result temperature control is not a significant concern.) Transport densities are monitored to stay below 2000 pounds of fish per load.

Smaller scale transport units are sometimes used at either facility and include insulated tanks outfitted for use in pickup trucks. These units are primarily oxygenated using bottled oxygen and air stones. However the larger unit has a fresh flow aerator installed. Transport densities are generally low, following a general guideline of loading less than 2.5 pounds of fish per gallon of water.

2.5.3 Broodstock Holding and Spawning Facilities

DCFH Facilities

Broodstock holding and spawning facilities include six concrete holding ponds located outdoors under a shelter, and spawning facilities located inside the hatchery building. A crowder channel acts as a conveyance route between these two areas. A mechanical crowder located in the channel is used to force fish towards the far end of the channel and subsequently lift them up over a raised entrance port into the spawning room of the hatchery building. (The fish in the crowding channel will be either fish newly arrived from the ladder, or fish previously held in one of the six concrete holding ponds, depending on actions of the hatchery staff.)

In the spawning room, fish slide over a dewatering grating and into a fish lift basket. The fish lift basket rests in an anesthetic solution using carbon dioxide as the anesthetic. The fish are held in the solution long enough to sedate them, at which point they are transferred to a table for sorting by criteria such as species, sex, and maturation. Selected broodstock that are not ripe for spawning are slid into fish return tubes that transport them back to one of the adult holding ponds. The fish will remain in the holding ponds for up to three weeks, with periodic cycles through the crowder channel and sorting table until found ripe for spawning. Spawning for steelhead is conducted once a week, resulting in a maximum holding period of one week for fish that have entered the crowder channel. On spawning day, all steelhead are crowded to the spawning area and sorted. Since steelhead are multiple spawners, they are not killed in the spawning process. A small air compressor unit is used to inject air into the egg cavity of female steelhead and force out eggs without harming the fish. Steelhead are returned to the river within one day of spawning, along with any excess steelhead not used as broodstock and any natural fish that are found in the trap. The release location for steelhead adults is the Russian River near Cloverdale, approximately 10 miles upstream of the confluence with Dry Creek.

CVFF Facilities

Adult steelhead are spawned at the CVFF using facilities similar to those of the DCFH. The facilities include two fish holding areas, a manual fish crowder, a fish transfer tank, a sorting table transfer basket, a dewatering bar rack, and an anesthesia tank. The two adult fish holding areas are constructed of concrete, each containing a framed screen which can be to crowd fish into the desired section of the fish holding area. Typically, the fish are crowded into the northerly adult fish holding area, where they can be moved to an anesthesia tank with the use of a sorting table transfer basket. The basket is designed to discharge the fish into the anesthesia tank once it has been lifted from the holding area and reaches the appropriate height. At the anesthesia tank, fish are passed over a dewatering bar rack to drain water away from the fish before they enter the anesthesia tank. Fish are held in a carbon dioxide anesthesia solution long enough to tranquilize them before they are transferred to the sorting table, again using the sorting table transfer basket. The fish are sorted according to species, sex, and maturation, and a determination is made to either 1) use the fish for immediate spawning, 2) place it back in the adult holding pond for later spawning, or 3) release it to the Russian River with the use of fish transfer tubes.

CVFF also has a fish transfer tank designed for loading fish from the southern adult holding tank directly into transfer trucks. The system utilizes a three-ton overhead crane to raise, lower, and move the fish transfer tank. However, this system has not been used in recent years. Instead, excess fish have been manually loaded into trucks from the spawning slab following the typical sorting procedures described above.

2.5.4 Incubation Facilities

Incubation for both the DCFH and CVFF components of the steelhead program is conducted at DCFH. The egg incubation facilities are located within the hatchery building and consist of 22 stacks of 16-tray incubation units, as well as hatching jars in a variety of sizes (6-, 8-, and 10-inch diameter). The incubation trays and the hatching jars can both be used to raise the eggs to the hatching stage. The current practice is to use only the hatching jars, since they reduce or eliminate fungus growth during incubation, require less handing of the eggs and emergent fry, and have exhibited a higher survival rate to hatching than the incubation trays. Both the incubation trays and hatching jars have two sources for water supply, one at ambient temperature and one chilled, allowing excellent control and flexibility of the water supply temperature.

2.5.5 Rearing Facilities

Both the DCFH and CVFF components of the steelhead program conduct the rearing stage of production at DCFH. There are two types of rearing facilities at DCFH: start tanks located inside the hatchery building for early rearing of fry, and outdoor raceways for final rearing of fingerling and yearlings. When eggs within the hatching jars reach the emergent fry stage, they move volitionally into the start tanks in which the hatching jars are located. (The use of incubator trays requires manual placement in the nursery trays.) After six weeks in the start tanks, the fish are transferred to the raceways where they remain until final release.

The start tank system is a series of large tanks, fish feeders, and water supply. Each of the 18 start tanks is made of aluminum and measures 28 feet in length, 3 feet in width, and 22 inches in depth. There are eight juvenile rearing raceways, constructed of concrete, each with an available rearing volume measuring 72 feet in length, 9 feet in width, and 27 inches in water depth. These raceways are grouped in two sets of four raceways, laid out in pairs (side-by-side). An automatic fish feeder is located between the supply ends of each pair of raceways. Each feeder is capable of supplying dry or moist pellets to the raceway. The amount and timing of food delivered to the raceways are set by hatchery personnel, and are fully automated.

Due to design flaws, the raceway system supplies approximately one-half of the amount of water called for in the original specifications for the project. The raceways have a water recirculation system, but attempted use of this system resulted in disease outbreaks and high mortality and use was discontinued. As a result, rearing production of fish was lower than originally anticipated.

In 1991, DCFH was expanded to provide additional hatchery and rearing facilities as authorized in Section 95 of Public Law 93-251, to provide mitigation for the Coyote Valley Dam Project. The hatchery raceway system was expanded with the addition of 3 sets of 4 raceways for a total of 12 new raceways, and rearing capacity is no longer a problem. The raceways are equipped with automatic fish feeders and are totally independent of the original raceways. The new raceways are 65 feet in length, 9 feet in width, and 5 feet in depth.

2.5.6 Acclimation/Release Facilities

Acclimation/release facilities are provided only for the CVFF portion of the steelhead program. After rearing at DCFH for about one year, the CVFF juveniles are transported back to CVFF in one of four groups for final acclimation and release. The first group arrives at CVFF in late December or early January and the last group arrives in April, and the numbers of fish in each group reflect the bell-shaped curve seen in the pattern of adult returns to the facility. Juvenile fish arrive at CVFF typically at a size of about 5 fish per pound, and they are held in the CVFF raceways for approximately 30 days. This 30-day residency occurs during the spring when juvenile steelhead typically go through the physiological process known as smoltification, which prepares them for the transition from freshwater in the stream to saltwater in the ocean. During the residency period and smoltification process, the smolts become “imprinted” on the water released from Coyote Valley Dam. The raceways at the CVFF are designed to allow the smolts to leave the facility without assistance (volitional release); thus, they enter the river when they are physiologically ready to migrate downstream to the ocean. The fish may be released prior to the completion of their imprinting process only if a disruption to the primary water supply occurs.

2.5.7 Describe Operational Difficulties or Disasters that Led to Significant Fish Mortality

DCFH has incurred a single incident that led to significant fish mortality during the second year of that facility's operation. There have been no significant fish mortalities at CVFF.

On September 24, 1981, a power failure at DCFH resulted in the loss of the majority of fish being raised at the facility. The event began between 7:30 and 8:00 p.m. when a severe variance in the electrical power supply resulted in a single-phase low voltage condition and finally a power outage at the hatchery. The immediate audible/visible results of the low-voltage "brown-out" condition were actuation of the emergency alarms in the hatchery worker residence, dimmed and over bright hatchery office lights, starting of the emergency generator, stopping of the treated water pumps, and burning of parts of the electrical circuits.

At the time of the incident, juvenile fish rearing in the hatchery consisted of 9,300 Chinook salmon, 51,000 coho salmon, and 100,200 steelhead trout. No eggs were being incubated at the time.

Emergency response by hatchery personnel consisted of observations of facility and fish conditions; notification of key personnel; attempts to start pumps and generators; and solicitation of help from Pacific Gas and Electric (PG&E), the electric supply company. Hatchery personnel were unable to maintain a flow of water to the start tanks and raceways, resulting in the loss of all fish except for some of the coho salmon.

A subsequent investigation concluded that the following factors contributed to loss:

- Voltage surges resulted in damage to electrical circuits, causing the treatment pumps to stop running and thereby cutting the water source to the head box.
- The circuit breaker on the 400 kw standby generator was open and prevented transfer of emergency power to the treatment pumps. The breaker panel was not marked, and personnel were unable to locate the breaker.
- The emergency generator at the wells failed to operate because of a stuck solenoid.
- Duty personnel failed to open the valve between the aeration pond and the raceways until about 30 minutes following the power loss.
- Water losses occurred in the raceways due to poor fitting of substitute overflow pipes.
- Decisions concerning transfer or release of fish were not made in a timely fashion.

2.5.8 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.

Training of personnel now includes practice for appropriate response to emergency conditions. In addition, the facility has been modified to provide additional backup provisions, including:

- addition of a bypass pipeline for emergency water supply;
- provision for gravity flow from aeration pond to new raceways;
- routine maintenance of the two recirculation/flood control pumps located in the settling basin;

- additional alarm system modifications;
- a gasoline-powered pump assembly and associated collapsible pipeline to enable pumping from treatment sump to the hatchery building head box; and
- a digital day tank assembly for the generator, along with implementation of a weekly exercise routine.

In any event, the steelhead program does not involve listed natural fish within the confines of the hatchery, and there is minimal likelihood for take of listed fish due to equipment failure or other catastrophic event under the steelhead program.

2.6 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.

2.6.1 SOURCE

Original Source for Program Start-Up

DCFH (1980):

- Dry Creek Steelhead
- Mad River Hatchery (Mad / Eel River hybrids)

CVFF (1992):

- Dry Creek (from DCFH returns)

2.6.2 SUPPORTING INFORMATION

2.6.2.1 History

A detailed history of hatchery stocks within the Russian River is recorded in a 1996 report by Steiner Environmental Consulting (SEC) entitled *A History of the Salmonid Decline in the Russian River*. The following is a brief summary of the history of salmonid stocks within the Basin, taken from the SEC report.

Historic stock transfers of salmonids into the Russian River are recorded as far back as the 1890s and include a variety of sources of origin. Prior to the start-up of DCFH in 1982, nearly all fish stocking events (commonly called outplants) used broodstock from out-of-basin sources, due to the absence of any fish collection facilities within the Russian River basin. The broodstock source for many of the earlier outplants is not known. The known out-of-basin broodstock sources for Russian River outplants occurring prior to DCFH, with the last known year of planting noted in parenthesis, include Scott Creek (1911), Prairie Creek (1927), Eel River (1972), San Lorenzo Creek (1973), Mad River (1981), and the Washougal River in Washington

(1981) (SEC 1996, FishPro and ENTRIX 2000). It is not possible to know if these outplants were successful with regard to survival nor has any effort been made to establish the extent of residual integration within present stocks.

Implementation of the DCFH steelhead program in 1982 utilized broodstock collected from Dry Creek and the Mad River Hatchery. All broodstock since the initial year have been collected from fish returning to the DCFH ladder and trap. Nonetheless, in 1999, a policy was implemented for all DCFH production programs requiring that all broodstock be obtained solely from adults captured within the Russian River. There have been no outplants of out-of-basin stocks from DCFH since 1982.

Broodstock used for the initial year of the CVFF steelhead program in 1992 were collected from DCFH. Since that initial year broodstock have been collected solely from fish returning to the CVFF ladder and trap. There have never been any outplants of out-of-basin stocks from CVFF.

A summary of Russian River outplants and their source of broodstock through 1998 is included in the following table. These data are intended to convey general magnitude of hatchery planting and the historical timeframe, rather than exact numbers. There is no information available regarding the survival of fish from outplants prior to the current DCFH/CVFF program.

Broodstock Source	Years Outplanted	Total Outplants[1]
Russian River	1959, 81-98	18,167,885
Eel River	1914-19, 21-23, 58-59, 72	4,900,843
Mad River	1975-76, 78-79, 81	324,101
Prairie Creek	1927	249,000
San Lorenzo Creek	1973	83,350
Scott Creek	1911	433,458
Washougal	1980-81	270,360
Unknown	-	8,934,122
Total	**-**	**33,471,432**
% Russian River Origin[2]		**54%**

[1]Data compiled from SEC (1996) and CDFG (1996b, 1997, and 1998b). Some historical records are incomplete. This compilation is intended to convey general magnitude of hatchery planting rather than exact numbers.

[2]As planting records are incomplete, this is only an estimate based on numbers presented in this table, assuming the "unknown" is not Russian River. Out-of-basin sources were planted extensively in the past, but this practice was diminished and then discontinued in more recent years.

2.6.2.2 Annual Size

The annual size of the broodstock pool is about 720 hatchery steelhead for DCFH and 480 hatchery steelhead for CVFF. More detail is provided in Section 2.7.4.

2.6.2.3 Past and Proposed Level of Natural Fish in Broodstock

Prior to the 1996 implementation of the mass marking program at both facilities for all steelhead production, there was no way to determine (with absolute certainty) that returning steelhead were of hatchery or natural origin. Previous to the advent of mass marking, returning fish were spawned indiscriminately in this respect and it is likely that natural fish were incorporated into spawning. However, estimates calculated with data collected since the advent of mass marking suggest that less than 3 percent of returning steelhead to either facility were unmarked. Under current spawning protocol, any unmarked fish are released without spawning.

2.6.2.4 Genetic or Ecological Differences

Allozyme studies presented in Busby *et al*. (1996) show a great deal of genetic variability among populations of the CCC steelhead ESU. The samples from Coleman NFH and two tributaries in the Sacramento River Basin cluster distinctly from other steelhead in this ESU (Figure 5-4, Cluster H). Cluster G includes streams from this ESU (Lagunitas, Scott, San Lorenzo, Alameda, Arroyo Hondo, and Gaviota) but also includes the Ten Mile River sample in Mendocino County north of the Russian River, and Whale Rock near San Luis Obispo in southern California.

An anomalous geographic structure was detected in this allozyme study (Busby *et al*. 1996). Only modest differences were found between samples from Ten Mile River and Lagunitas Creek, but these samples were more similar to Whale Rock Hatchery (near San Luis Obispo than to populations geographically closer (Scott Creek and San Lorenzo rivers). Nielsen (1994) found substantial differences in frequencies of some mtDNA alleles between Mendocino and Marin County samples, but these allozyme data did not, as seen by the relative similarity between Ten Mile River and Lagunitas Creek.

Nielsen *et al*. (1994) included Russian River samples in a study that found biogeographic distribution of mitochondrial and nuclear DNA in naturally spawning coastal steelhead in California. Data for both mtDNA and a single microsatellite locus (Omy77) gave significant differentiation between three broad bioregions, north coast, central coast (Russian River to Point Sur), and south coast, as described in the previous section. Six steelhead hatchery populations (Van Arsdale Hatchery on the Eel River, Van Duzen River Hatchery, Warm Springs Hatchery on the Russian River, Big Creek Hatchery near Scott Creek, San Lorenzo River hatchery in Santa Cruz, and Whale Rock Hatchery near Morro Bay in southern California) did not show significant biogeographic structuring of mtDNA genotypes, but were dominated by mtDNA types that were most common in their general geographic area. Similarly, no significant biogeographic association with Omy77 was detected.

2.6.2.5 Reasons for Choosing

<u>Historic</u>

Selection of steelhead broodstock used (other than that taken from original stocks) was based primarily on geographic proximity and similarity to presumed original Russian River stocks. Additional criteria used for selection were based on physiological condition of the stock and resulted in selection of the most robust stocks available.

<u>Present Selective Criteria</u>

DCFH:

Broodstock is chosen from a total random selection of adipose fin clipped (hatchery origin) fish returning to the facility.

CVFF:

Broodstock is chosen from a total random selection of adipose fin clipped (hatchery origin) fish returning to the facility.

2.6.3 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.

At present returning steelhead numbers to both facilities are high enough that the probability of inbreeding is relatively low. Furthermore at present there is no method for determining the degree of relatedness of returning fish nor is there any method for readily identifying sibling fish visually. Management has been continuously evaluating methods for identifying related stocks using marks that are readily visible. At present none of the methods have produced the reliability and longevity required without impairment to the organism, however this evaluation process will continue until a suitable mass marking strategy is forthcoming which provides for immediate identification of related groups of fish.

Spawning protocols presently provide for the representation of returning fish over the complete spectrum of the spawning run (steelhead are selected systematically across the entire adult return). In addition, surplus eggs are taken from which a random sample will comprise the harvest for each week. This strategy will continue to be employed to decrease the loss of genetic diversity.

2.7 BROODSTOCK COLLECTION

2.7.1 LIFE-HISTORY STAGE TO BE COLLECTED (ADULTS, EGGS, OR JUVENILES)

The program collects only returning adult hatchery fish.

2.7.2 COLLECTION OR SAMPLING DESIGN

Collection of returning adult hatchery fish is conducted at permanent fish ladder and trapping facilities located at DCFH and CVFF. Ladders and traps are normally operated from October 1 to April 31, though CDFG management may advance, retreat or extend this period depending on conditions and the presence of fish. Returning hatchery steelhead typically enter the trap over a 16 week period beginning in mid-December and ending in mid-April. Trap operations extend well before and after the typical run time of returning hatchery steelhead, so that broodstock collection will provide a fully-representative sample of the population.

2.7.3 IDENTITY

Since 1997, all steelhead released from DCFH and CVFF have been marked by clipping the adipose fin. Any fish collected in the DCFH or CVFF traps that does not have a clipped adipose fin is released from the trap.

2.7.4 PROPOSED NUMBER TO BE COLLECTED

2.7.4.1 Program Goal

The following table provides a general guideline for the number of adults collected over an average 16 week spawning season. The number of males is collected to provide a 2.5:1 spawning ratio with the females (B. Wilson, CDFG, pers. comm. 8/30/02).

Program Goal for Steelhead Broodstock Collection

Group	DCFH		CVFF	
	Females	Males	Females	Males
1 (Weeks 1-4)	32	81	18	45
2 (Weeks 5-8)	72	180	48	120
3 (Weeks 9-12)	54	135	36	90
4 (Weeks 13-16)	22	54	18	45
Total	180	450	120	300

2.7.4.2 Broodstock Collection Levels for the Last Twelve Years, or for Most Recent Years Available

Year	DCFH Adults			CVFF Adults			Eggs	Juveniles
	Females (actual)	Males (approx.)	Jacks (approx.)	Females (actual)	Males (approx.)	Jacks (approx.)		
1990-1991	159	394	3	NA	NA	NA	0	0
1991-1992	342	848	7	NA	NA	NA	0	0
1992-1993	365	905	7	106	263	2	0	0
1993-1994	342	848	7	123	305	2	0	0
1994-1995	292	724	6	92	228	2	0	0
1995-1996	250	620	5	118	293	2	0	0
1996-1997	241	598	5	117	290	2	0	0
1997-1998	157	389	3	107	265	2	0	0
1998-1999	184	456	4	107	265	2	0	0
1999-2000	184	456	4	128	317	3	0	0
2000-2001	146	362	3	148	367	3	0	0

Data source: DCFH (female counts only)

Notes:

1 Operating year for CDFG extends from July 1 of first year to July 30 of second year.

2. Numbers of females taken from spawning records.

3. Total number of males (including jacks) estimated by assuming spawning ratio of 2.5 males:1female (CDFG 2000).

4. Number of jacks estimated assuming a 0.8 percent presence in the returning male population.

2.7.5 DISPOSITION OF HATCHERY-ORIGIN FISH COLLECTED IN SURPLUS OF BROODSTOCK NEEDS

Present policy provides that all wild adult steelhead returning to DCFH (Dry Creek) are relocated to tributary streams of Dry Creek and all wild adult steelhead returning to CVFF (Russian River) are relocated to the west branch of the Russian River above Mumford Dam or on the East Fork near Forsythe Creek. All surplus hatchery adult steelhead are relocated into the Russian River between Geyserville and Ukiah for increased angling opportunity. There are no upstream hatchery fish escapements.

2.7.6 Fish Transportation and Holding Methods

Adult fish are held in the adult holding ponds until ripe and ready to spawn. This length of time is rarely more than one week. Excess fish that are not spawned are transported back to the Russian River to increase angling opportunities for the sport fishery.

No applications of salves, antibiotics or chemical anesthesia occurs with the exception of the use of carbon dioxide as an anesthetic during sorting of adult fish. Carbon dioxide has been selected as the anesthetic used at both facilities because it leaves no harmful residue in the tissues of the fish. Application of any additional or medicinal treatments to adult steelhead is not permitted at either facility due to the subsequent release of adult steelhead for sport harvest.

The transit time for excess adult steelhead is usually 30 minutes to one hour. The equipment used for fish transport is described in Section 2.5.2.

2.7.7 Describe Fish Health Maintenance and Sanitation Procedures Applied

With regard to adult fish, all surgically related equipment (*i.e.* needles for egg harvest, and tissue collection utensils) are disinfected in alcohol or argentyne prior to use. All harvested eggs are disinfected as well, using methods developed by DFG pathology. Bacterial kidney disease screening, like that undertaken for coho salmon at DCFH, is not carried out routinely on hatchery steelhead due to the low incidence of infection due to this pathogen. However, the ovarian fluid of steelhead is periodically screened by pathology for incidence of BKD and to screen for viruses. Returning adult steelhead with any anomalous deformations are culled from the run (a very rare occurrence) to maintain the health of the run. Rigorous maintenance sanitation procedures are a continuous part of standard daily hatchery operations.

All cleaning equipment and nets are disinfected in Argentyne (iodine based disinfectant) prior to use and separate cleaning instruments are kept for each raceway. Overall fish health maintenance and sanitation procedures include daily pond cleaning, which also facilitates daily conditioning exercise to the ponded fish through fluctuating flow regimes. In addition, weekly prophylactic salt flushes are given to all life stages of steelhead throughout the duration of rearing.

Feeding practices are continuously monitored and feeds are continuously rotated and inventoried. Overcrowding is prevented by monitoring stocking density. Fish condition is observed daily by hatchery staff, and treatment of routine fish diseases is administered by the hatchery manager as needed. At the request of the hatchery manager, CDFG pathology staff is periodically called in to do health assessments and proscribe treatments.

2.7.8 DISPOSITION OF CARCASSES

Carcasses arising from hatchery mortalities and spawning activities are generally disposed of through the DCFH solid waste disposal system.

2.7.9 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.

Based on the historically low incidence of BKD found in DCFH and CVFF hatchery broodstock, each facility typically collects a single sample each spawning season for BKD analysis, compiled from approximately 20 hatchery adult females. Thus the risk of disease amplification or transmission has been reduced. Listed natural fish are not handled excessively (when they return to either facility), and are returned to the Russian River unspawned. The return of natural fish to the river where they may spawn naturally has decreased the risk of possible genetic effects due to hatchery broodstock collection.

2.8 MATING

2.8.1 SELECTION METHOD

Spawning fish are chosen randomly over the course of the whole run. A proportion of the fish returning from a given week are taken as spawners with a 3:1 ratio of male to female fish. The additional male (or males) is used to ensure fertilization. Spawning does occur on a certain day and spawners are taken randomly from any ripe fish on a certain day. It should be noted that for steelhead, the minimum effective number of breeders (50-100) is exceeded at both facilities. No prioritization presently occurs to preferentially select wild returning fish for incorporation, however, due to the mass marking that occurs at both facilities, it is now possible to distinguish between hatchery and wild progeny.

2.8.2 MALES

Multiple males are used to fertilize the eggs harvested from a single female, with the average rate being 2.5 males to 1 female. Males are not used repeatedly and sperm is not preserved (cryopreservation). Back up males (not used in spawning) are released into the Russian River. Two-year-old fish may be spawned, and then return as 3-year-old fish, where they could potentially be spawned for a second time. However, the use of repeat spawners is not, in general, a practice at either facility. Jacks are incorporated into the spawn in a proportion based on their occurrence in the run, which is approximately 0.4 percent based on DCFH return records for 1981 to 1999.

2.8.3 FERTILIZATION

Two to three male fish are presently used to ensure fertilization of the eggs of each female steelhead. The milt from each male is carefully introduced into a segregated area of the bucket containing eggs from a single female, and the entire contents are mixed at once to encourage equal time of contact between the different sources. No sperm extenders are used during spawning. Male steelhead are not used more than once in the fertilization scheme. Precocious males are presently used due to current sentiments among the biological community of the importance of this component of the spawning run; they are used at a rate that reflects the approximate 0.4 percent representation in the total returning population.

2.8.4 CRYOPRESERVED GAMETES

No cryopreservation techniques are employed at either facility.

2.8.5 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.

At present, intentional selection does not occur with the present mating scheme. To reduce the risk of loss of within population genetic diversity, a proportion of fish from each week returns will be randomly selected as spawners. In addition, jacks will be incorporated in a proportion based on their occurrence in the run.

2.9 INCUBATION AND REARING

2.9.1 INCUBATION

2.9.1.1 Number of Eggs Taken and Survival Rates to Eye-Up and/or Ponding

Year	DCFH		CVFF	
	Eggs Taken	Survival Rate to Ponding	Eggs Taken	Survival Rate to Ponding
1989-1990	1,134,000	83%	NA	83%
1990-1991	795,000	83%	NA	83%
1991-1992	1,710,000	83%	NA	83%
1992-1993	1,825,000	83%	530,000	83%
1993-1994	1,710,000	83%	619,000	83%
1994-1995	1,460,000	83%	460,000	83%
1995-1996	1,250,000	83%	590,000	83%
1996-1997	1,305,000	83%	636,285	83%
1997-1998	784,116	83%	535,000	83%
1998-1999	920,000	83%	535,000	83%
1999-2000	920,000	83%	645,000	83%
2000-2001	730,000	83%	740,000	83%

Notes:
1. Year extends from July 1 of the first year through June 30 of the second year.
2. CVFF began operations in 1992.

The number of eggs taken for each facility are indicated in the previous table. It should be noted that the number of eggs harvested at DCFH has been decreased in recent years and reflects the present policy of releasing only mass marked smolts that can be identified as hatchery origin (no fingerlings or other life stages are released). With regard to present policy, an emphasis has been placed on releasing lower numbers of higher quality smolts rather than releasing high numbers of assorted life stages.

In general, survival rates to eye up average 93 percent of the original number harvested. Subsequent survival rates show a consistant loss of 5 percent between eye-up and hatch, and a loss of 5 percent between hatch and ponding. These rates result in an average 83 percent survival to ponding of original egg number harvested. These percentages are an average of the past twelve years, and slight variations occur annually.

2.9.1.2 Cause for, and Disposition of Surplus Egg Takes

Surplus eggs are taken during each spawning session to prevent against potential losses through the eyed-egg stage. Following inventory at the eyed-egg stage, surplus eggs are destroyed. No surplus eggs or fish are released into the wild.

2.9.1.3 Loading Densities Applied during Incubation

Vertical flow incubators (Heath Trays) are no longer used at DCFH. Egg measurements are made using the California Volumetric Method and measured eyed eggs are reared in acrylic hatch jars that are fabricated on site. Steelhead egg size typically averages 200 eggs per ounce. The flows in the hatchery jars vary from three to twelve gpm and adjustment can be made for individual units. Generally the loading density in the hatchery jars ranges 50 percent of capacity. The following are the usable volume capacities for the most commonly used production hatch jar sizes: six inch – 254.4 cubic inches, eight inch – 452.2 cubic inches, ten inch – 706.5 cubic inches, and twelve inch – 1017.36 cubic inches.

2.9.1.4 Incubation Conditions

Water quality is tested biweekly at each facility and analyzed in the laboratory at DCFH. Chloride tests are performed weekly at each facility. Additional samples for suspended solids are submitted for analysis to the CDFG Lab in Rancho Cordova.

Incubation temperatures do not typically fluctuate as temperature can be controlled by selecting various intakes in the reservoir or by using the refrigeration chillers. Water is highly aerated with dissolved oxygen levels of 9 to 10 mg/l. Silt is controlled through the use of sand filters; however, due to a highly colloidal suspended matter, the filters are only marginally effective. The turbidity is a parameter monitored in the biweekly analysis.

2.9.1.5 Ponding

Swimup and ponding are volitional using the hatch jar method. Generally at 51 to 54 degrees F steelhead will hatch in 26 to 30 days and will swim up in 18 to 21 days from the hatch date. Upon swimup, the larval fish can flow out into the nursery tank in which the hatch jar is located. Ponding into raceways (which is forced) generally occurs when the fish are at the fingerling stage, which corresponds to a size of 2,000 fish to the pound (six weeks of age).

2.9.1.6 Fish Health Maintenance and Monitoring

The design of the hatch jars at DCFH provides for the automatic removal of egg mortalities. Dead eggs rise to the surface and are carried out with the gentle current of water flowing through the hatch jar. Any remaining white eggs are removed manually using a hand held pipette.

Due to the use of clear acrylic in the hatch jar construction process, visual monitoring can be carried out continuously. Hatch jar incubation also reduces the amount of chemicals used in disease treatment. Traditionally, formalin and/or salt would be required for combating fungal infections with eggs incubating in Vertical Flow incubators (Heath Incubators). The current of water which envelopes incubating eggs in the hatch jars allows for gentle movement of the developing eggs which reduces the incidence of fungus. No additional treatment procedures other than flow adjustment are necessary during the duration of incubation.

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

The following refers to techniques that are presently used only with hatchery origin steelhead which are not presently considered as "the listed fish."

Eggs will be incubated using water treated with UV purification to prevent exposure to pathogens. In addition, the treated water is filtered with sand / gravel filters and temperature controlled. Vertical flow incubators have been phased out in favor of acrylic hatch jars which have the following advantages:

- Eggs are continuously agitated (gently) to reduce fungal invasion.
- Chemical treatment of the eggs is eliminated.
- Eggs can be monitored readily (clear jars only).
- Higher egg to alevin survival ratios can be achieved.
- Eliminates handling sac-fry when moving from incubator to troughs.

2.9.2 Rearing

2.9.2.1 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.

Survival rates from ponding as fry to fingerling size is 87 percent survival. Survival rates from fingerling to yearling smolt release averages 78 percent survival. These percentages are an average of the past twelve years, slight variations occur annually. Calculations are based on fry at swimup to six weeks of age, at six weeks of age the juveniles are referred to as fingerling, and are classified as fingerling until they reach 20 fish per pound, at which time they are classified as yearlings. Yearling smolts are classified as such when they approach 4-5 fish per pound.

2.9.2.2 Density and Loading Criteria (Goals and Actual Levels)

Rearing pond densities are usually managed to maintain a maximum density of 2.25 lbs fish/ft^3.

2.9.2.3 Fish Rearing Conditions

All steelhead reared at either facility are monitored daily. Temperature regimes do not fluctuate critically as temperature of rearing water can be manipulated. Over the entire duration of rearing (9-12 months), temperature will rarely vary more than 5 degrees. Daily temperature variation rarely ranges more than a single degree. Dissolved oxygen of influent and effluent, is analyzed in the laboratory weekly (Winkler Titration) and can be checked as needed at other times with a dissolved oxygen meter. Other water quality data that is collected during laboratory analysis includes: pH, turbidity, chloride, suspended and settleable solids.

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

Weight counts are taken biweekly at either facility and to reduce handling, juvenile fish are not measured for length. Selected steelhead biweekly growth rates averaged for 1998-2000 are displayed in the following table.

Date	Average Size (fish per pound)
Apr 15	408
May 1	274
May 15	201
Jun 1	159
Jun 15	123
Jul 1	104
Jul 15	44
Aug 1	36
Aug 15	31
Sep 1	26
Sep 15	21
Oct 1	18
Oct 15	15
Nov 15	10
Dec 1	8
Dec 15	6
Jan 1	5
Jan 15	4.5
Feb 1	4

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

Hepatosomatic index and body moisture content data has not been routinely collected by staff at these facilities. Monthly growth rates are evaluated using standard CDFG protocol for taking weight count estimates without sacrificing the fish sampled (as a hepatosomatic index would require).

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

Fish feeds include a diet of extruded fish pellets which may be dry or moist, which are prepared by Bio-Oregon. Feeding is scheduled by electric timers which are set to dispense feed automatically at 8 times over the course of a day. Fish feed conversion rates for the last 12 years are noted in the following table.

Year	Fish Feed Conversion Rate
1989-1990	1.80
1990-1991	1.62
1991-1992	1.48
1992-1993	1.95
1993-1994	1.86
1994-1995	1.63
1995-1996	1.35
1996-1997	1.23
1997-1998	1.38
1998-1999	1.45
1999-2000	1.59
2000-2001	1.17

2.9.2.7 Fish Health Monitoring, Disease Treatment, and Sanitation Procedures

All fish reared are monitored by CDFG pathologists and certified prior to release. Treatment methods are prescribed by fish pathologists for disease outbreaks and treatment protocols are carried out by hatchery staff. Weekly salt flushes are given throughout the duration of rearing. Depending upon the cause of an outbreak, treatment methods may vary however, chemical treatments for external parasites are limited to the use of salt, formalin and hydrogen peroxide. Bacterial infections are generally infrequent with post larval steelhead but could include the use of penicillin G or oxytetracline. Sanitation procedures outlined in section 2.7.7 are included here for reference:

General Sanitation and Health Maintenance:

- All cleaning equipment and nets are disinfected in Argentyne (iodine based disinfectant) prior to use and separate cleaning instruments are kept for each raceway.

- Overall fish health maintenance and sanitation procedures include daily pond cleaning which also facilitates daily conditioning exercise to the ponded fish through fluctuating flow regimes.

- In addition, weekly prophylactic salt flushes are given to all life stages of steelhead throughout the duration of rearing.

- Feeding practices are continuously monitored and feeds are continuously rotated and inventoried.

- Overcrowding is prevented and routine pathology health assessments are carried out to maintain the health of all hatchery stocks.

2.9.2.8 Smolt Development Indices (*e.g.* Gill ATPase Activity), if Applicable

Gill ATPase activity and thyroxin levels are two indices that are proposed to be measured at each facility, but have not yet been measured. At present, plasma sodium levels have been analyzed by the SCWA for DCFH steelhead, however, preliminary results have not as yet been published.

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

Photoperiods of outdoor rearing facilities (containing salmonids ranging in size from fingerlings to smolts) follow the natural environment at both facilities. Additional “natural” rearing methods as described by the Conservation Hatchery Conceptual Framework have not been significantly adopted at either facility. However, the routine operations of these facilities already includes some of the recommended procedures for the “Conservation Hatchery” strategy: broodstock selection, shaded ponds at DCFH, volitional release at CVFF, imprinting at both facilities, health monitoring, release timing coordinated with smoltification and lunar phase, and daily exercise periods.

2.9.2.10 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 reared to smolt size to mimic the natural fish emigration strategy and encourage rapid downstream migration to the estuary, thereby minimizing the risk of ecological interaction with listed fish.

2.10 RELEASE

2.10.1 PROPOSED FISH RELEASE LEVELS

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	0	NA	NA	NA
Unfed Fry	0	NA	NA	NA
Fry	0	NA	NA	NA
Fingerling	0	NA	NA	NA
Yearling - DCFH	300,000	4	Jan - Apr	Dry Creek (Yoakim Bridge)
Yearling - CVFF	200,000	5	Jan - Apr	E. Fork Russian River (at CVFF)

2.10.2 SPECIFIC LOCATION(S) OF PROPOSED RELEASE(S)

DCFH

Release point: Dry Creek, three miles downstream from hatchery at Yoakim Bridge

Major watershed: Russian River

Basin or region: Central Coast Region of California

CVFF

Release point: East Fork Russian River, at discharge point of CVFF facility

Major watershed: Russian River

Basin or region: Central Coast Region of California

2.10.3 ACTUAL NUMBERS AND SIZES OF FISH RELEASED BY AGE CLASS THROUGH THE PROGRAM

DCFH Fish Releases

Release Year	Eggs/ Unfed Fry	Average Size	Fry and Fingerling	Average Size	Yearling	Average Size
89/90	0	NA	347,347	630	212,769	4
90/91	0	NA	121,326	64	243,881	4
91/92	0	NA	1,188,663	349	335,181	4
92/93	0	NA	1,249,521	350	321,890	4
93/94	0	NA	627,730	410	355,164	4
94/95	0	NA	397,455	149	309,458	4
95/96	0	NA	134,000	2,000	316,758	4
96/97	0	NA	279,088	733	312,388	4
97/98	0	NA	119,681	229	348,734	4
98/99	0	NA	210,832	40	572,659	4
99/00	0	NA	0	NA	(missing rpt)	NA
00/01	0	NA	0	NA	548,121	4
Average	0	NA	484,186	545	296,375	4

Data source: DCFH

CVFF Fish Releases

Release Year	Eggs/ Unfed Fry	Average Size	Fry and Fingerling	Average Size	Yearling	Average Size
92/93	0	NA	0	NA	165,469	6
93/94	0	NA	227,313	623	213,872	5
94/95	0	NA	107,667	452	235,416	5
95/96	0	NA	76,670	11	224,702	5
96/97	0	NA	122,188	206	206,333	5
97/98	0	NA	110,981	301	242,438	5
98/99	0	NA	164,770	152	231,320	5
99/00	0	NA	0	NA	229,451	5
00/01	0	NA	0	NA	211,801	5
Average	0	NA	115,656	249	217,867	5

Data source: DCFH

2.10.4 Actual Dates of Release and Description of Release Protocols

Release Year	DCFH Steelhead Fry (149-2000 fpp)		DCFH Steelhead Fingerling (21-150 fpp)		DCFH Steelhead Yearling (11-20 fpp)		DCFH Steelhead Smolts (1-10 fpp)	
	First Release	Last Release	First Release	Last Release	First Release	Last Release	First Release	Last Release
1994	4/20	6/29	5/17	5/17	11/23	11/23	1/6	4/7
1995	4/4	6/23	8/22	8/22	none	none	1/27	3/29
1996	3/19	7/12	9/21	9/22	9/5	9/22	12/13/95	3/15
1997	4/12	7/10	8/1	9/19	10/13	10/13	10/9	4/10
1998	5/28	7/29	10/1	10/6	9/29	10/1	12/26/97	4/25
1999	none	none	(missing rpt)	(missing rpt)	(missing rpt)	(missing rpt)	1/14	5/11
2000	(missing rpt)	(missing rpt)	none	none	none	none	(missing rpt)	(missing rpt)
2001	none	none	none	none	none	none	12/20/00	3/23

Release Year	CVFF Steelhead Fry (149-2000 fpp)		CVFF Steelhead Fingerling (21-150 fpp)		CVFF Steelhead Yearling (11-20 fpp)		CVFF Steelhead Smolts (1-10 fpp)	
	First Release	Last Release	First Release	Last Release	First Release	Last Release	First Release	Last Release
1994	5/17	6/29	9/27	9/27	none	none	2/6	4/8
1995	4/26	6/23	(missing rpt)	(missing rpt)	(missing rpt)	(missing rpt)	1/27	3/28
1996	(missing rpt)	7/12	8/1	9/19	none	none	(missing rpt)	(missing rpt)
1997	4/24	7/7	none	none	none	none	1/3	4/6
1998	5/28	7/22	10/6	10/6	9/30	9/30	1/25	4/23
1999	none	none	none	none	none	none	1/14	4/9
2000	none	none	none	none	none	none	2/1	3/31
2001	none	none	none	none	none	none	12/24/00	3/22

Yearling smolt steelhead releases from DCFH and CVFF are made in coordination with the new-moon lunar phase. DCFH releases are forced, while CVFF releases are volitional during a one month acclimation period, and then forced at the end of the period.

Prior to 1999, forced fry and fingerling releases were made when it was determined they were surplus to the hatchery production needs. Since 1999, all releases of surplus fish were discontinued.

2.10.5 Fish Transportation Procedures, if Applicable

Juvenile fish are loaded into transport vehicles manually or through the use of an Aqualife Harvester fish pump. Time in transit for juvenile releases from DCFH are generally no longer than approximately 20 minutes. Transport times from DCFH to CVFF are the longest times incurred at roughly 45 minutes in transit.

Transport is conducted in either the 800- or 1,200-gallon tank truck. The tank trucks are outfitted with four fresh flow aerators and a twin oxygen bottle / air stone assembly for oxygenation, but are not outfitted with temperature control (refrigeration). Transport densities do not exceed 2,000 pounds of steelhead.

Smaller scale transport units are sometimes used at either facility and include insulated tanks outfitted for use in pickup trucks. These units are primarily oxygenated using bottled oxygen and air stones or micropore tubing, however the larger unit has a fresh flow aerator installed. No temperature control (refrigeration) is used for these smaller units and densities (fish transported) are generally very low.

2.10.6 ACCLIMATION PROCEDURES

The acclimation period at DCFH is approximately one year, as all fish released from the hatchery are spawned, incubated, hatched and reared in the water they are released in. The fish released at CVFF are transported to the facility approximately 30 days prior to their releases.

2.10.7 MARKS APPLIED, AND PROPORTIONS OF THE TOTAL HATCHERY POPULATION MARKED, TO IDENTIFY HATCHERY ADULTS

All juvenile steelhead released from DCFH and CVFF are marked with an adipose fin clip to identify their hatchery origin. This mass marking program was initiated in 1996, and the 1998 spawning season marked the first return of progeny (two year old fish) bearing the adipose fin clip from the program.

As of 1999 all adult fish returning to either facility can be identified as being of hatchery origin by the presence of an adipose fin clip from the mass marking program. Those fish, which return to either facility without an adipose fin clip, are regarded as being of wild origin. All adult fish released from either facility, whether of hatchery origin or wild, have a mark (punch) applied to the caudal fin, identifying them as fish that have already returned to DCFH or CVFF.

2.10.8 DISPOSITION PLANS FOR FISH IDENTIFIED AT THE TIME OF RELEASE AS SURPLUS TO PROGRAMMED OR APPROVED LEVELS

The current management procedure at the hatchery is to retain only as many eggs required to meet the yearling production goals. All surplus spawn is discarded prior to hatching.

2.10.9 FISH HEALTH CERTIFICATION PROCEDURES APPLIED PRE-RELEASE

All fish released from either facility are inspected for condition and disease by CDFG pathologists prior to certification for release.

2.10.10 EMERGENCY RELEASE PROCEDURES IN RESPONSE TO FLOODING OR WATER SYSTEM FAILURE

An assortment of small volume pumps are available for low volume water supply needs. Additional, both facilities have emergency procedures in the event of water system failure.

DCFH

In the event of a water system failure, a variety of emergency backup measures can be initiated by personnel depending on the extent and duration of the emergency. Two alternative water sources may be used, one of which can permit full operation of the hatchery facilities - the emergency bypass water pipeline and well water. While well water is a possible alternative source of water for the hatchery, its suitability as a sole source in an emergency situation is most likely inadequate as the well water is flat (low oxygen) and is prone to harboring dissolved methane gas.

In the event of an emergency situation calling for complete activation of the emergency water supply bypass pipeline, hatchery personnel must first contact the USACE office to request the emergency water supply bypass pipeline be charged. Charging of the line is controlled by the energy dissipation valve in the stilling well at the dam which is not available to hatchery personnel. The emergency water supply is generally charged and ready for immediate use, however, hatchery staff are required to contact USACE during an emergency to open the valve for access to the emergency water supply bypass pipeline, which will delay delivery of emergency water, especially during an emergency after hours, when the USACE offices are closed.

The aeration pond can supply sufficient water to the raceway as during an emergency, as it drains, for a maximum of 8 to 30 minutes. During this 8 to 30 minutes, hatchery staff must contact an employee of the USACE to provide access to the EWS system and then must initiate steps to operate the emergency water bypass. Delays of any length longer than this period of time (maximum 30 minutes) will result in mortalities to steelhead raised at DCFH, with degree of loss dependent upon time of year. A standby generator is available to provide power for operations during a power outage, however, failure of this generator would result in a condition which would require the use of the emergency water supply bypass line. Power system failures requiring the operation of the standby generator are the most common operational difficulties encountered at DCFH occurring with fairly regular frequency during winter storms.

Wells E and F were initially provided as an emergency water source and are capable of providing the hatchery with a partial water source. This source of water is unsuitable as a single source supply to the hatchery due to elevated temperatures, low dissolved oxygen and dissolved methane gas. In addition, operation of the wells would not be possible in the event of a power failure, as the backup generator operating the wells has to be taken offline.

A third source of water is available and will automatically begin to fill the aeration pond if the aeration pond level begins to drop to a crucial level. This will occur only when the water system failure is not accompanied by a power failure. The source supply for this provision is the wastewater control pond, which is not highly desirable as it is untreated water and may harbor pathogens. This provision will also function on standby power.

If the above backup systems are not available, and survival of the fish is threatened, the fish can be released into the water pollution control pond or released directly into Dry Creek. A large scale release of this type would undoubtedly be difficult to implement, would require considerable efforts on behalf of hatchery staff and would inundate the water system with large numbers of salmonid fish. Retrieval of these fish would be difficult at best.

CVFF

A portable emergency generator is installed and located at the facility to run two water supply pumps in the event of a power failure. This system is manually operated unlike the automatic system at DCFH. If for some reason the generator or pumps fail, and the facility is left with no water supply, the fish rearing in the raceways can be released directly into the river. This act would require considerable efforts on behalf of hatchery personnel during an emergency release.

2.10.11 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.

To minimize competition between hatchery fish and naturally spawned fish, limited numbers, and only smolts which migrate directly to the ocean, are released. While the hatchery progeny are larger than their wild counterparts, the size of released smolts corresponds to highest return rates. Additionally, releases of steelhead are coordinated with lunar cycles to take advantage of tidal influences through their effects on out-migration.

Outbreeding depression is a genetic concern caused by the loss of localized genetic adaptations, resulting in decreased fitness and can be caused, for example, by the interbreeding of naturally spawned fish with hatchery fish from out-of-basin origin. All broodstock released into the Russian River now comes solely from returns to DCFH or CVFF.

Hatchery fish may harm naturally spawned fish directly by predation, as they are released at a larger size than their naturally spawned counterparts. In order to minimize this effect, hatchery fish are not generally released immediately into spawning or rearing habitat. In addition, straying is minimized through the release of progeny at or very close to the rearing facility. Fish released at CVFF are imprinted first for a minimum of 30 days and releases are volitional. Further, release takes place only on Dry Creek and the East Fork Russian River, leaving additional rearing habitat in the basin unaffected.

An indirect stress put on naturally spawned fish may be an increased harvest effort following elevations in steelhead populations resulting from hatchery fish production. Although regulations prohibit the take of wild fish, hooking mortality and harassment may affect the survivability of wild populations.

2.11 MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

2.11.1 MONITORING AND EVALUATION OF "PERFORMANCE INDICATORS" PRESENTED IN SECTION 2.1.10

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

The Performance Indicators presented in Section 2.1.10 are reproduced in the table below, along with an indication of the present status of data collection efforts relating to these activities. The status of "Ongoing" indicates that activities are currently being undertaken that address the issue, although these activities may not be under the direct supervision or funding umbrella of the USACE/CDFG hatchery program. The status of "NEEDED" indicates that data collection efforts have yet to be implemented. Plans and methods for many recommended data collection activities have been compiled in the document entitled *Hatchery and Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities* (FishPro and ENTIRX 2002). Where appropriate, the last column indicates a cross-reference between the Performance Indicators of Section 2.1.10 and the Activities described in the existing M&E plan. In cases where there is no cross reference, the need exists to develop a plan that will adequately assess the issues.

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B1A.	Assess contribution to the recreational fishery	Needed	1.4.2
B2A.	Develop harvest management plan for hatchery fish	Needed	1.4.4
B2B.	Compute ratio of wild fish to harvest	Needed	1.4.2, 2.1.2
B2C.	Document total harvest of hatchery fish	Needed	1.4
B2D.	Determine that total harvest of wild steelhead does not exceed upper maximum of absolute number of wild fish	Needed	1.4
B2E.	Assure that hatchery broodstock goals are met 4 out of 5 years ± 10%.	Ongoing	1.2.3, 1.3.1
B3A.	Mitigation goals of the hatchery are met	Not Feasible at Present	none
B4A.	Hatchery performance standards established in the DCFH / CVFF Management Plan are achieved.	Ongoing	1.1.1
B4B.	Relevant state-wide hatchery performance standards are achieved.	Ongoing	1.1.1
B5A.	Establish increasing trend in the value of harvest	Needed	none
B5B	Develop an overall economic impact assessment to compute effects from Russian River hatchery production	Needed	none
R1A.	Maximum allowable effect to weak populations not exceeded in 4 out of 5 years ±10 %	Needed	4.2.1
R1B.	Life history characteristics of weak populations monitored for change from baseline by comparing at year 1 with 5-year survey or after one generation	Needed	2.1..2
R1C.	Maintenance of unique life history characteristics evaluated by comparing baseline at year 1 with a 5 year survey, or after one generation.	Needed	2.1.2
R1D.	Document that natural population escapement goal not adversely affected in 4 out of 5 years ± 10 % for specific species and populations	Needed	2.1.2
R2A.	Assess genetic effects, initially through stray rates as a surrogate for a thorough and more complex measurement of genetic effect	Needed	3.2, 1.2.3
R2B.	More specific genetic effects measurements to be implemented on a selected basis	Ongoing	3.1. 3.2
R3A.	Achieved percent egg take goal in 4 out of 5 years	Ongoing	1.1.1
R3B.	Implemented CDFG disease protocols in any events involving egg transfer to the hatchery	Ongoing	1.1.1
R4A.	Selected tributaries by subbasin and hatchery by species – conducted comparative evaluation of prestocking population with post stocking after five years or after one generation	Needed	2.1.2, 4.2.1
R4B.	Implemented tributary M&E plan by subbasin by specific hatchery by species, and extrapolated to other subbasins and the other hatchery in the basin	Ongoing	2.1, 2.2
R4C.	Developed M&E plan for estuary and near shore marine habitat	Ongoing	2.2

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
R5A.	Develop an appropriate M&E plan to assure program does not exceed the carrying capacity of freshwater habitats	Needed	2.1.3
R5B.	Reservoir, estuarine, and ocean research, monitoring, and evaluation plan developed	Needed	2.2.3
R6A.	Documented stable or increasing trend of redd counts as index of natural spawning	Ongoing	2.1.2
R6B.	Documented stable or increasing numbers of adult fish.	Ongoing	2.1.1, 2.1.2
R6C.	Documented stable or increasing trend in adult resident fish.	Ongoing	4.1.1
R6D.	Documented hatchery spawner to recruit ratio equal to or greater than 1	Needed	4.1.1
R7A.	Established comparative annual sampling of disease in hatchery and wild populations	Needed	4.2.1
R7B.	Complied with CDFG standards and NMFS guidelines	Ongoing	1.1.1
R7C.	Applied disease standards to stocking activities	Ongoing	1.1.1
R7D.	Evaluated incidence of drug resistant pathogens by comparing to baseline in year 1 to survey every five years	Needed	4.2.2
R8A.	Evaluated trends in the ratio of hatchery juvenile production cost per cost of juvenile production from habitat projects by subbasin by hatchery per adult production	Needed	none
R9A.	Developed cost effective methods of producing benefits to recreation fishery	Needed	none
R9B.	Achieved highest numerical ratio of returning adults per cost of action (habitat, passage, hatchery)	Needed	None
R9C.	Achieved highest ratio of intrinsic social value (satisfaction survey) of returning adults per cost of action	Needed	none

Many methods coming into use that can reduce potential effects of hatchery fish on protected wild populations require greater understanding of the natural population than is currently available within the Russian River. As an example, while there may be substantial genetic benefit that could be achieved by incorporating wild fish into the steelhead hatchery broodstock protocol, there is extremely little quantitative information regarding the population trend for natural Russian River steelhead. Certain hatchery evaluation parameters are unquestionably the responsibility of the hatchery owner, but it must also be recognized that many evaluation parameters that may be more strongly related to resource management may fall under the stewardship responsibility of the State and Federal fisheries resource agencies. It is felt to be critical to the optimal operation of Russian River fish production facilities, as well as to the recovery of listed species, that the activities described in the *Monitoring and Evaluation Plan for Russian River Fish Facilities* be fully implemented. This implementation will require significant coordination to establish relevant and fair delegation of tasks to various parties. The following table provides a synopsis of activities presented in the M&E Plan, along with initial concepts relating to project implementation:

- each activity's relative priority;
- whether there is any ongoing effort related to the activity;
- the entity which would appear to be the responsible party for supervising the data collection and reporting efforts; and
- the existing or potential funding source for the activity.

Activity	Description	Priority	Status	Responsible Entity	Funding Source
Objective 1.	**Determine if the Hatchery Products are Meeting Program Goals and Expectations.**				
Task 1.1	Monitor the In-Hatchery Survival and the Hatchery Operational Practices for Each Release Group.				
Activity 1.1.1	Develop hatchery annual operation plan to ensure consistency of hatchery production approaches and quantification of results achieved.	High	On-Going	CDFG	USACE
Subactivity 1.1.1.1	Determine egg-to-fry, fry-to-parr, parr-to-smolt survival rates for each release group.	High	On-Going	CDFG	USACE
Subactivity 1.1.1.2	Document numbers, size, time of release, and release location for all fish.	High	On-Going	CDFG	USACE
Subactivity 1.1.1.3	Conduct periodic monitoring for size during rearing.	High	On-Going	CDFG	USACE
Subactivity 1.1.1.4	Participate in planning processes for ponding and rearing.	High	On-Going	CDFG	USACE
Subactivity 1.1.1.5	Prepare and submit tag, mark and release reports.	High	On-Going	CDFG	USACE
Task 1.2	Estimate the Number of Adults Produced by Each Rearing and Release Strategy.				
Activity 1.2.1	Mark all hatchery-reared fish so they can be detected as smolts and as adults.	High	On-Going	CDFG	USACE
Subactivity 1.2.1.1	Use CWT, PIT tags or other special marks for a portion of special hatchery release groups, so they can be detected wherever they are recovered.	Low			
Activity 1.2.2	Estimate abundance of hatchery fish departing as smolts.	High	On-Going	CDFG	USACE
Activity 1.2.3	Quantify the number of hatchery produced adults returning to the Russian River basin.	High	On-Going	CDFG	USACE
Subactivity 1.2.3.1	Operate ladders at hatcheries to estimate escapement of hatchery-produced fish.	High	On-Going	CDFG	USACE
Task 1.3	Estimate Survival from Smolt-to-Adult Survival for Various Treatments.				
Activity 1.3.1	Estimate smolt-to-adult survival for each treatment based on smolt abundance from Activity 1.2.2 and adult abundance in Activity 1.2.3 and 2.1.	High	On-Going	CDFG	USACE

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 1.3.2	Use monitoring and evaluation results to revise parameters in the life-history simulation model used to predict stocking rates.	High	Needed	CDFG	USACE
TASK 1.4	Estimate Total Harvest of Russian River Hatchery Produced Fish.				
Activity 1.4.1	Monitor harvest-rate of Russian River hatchery fish in any ocean fisheries.	Low			
Activity 1.4.2	Survey fishermen in the Russian River basin to estimate total catch of hatchery origin steelhead trout.	High	Needed	CDFG	USACE
Activity 1.4.3	Analyze the age and spatial distribution for freshwater landings to determine how they differ between groups from different release strategies.	Low			
Activity 1.4.4	Develop run prediction and harvest monitoring to allow harvest of abundant fish returns.	High	Needed	CDFG	USACE
OBJECTIVE 2.	**DETERMINE THE STATUS AND PERFORMANCE OF NATURAL PRODUCTION IN THE RUSSIAN RIVER BASIN.**				
TASK 2.1	QUANTIFY THE ESCAPEMENT/ABUNDANCE OF HATCHERY AND NATURALLY PRODUCED RETURNING ADULTS TO THE RUSSIAN RIVER BASIN.				
Activity 2.1.1	Quantify adult escapement to the mouth of the Russian River.	Low			
Activity 2.1.2	Quantify the escapement/abundance of hatchery and naturally produced returning adults to the tributary specific areas.	High	Needed	CDFG	
Subactivity 2.1.1.1	Conduct stratified random spawning ground surveys.				
Subactivity 2.1.1.2	Operate fish counting facilities to provide an annual non-biased and precise quantification of adult abundance.				
Subactivity 2.1.1.3	Conduct mark-recapture studies to estimate adult steelhead escapement as a back-up population estimate if direct measurement is not achieved.				
Subactivity 2.1.1.4	Collect biological information of fork length, sex, scales, general fish health, examine for marks/tags, scan with PIT tag and CWT scanners, and collect fin tissue sample for DNA analysis (see Objective 3) from all adult fish captured in individual tributaries.				
Activity 2.1.3	Conduct juvenile density surveys.	High	On-Going	CDFG	

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 2.1.4	Operate juvenile emigration traps to estimate production.				
Subactivity 2.1.4.1	Tributary specific juvenile emigration trapping.	High	On-Going	CDFG	
Subactivity 2.1.4.2	Russian River basin monitoring at Mirabel Dam.	High	On-Going	CDFG	
TASK 2.2	COLLECT PHYSICAL HABITAT, STREAM TEMPERATURE, AND DISCHARGE DATA TO CORRELATE WITH STAFF GAUGE INFORMATION IN ALL TRIBUTARIES DIRECTLY MONITORED FOR ADULT ESCAPEMENT AND JUVENILE PRODUCTION.				
Activity 2.2.1	Install constant recording thermographs and document hourly water temperature at the facility sites, year-round.	Low			
Activity 2.2.2	Install a staff gauge and collect stream discharge information that is sufficient to develop discharge curves for each key tributary.	Low			
Activity 2.2.3	Implement environmental monitoring and assessment program for habitat conditions throughout the entire Russian River basin.	High	On-Going	CDFG	
OBJECTIVE 3.	**GENETICS EVALUATION.**				
TASK 3.1	GENETIC SAMPLE COLLECTION AND ANALYSIS.				
Activity 3.1	Collect samples.	High	On-Going	CDFG	
Activity 3.2	Analyze samples.	High	On-Going	Sonoma State	
TASK 3.2	APPLY DNA DATA TO IMMEDIATE MANAGEMENT NEEDS.				
Activity 3.2.3	Determine the stocks.	High	Needed		
Activity 3.2.2	Determine the extent to which the hatchery stock is representative of the naturally spawning stock.	High	Needed		
Activity 3.2.1	Determine the reproductive success of naturally-spawning hatchery-reared fish.	High	Needed		
TASK 3.3	APPLY DNA DATA TO LONG-TERM MANAGEMENT NEEDS.				
Activity 3.3.1	Confirm that the hatchery program is consistently representative of the naturally spawning stock.	Low			
Activity 3.3.2	Determine whether hatchery operations are decreasing, maintaining, or increasing the effective population size in both the hatchery and naturally spawning stocks.	Low			

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
OBJECTIVE 4.	**ESTIMATE ECOLOGICAL IMPACTS TO FISH POPULATIONS.**				
TASK 4.1	DETERMINE IF THERE IS EVIDENCE THAT NON-TARGET FISH POPULATIONS IN OUTPLANTED STREAMS ARE INFLUENCED BY COMPETITION OR PREDATION INTERACTIONS WITH THE SUPPLEMENTED POPULATIONS.				
Activity 4.1.1	Monitor short- and long-term changes in the relative density of competitor fish species in treatment and reference streams in conjunction with ongoing parr monitoring studies. Determine whether these changes are correlated with hatchery outplant activities.	High	Needed	CDFG	USACE
Subactivity 4.1.1.1	Snorkel and count fish by species each season, and classify into size intervals.				
Subactivity 4.1.1.2	Conduct small-scale studies to determine microhabitat utilization.				
TASK 4.2	DETERMINE IF THERE IS EVIDENCE THAT NON-TARGET FISH POPULATIONS IN TREATMENT STREAMS ARE INFLUENCED BY DISEASE TRANSMISSION FROM THE SUPPLEMENTED POPULATIONS.				
Activity 4.2.1	Conduct routine sampling to establish ambient levels of infectious and non-infectious diseases among free-living hatchery and natural fish under natural conditions.	High	Needed	CDFG	USACE
Subactivity 4.2.1.1	Determine the frequency of common fish pathogen presence and virulence in Russian River hatchery produced fish.				
Subactivity 4.2.1.2	Determine the frequency of common fish pathogen presence and virulence among naturally produced fish in the Russian River basin.				
Activity 4.2.2	If a disease outbreak is detected, increase sampling intensity to determine its prevalence and full effect on hatchery and wild fish.	High	Needed	CDFG	USACE
Subactivity 4.2.2.1	Identify and assess factors that caused disease outbreak.				
Subactivity 4.2.2.2	Determine potential adverse effects of any disease outbreak.				
OBJECTIVE 5.	**EFFECTIVELY COMMUNICATE MONITORING AND EVALUATION PROGRAM APPROACH AND FINDINGS TO RESOURCE MANAGERS.**				
TASK 5.1	DATA MANAGEMENT AND DISSEMINATION.				

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 5.1.1	Provide data summary to the joint NMFS/CDFG salmonid research database.	High	On-Going	CDFG	USACE
Activity 5.1.2	Provide data summary to the CDFG Natural Diversity Data Base (NDDB).	High	On-Going	CDFG	USACE
Activity 5.1.3	Report Coded-Wire Tagging summary reports to the Regional Mark Information System (RMIS) database.	High	On-Going	CDFG	USACE
TASK 5.2	COMMUNICATION OF RESULTS AND TRANSFER OF TECHNOLOGY.				
Activity 5.2.1	Develop annual Statement of Work.	High	On-Going	CDFG	USACE
Activity 5.2.2	Develop quarterly reports.	High	On-Going	CDFG	USACE
Activity 5.2.4	Develop ESA Section 7 summary reports.	High	On-Going	CDFG	USACE
Activity 5.2.5	Develop annual reports.	High	On-Going	CDFG	USACE
Activity 5.2.6	Develop five-year summary report.	High	On-Going	CDFG	USACE
Activity 5.2.7	Develop peer-reviewed journal publications.	Low			
Activity 5.2.8	Participate in regional conferences and workshops.	Low			
TASK 5.3	DEVELOP AND MAINTAIN OPEN COMMUNICATIONS WITH ALL RESOURCE MANAGERS (COORDINATION).				
Activity 5.3.1	Participate in the coho supplementation program Technical Oversight Committee (TOC) and the basin-wide monitoring and evaluation TOC.	High	On-Going	CDFG	USACE
Activity 5.3.2	Facilitate hatchery annual review and operating plan modification through an Annual Operating Plan.	High	On-Going	CDFG	USACE
Activity 5.3.3	Attend coordination meetings regarding hatchery production and salmonid recovery.	High	On-Going	CDFG	USACE
Subactivity 5.3.3.1	Attend meetings of the Joint Hatchery Review Committee.				
Subactivity 5.3.3.2	Attend meetings of the Russian River Coho Salmon Recovery Work Group.				
Subactivity 5.3.3.3	Attend meetings of additional salmonid recovery teams as they come into existence.				

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

Significant coordination efforts are required to identify available funding, staffing, and support logistics as a means to allow full implementation of the monitoring and evaluation program.

2.11.2 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.

Specific risk aversion measures will be developed as individual M&E tasks and activities are identified and implemented.

2.12 RESEARCH

2.12.1 OBJECTIVE OR PURPOSE

The efforts required under Objective 3 - Genetic Evaluation in the M&E plan described above may be considered to be research. The genetic evaluation activities being conducted in association with the hatchery program described in this HGMP include the following activities:

Genetic sampling of tissues taken from the hatchery stocks has been ongoing for several years. Tissues are randomly sampled from hatchery stocks and evaluated using genetic analysis tools developed by the U.C. Davis Bodega Marine Laboratory. The majority of this work has focused on salmon stocks entering into DCFH, however, tissues were recently taken from the 99/00 brood year of steelhead at DCFH.

In addition, CDFG takes tissue samples from wild fish and hatchery fish found within the Russian River. A random sample is selected from fish captured in the wild during routine biological surveys. Efforts are made to ensure that a representative sample is taken from each reach surveyed and reaches selected are representative of the habitat available on each tributary. In addition, efforts are made to collect tissues when possible from fish above barriers and also during winter carcass surveys.

It is anticipated that these samples may contribute to genetics research recently initiated at the Sonoma State University, analyzing steelhead populations occurring above and below impassable barriers on the Russian River. Warm Springs Dam is one of 10 barriers identified in this project. This project is scheduled for completion in 2003. The intent of this research is to elucidate the genetic differences between anadromous populations and residualized populations and to identify stocks more closely related to historic steelhead runs in the Russian River. It is hoped that this research will ultimately identify candidate populations for the development of a supplementation program in the Russian River. Coyote Valley Dam has also been proposed as one of the barriers, however may be replaced, as it is becoming apparent that catchable trout introductions into Lake Mendocino may have influenced resident trout populations in tributaries above the lake.

Russian River tissue samples may also contribute to genetics research being conducted at the NMFS Santa Cruz Laboratory. In support of the ESA Technical Recovery Team (TRT), the lab has started a large-scale evaluation of genetic population structure for steelhead populations in the Northern California/CCC ESUs. The study involves the collection of molecular genetic data from samples of 50 individuals from approximately 40 watersheds in the study area. Samples are being collected by field crews from the Santa Cruz Laboratory and collaborators such as CDFG. SCWA has contributed steelhead and Chinook samples taken in 2000/01 and 2001/02 seasons. Genetic markers for which data are being collected include 12 microsatellite markers and sequences from two immunogenetic regions (MHC loci). These data will be used to estimate genetic distances and construct trees of population relatedness. Rates of migration and change in effective population size will also be estimated. A parallel effort for coho salmon is also underway.

With time, it is hoped that research will be able to answer the following genetics informational needs identified in the CDFG Draft Russian River Restoration Plan:

- Broad sampling across basin.
- A comparable genetic baseline for Russian River salmonids.
- Genetic assessment of hatchery runs.
- Genetic assessment of wild runs.
- Genetic comparison of fish from above barriers vs. hatchery and wild fish below barriers.
- Genetic comparison of fish from tributaries that have had very little stocking influence (ex. check database).
- Genetic comparison of multiple year returns to both hatcheries.
- Genetic comparison of Russian River salmonids to salmonids from nearest basins.
- Genetic comparison of Lake Sonoma steelhead to the hatchery run (to identify divergence in the hatchery population).
- Genetic identification of local adaptations (if technology is available).
- Identification of closely related stocks.
- A comparison of stock transfers (only over the course of hatchery operations) and present hatchery run to determine degree of integration and the influence of these stocks on the hatchery funs genetic makeup.

2.12.2 Cooperating and Funding Agencies

Tissue analysis conducted by the Bodega Marine Lab has been funded by the SCWA.

Samples supplied by CDFG for analysis at the Bodega Marine Lab are first submitted to CDFG Salmonid Tissue Archive (1701 Nimbus Road, Rancho Cordova, CA 95670, 916-358-2895).

Funding for these tissue sampling and archiving efforts is supplied through the budgets of the DCFH, the CDFG Hopland Research Center and the CDFG Salmonid Tissue Archive.

The genetic research being conducted at Sonoma State University is funded through the California Coastal Salmon Recovery Program. Genetic tissue analysis being carried out at the NMFS Santa Cruz Lab is funded by NMFS.

2.12.3 PRINCIPAL INVESTIGATOR OR PROJECT SUPERVISOR AND STAFF

The principal investigator for the activities at Bodega Marine Lab is Dennis Hedgecock. The principal investigator for the activities at Sonoma State University activities is Derek Girman. The principal investigator for the activities at the NMFS Santa Cruz Lab is Carlos Garza. Activities relating to sampling of DCFH and CVFF fish is supervised by Royce Gunter, Jr., while CDFG sampling of wild Russian River fish is supervised by Bob Coey at the Hopland Research Station.

2.12.4 STATUS OF STOCK, PARTICULARLY THE GROUP AFFECTED BY PROJECT, IF DIFFERENT THAN THE STOCK(S) DESCRIBED IN SECTION 2.2

The status of the affected stocks is uncertain, as was described in Section 2.2.

2.12.5 TECHNIQUES: INCLUDE CAPTURE METHODS, DRUGS, SAMPLES COLLECTED, TAGS APPLIED

Collection of tissues for the above-mentioned research activities are similar whether the tissues are collected from hatchery stocks or from fish in tributaries of the Russian River. Collection methods are as follows:

Juvenile Fish: For the sampling of hatchery stock, fish are netted from the rearing vessel and anaesthetized in a bath of MS222. Collection of juvenile fish in the field is accomplished while electrofishing (generally using the Smith Root Model 12 backpack electrofisher). In the field, the anesthetic bath is not used due to the MS222 quarantine period required prior to re-release. Whether in the field or in the hatchery, approximately one square millimeter of tissue is removed from the caudal fin using clean instruments. The tissue is placed in a vial of buffer for cold storage or the tissue is placed in filter paper for dry storage. Juvenile fish are released alive back into the rearing unit or stream reach from which they were collected.

Adult Fish: Adult fish being held in the hatchery receive a fin punch for identification during sorting, regardless of tissue sampling requirements. If tissues are needed for analysis, this section of tissue removed for identification is submitted. Anesthesia of adults in the hatchery is accomplished using carbon dioxide. Sampling of adult fish in the field is conducted on carcasses.

2.12.6 DATES OR TIME PERIOD IN WHICH RESEARCH ACTIVITY OCCURS

Collection of adult salmonid tissues at the hatchery facility generally occurs during the holding and spawning period of the subject species. Tissue collection for hatchery juveniles can be conducted at any time of the year but is most often performed at the same time as mass marking procedures.

Collection of tissues from fish captured in tributaries of the Russian River typically begins in late summer (August) and ceases immediately prior to winter storms.

2.12.7 CARE AND MAINTENANCE OF LIVE FISH OR EGGS, HOLDING DURATION, TRANSPORT METHODS

Natural steelhead (listed fish) sampled for tissues using the above techniques are held in water from the location of capture, in an insulated container and aerated with a batter powered aerator. Fish are held for a short duration (5-10 minutes) and tissue collection is processed in small batches as fish are captured. No fish are transported for this type of sampling.

2.12.8 EXPECTED TYPE AND EFFECTS OF TAKE AND POTENTIAL FOR INJURY OR MORTALITY

With regard to the tissue sampling activities described above, the most significant potential for injury or mortality occurs with the electrofishing necessary for sampling of wild juveniles. Estimates of mortality due to electrofishing activities are less than 1 percent, not including estimates of delayed trauma or delayed mortality. Often any mortalities that are incurred are attributed to fish that appear to be physiologically compromised based on observable fitness, physical abnormality, or a previously weakened state.

2.12.9 LEVEL OF TAKE OF LISTED FISH: NUMBER OR RANGE OF FISH HANDLED, INJURED, OR KILLED BY SEX, AGE, OR SIZE, IF NOT ALREADY INDICATED IN SECTION 2.2 AND THE ATTACHED "TAKE TABLE" (TABLE 1).

Levels of estimated take are presented in Table 1 (page 2-67).

2.12.10 ALTERNATIVE METHODS TO ACHIEVE PROJECT OBJECTIVES

Because the caudal fin tissue of salmonid fish readily regenerates, the removal of small amounts of tissue for genetic analysis is not likely to compromise the health of the individuals sampled to a great degree. A less invasive approach to tissue sampling has not been forthcoming, however, as genetic analysis tools are rapidly developing, CDFG will keep abreast of the latest technology available and employ the techniques that procure the necessary data while causing the least effect to the listed fish.

2.12.11 LIST SPECIES SIMILAR OR RELATED TO THE THREATENED SPECIES; PROVIDE NUMBER AND CAUSES OF MORTALITY RELATED TO THIS RESEARCH PROJECT.

The most closely related species to threatened stocks of steelhead in the Russian River are Chinook salmon and coho salmon. In the Biological Opinion (BO) for the coho program, NMFS estimates the unintentional lethal take associated with the coho research activities to be 700 fish. Since research on wild Russian River Chinook and steelhead will be limited to tissue sampling and will not involve the broodstock collection efforts of the coho program, the estimated mortality from tissue sampling of wild Chinook and steelhead is the 1 percent mortality associated with electroshocking. Assuming a conservative field sampling effort of 500 juvenile fish of each species, the estimated mortality is 5 Chinook and 5 steelhead.

2.12.12 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.

Risk aversion measures include the following:

- Close attention will be made to electrofishing techniques.

- These ESA-listed fish will be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. The transfer of fish will be conducted using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.

- Juvenile fish will not be captured or handled if the water temperature exceeds 70 degrees Fahrenheit at the capture site.

2.13 ATTACHMENTS AND CITATIONS

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Winzler and Kelly Consulting Engineers. 1978. Evaluation of fish habitat and barriers to fish migration. San Francisco, California. Prepared for the U.S. Army Corps of Engineers, Eureka, California.

2.14 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:_____________

Table 1 Estimated Listed Salmonid Take Levels by Hatchery Activity

Listed species affected: Steelhead Trout **ESU/Population:** Central California Coast/Russian River **Activity:** DCFH/CVFF Steelhead Program
Location of hatchery activity: DCFH and CVFF **Dates of activity:** Year-round **Hatchery program operator:** CDFG

	Annual Take of Listed Fish By Life Stage *(Number of Fish)*			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)			100	
Collect for transport b)				
Capture, handle, and release c)			100	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (*e.g.* broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			5	
Other Take (specify) h)			60	

a. Estimated contact with listed fish through stream surveys, carcass and mark recovery projects.
b. Not applicable; there are no DCFH/CVFF facilities for capture and transport only.
c. Estimated take associated with DCFH and CVFF adult trapping operations, assuming some incidental capture of listed fish, with subsequent transported for release.
d. Not applicable for DCFH/CVFF.
e. Not applicable for DCFH/CVFF.
f. Not applicable for DCFH/CVFF.
g. Unintentional mortality of listed adult fish during holding and transport prior to release into the wild.
h. Estimated take resulting from bycatch in sport fishery for hatchery steelhead.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

3.1 GENERAL PROGRAM DESCRIPTION

3.1.1 NAME OF HATCHERY OR PROGRAM

Don Clausen Fish Hatchery (DCFH) Coho Program.

3.1.2 SPECIES AND POPULATION (OR STOCK) UNDER PROPAGATION, AND ESA STATUS

Central California Coast (CCC) coho salmon *(Oncorhynchus kisutch)*, Russian River stock and Lagunitas Creek stock. The CCC coho salmon ESU was listed as a threatened species October 31, 1996, and the take of this species was prohibited pursuant to section 4(d) and Section 9 of the ESA in the final determination (61 FR 56138).

3.1.3 RESPONSIBLE ORGANIZATION AND INDIVIDUALS

Lead Contact

Name (and title):	Peter LaCivita, Regional Fishery Biologist
Agency:	US Army Corps of Engineers, San Francisco District
Address:	333 Market Street, 7th Floor; San Francisco, CA 94105
Telephone:	(415) 977-8672
Fax:	(415) 977-8695
Email:	Peter.E.LaCivita@usace.army.mil

On-site Operations Lead

Name (and title):	E. Royce Gunter, Jr., Senior Hatchery Supervisor
Agency:	California Department of Fish and Game, Warm Springs Hatchery
Address:	3246 Skaggs Springs Road, Geyserville, CA 95441
Telephone:	(707) 433-6325
Fax:	(707) 433-8146
Email:	rgunter@dfg.ca.gov

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

As a special condition of the Section 10 permit authorizing the coho program, a Technical Oversight Committee (TOC) has been established that considers all ongoing and future research and restoration activities. To maximize efficiency, the TOC has been operating in conjunction with the Russian River Coho Salmon Recovery Program (RRCSRP), a workgroup initiated by California Department of Fish and Game (CDFG) and NMFS in 2001 to assure interagency coordination and public outreach for coho recovery activities within the basin. The lead contacts for agency representation on the TOC committee are:

Name (and title):	Miles Croom, Recovery Coordinator for the North-Central California Coast
Agency:	National Marine Fisheries Service, Southwest Region, Northern California Field Office
Address:	777 Sonoma Ave, Suite 325, Santa Rosa, CA 95404
Telephone:	(707) 575-6068
Fax:	(707) 578-3435
Email:	Miles.Croom@noaa.gov

Name (and title):	Brannon Ketcham, Hydrologist
Agency:	National Park Service, Point Reyes National Seashore
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Name (and title):	Carlos Garza, Research Geneticist
Agency:	National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz Laboratory
Address:	110 Shaffer Rd, Santa Cruz, CA 95060
Telephone:	(831) 420-3903
Fax:	(831) 423-3383
Email:	carlos.garza@noaa.gov

Name (and title):	Bob Coey, Senior Fisheries Biologist
Agency:	California Department of Fish and Game, Watershed Program
Address:	P.O. Box 47, Yountville, CA 94599
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Fax:	(707) 657-2388
Email:	bcoey@dfg.ca.gov

3.1.4 Funding Source, Staffing Level, and Annual Hatchery Program Operational Costs

The funding source for operations and maintenance of the DCFH facility is the U.S. Army Corps of Engineers (USACE), San Francisco District. The staffing level includes:

- seven permanent positions, consisting of one Senior Hatchery Supervisor, one Fish Hatchery Manager I, four Fish and Wildlife Technicians and one Office Technician; and

- four temporary positions.

The annual budget for DCFH in recent years has averaged around $750,000 dollars. This value covers both the coho and steelhead programs conducted at DCFH, but does not include an additional $400,000 expended annually for the steelhead satellite program conducted at Coyote Valley Fish Facility (CVFF).

The DCFH coho program includes a broodstock collection component, which involves both preliminary assessment of streams for broodstock donor capability and subsequent broodstock capture activities. These coho program efforts are funded by the CDFG through the Russian River Basin Planning Program. These funds are in addition to the USACE funding described above.

3.1.5 LOCATION(S) OF HATCHERY AND ASSOCIATED FACILITIES

The DCFH (also referred to as the Warm Springs Fish Hatchery) is located on Dry Creek at the base of Warm Springs Dam, within the Sonoma County portion of the Russian River basin of northern California. The hatchery is located approximately 14.4 miles upstream of the confluence of Dry Creek and the mainstem Russian River, which in turn is approximately 33 miles upstream of the mouth of the Russian River. The GIS coordinates of DCFH are:

038° 43’ 9.05” N

123° 00’ 9.45” W

Elevation: 206 feet

3.1.6 TYPE OF PROGRAM

The DCFH coho program is an “Integrated Recovery” program, based on the definitions provided in Attachment 1 of the HGMP template (see Appendix 1). The template defines an integrated recovery program as follows:

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

3.1.7 PURPOSE (GOAL) OF PROGRAM

The DCFH coho program was originally implemented in 1982 as a mitigation program to compensate for lost habitat capacity of naturally-producing coho resulting from the construction of the Warm Springs Dam. The program used artificially-produced coho to provide harvest opportunities and a source for program broodstock. In October 1999, a meeting between USACE, CDFG and NMFS established an interim operations plan for the 1999/2000 operations at DCFH that called for a cessation of hatchery production of coho salmon in the basin. In April 2000, the same agencies agreed to continue the interim operations plan until additional data were available regarding the genetic make-up of fish found in the wild (T. Daugherty, NMFS, pers. comm. 2001).

In May 2001, CDFG submitted a permit application to NMFS proposing a pilot program to analyze the effectiveness of coho salmon supplementation in the Russian River basin, with the USACE allowing conditional use of the DCFH facility and agreeing to provide funding for the pilot program. On May 10, the pilot program was approved by NMFS under Section 10(a)(1)(A) of the ESA, authorizing "take" for the purposes of scientific research or enhancement activities, and a biological opinion (BO) was issued to CDFG on August 31 (NMFS 2001a). Initiation of the program occurred in September 2001.

The purpose of this pilot coho program is to conserve genetic resources of a fish population at extremely low population abundance, and at risk of extinction, using captive propagation methods. It serves a secondary purpose of research, providing information regarding how to effectively use artificial propagation.

3.1.8 JUSTIFICATION FOR THE PROGRAM

NMFS has indicated that the remaining coho salmon population in the Russian River basin are currently below the viable population threshold, suggesting the risks of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame are less than negligible (NMFS 2001a). The basis for this determination is derived from four parameters, following the method of McElhany *et al*. (2000): population size, population growth rate, population spatial structure, and diversity. The following paragraphs synopsize the conditions of these four parameters for Russian River coho, as presented by NMFS in the BO for the Section 10 permit authorizing the coho program (NMFS 2001a).

> *Population size: The coho salmon population within the Russian River basin is not believed to be abundant or large enough to respond or recover from variation in environmental conditions and/or habitat conditions. Recent favorable environmental conditions and restored spawning and rearing habitat have not resulted in corresponding increases in coho salmon abundance and/or distribution within the basin.*
>
> *Population growth rate: Although empirical data and information to assess the viability of the coho salmon population within the Russian River basin relative to population growth rate are lacking, it is widely acknowledged the coho salmon population in the Russian River basin does not maintain a level of productivity sufficient to replace itself and is believed to be in a state of decline.*
>
> *Spatial structure: Salmonid habitat within the Russian River basin has been reduced dramatically over the past 100 years. Because of this, the present spatial structure of the coho salmon populations within the basin has been changed as well. As a result, the remaining coho salmon populations are restricted by redefined spatial boundaries that may not be sufficient to maintain the viability of the existing population. Although recent efforts to restore salmonid habitat within the basin have been successful, it is not realistic to expect that habitat within the basin will ever be restored to or*

maintained at historic levels because many historic habitat areas have been permanently altered and/or made inaccessible to coho salmon.

Diversity: Information describing the diversity of the native coho salmon population within the Russian River basin is relatively scarce. Researchers have not specifically focused on coho salmon within the basin and what data do exist has largely been collected as a side note to other research. However, given the demographics of the present population, it is possible that the level of diversity currently within the basin is greatly reduced from historic conditions and may not be sufficient to maintain a viable coho salmon population within the Russian River basin.

3.1.9 LIST OF PROGRAM "PERFORMANCE STANDARDS"

The following performance standards have been adapted from a list developed by the Northwest Power Planning Council (NPPC) as means of assessing the benefits and risks of artificial production programs (NPPC 1999). Only those standards that are relevant to an integrated recovery program (such as the DCFH coho program) are included in the list.

Performance Standards Addressing Benefits of the Program

B1. Conservation of genetic and life history diversity.

B2. Restore and create viable naturally spawning populations.

B3. Coordinate with ongoing research on mainstem passage and habitat utilization, and provide fish as needed.

B4. Conduct within-hatchery research to improve the performance or cost effectiveness of artificial production hatcheries.

B5. Fulfill mitigation/policy obligations.

B6. Achieve within-hatchery performance standards.

B7. Recommend improved performance indicators to better measure performance standards.

B8. Minimize management, administrative, and overhead costs.

B9. Enhance local, state, regional, and national economies.

Performance Standards Addressing Risks of the Program

R1. Assess detrimental genetic effects among hatchery vs. wild stocks where interaction exists.

R2. Assess survival of captive broodstock progeny vs. wild cohorts.

R3. Assure there is no depletion of naturally spawning populations through broodstock collection.

R4. Assure there is a predictable egg supply to achieve egg take goals.

R5. Evaluate habitat use and potential detrimental ecological interactions.

R6. Assure that program does not exceed the carrying capacity of fluvial, lacustrine, estuarine, and ocean habitats.

R7. Evaluate effect on life history traits of wild and hatchery fish, from harvest and spawning escapement.

R8. Avoid disease transfer from hatchery to wild fish and vice versa.

R9. Assure that production cost of program does not outweigh the benefit.

R10. Assure that cost effectiveness of the hatchery program does not rank lower than other actions such as habitat restoration.

These performance standards are adapted from the draft standards recommended in the Artificial Production Review (NPPC 1999).

3.1.10 LIST OF PROGRAM "PERFORMANCE INDICATORS," DESIGNATED BY "BENEFITS" AND "RISKS"

3.1.10.1 "Performance Indicators" Addressing Benefits

The following list of performance indicators are proposed as means of assessing the performance standards addressing hatchery benefits. These indicators are adapted from the list suggested in the Artificial Production Review (NPPC 1999).

Performance Standard B1: Conservation of genetic and life history diversity.

Performance Indicators:

B1A. Assure that number spawned is greater than the number of adults necessary to achieve minimum effective population size (MEPS). Trend target in 4 out of 5 years + 10 percent.

B1B. Evaluate whether life history characteristics were maintained by comparing baseline at year 1 with 5 year survey, or after one generation. Life history characteristics measured:

1. Age composition;
2. Fecundity (#, and size);
3. Body size (size, length, weight, age, and maturity index);

4. Sex ratio;

5. Juvenile migration timing;

6. Adult run timing;

7. Distribution and straying;

8. Time and location of spawning; and

9. Food habits.

B1C. Evaluate broodstock genetically in year 1 and compare after 5 years, or one generation, in terms of DNA or allozyme profile.

B1D. Captive broodstock assessment.

1. Increase number of individuals in captivity to substantially greater numbers than wild survival standard (percent survival standard).

2. Assure progeny represent full range of life history traits of parent population in the wild. Surrogate: genetic analysis (DNA or allozyme frequencies).

3. Implement M&E plan to document survival of juveniles and returning adults.

4. Follow NMFS interim standards for captive broodstock.

B1E. Cryopreservation

1. Implement M&E plan to represent full range of life history traits (see Risk R2).

2. Assure quality control standard for sperm viability is equaled or exceeded.

B1F. Promote regional gene bank to preserve existing populations not under threat of extinction.

B1G. Comply, where applicable, with HGMP.

Performance Standard B2: Restore and create viable naturally spawning populations.

Performance Indicators:

B2A. Manage for increasing trend of redd counts as index of natural spawning.

B2B. Manage for increasing numbers of adult fish.

B2C. Manage for increasing trend in juvenile anadromous fish rearing densities in #'s/m2 by habitat.

B2D. Manage for increasing trend in nutrients from adult carcasses in tributaries.

B2E. Manage for increasing F2 spawners.

B2F. Comply, where applicable, with HGMP.

Performance Standard B3: Coordinate with ongoing research in Russian River basin on mainstem passage and habitat utilization and provide fish as needed.

Performance Indicators:

B3A. Develop a project with a regional perspective for a multi-year funded research plan with funding support.

B3B. Describe funding umbrella to provide context for individual project research.

B3C. Develop plan consistent with basin management goals, objectives and strategies.

Performance Standard B4: Conduct within hatchery research to improve the performance or cost effectiveness of artificial production hatcheries to address the other four purposes.

Performance Indicators:

B4A. Develop comprehensive regionally coordinated M&E plan that includes a website for all hatcheries in the basin.

B4B. Develop a research study plan to:

1. Implement genetic studies of straying, introgression, and outbreeding depression for the program;
2. Conduct focused carrying capacity study;
3. Evaluate potential hatchery/wild competition by ecosystem;
4. Evaluate the fate of hatchery population mimicking the wild population in terms of adult return; and
5. Conduct hatchery evaluations on selected hatcheries within eco-systems to estimate post-release survival by tributary, mainstem, estuary, and ocean in order to accurately evaluate hatchery performance by species by hatchery.

B4C. Integrate hatchery and programs into CDFG Russian River Basin Fisheries Restoration Plan within 3 years using:

1. HGMP as part of the plan by species,
2. M&E plan, and

3. Hatchery-specific steelhead harvest management plan.

B4D. Improve marine survival and yield of adults in the fishery or spawning grounds.

B4E. Research priorities have been set by evaluating performance indicators that haven't been met. Standard is adaptive management.

Performance Standard B5: Fulfill mitigation/policy obligations.

Performance Indicator:

B5A. Assure that mitigation and policy obligations of the hatchery are met.

This performance indicator warrants discussion between the USACE and relevant fisheries agencies including CDFG and NMFS. The existing mitigation obligations include production goals for coho enhancement that have been discontinued under an interim operating agreement. The mitigation obligations of the USACE should be formally revised to reflect the current program and to provide objectives that are realistic and feasible under today's environmental and regulatory conditions. Without this action, it will not be possible to provide a concise measure that indicates fulfillment of the mitigation obligations.

Performance Standard B6: Achieve within-hatchery performance standards.

Performance Indicators:

B6A. Assure that hatchery performance standards established in the DCFH Management Plan are achieved.

B6B. Assure that relevant state-wide hatchery performance standards are achieved at DCFH.

Performance Standard B7: Improve performance indicators to better measure performance standards.

Performance Indicators:

B7A. Evaluate effectiveness of performance indicators using adaptive management in order to more accurately measure performance through audit process.

B7B. Evaluate and implement relevant regional hatchery production guidelines.

Performance Standard B8: Minimize management, administrative and overhead costs.

Performance Indicators:

B8A. Manage the process to accomplish declining expenditures for administrative overhead.

B8B. Achieve annual budgeting based on a results-oriented, performance-based management framework.

B8C. Assure that annual reports address program performance based on indicators.

B8D. Conduct hatchery audits as scheduled and integrate results into future funding and program decisions.

B8E. Document implementation of regional policies and procedures and hatcheries.

Performance Standard B9: Enhance local, state, regional, and national economies.

Performance Indicators:

B9A. Develop an overall economic impact assessment to compute direct, indirect and induced effects from Russian River hatchery production.

3.1.10.2 "Performance Indicators" Addressing Risks

The following list of performance indicators are suggested as means of assessing the performance standards addressing hatchery risks. These indicators are adapted from the list suggested in the Artificial Production Review (NPPC 1999).

Performance Standard R1: Assess detrimental genetic impacts among hatchery vs. wild where interaction exists.

Performance Indicators:

R1A. Initially, it is assumed that stray rate is a surrogate for a thorough and more complex measurement of genetic impact.

1. Evaluate hatchery population against standard stray rate (<5 percent non-indigenous populations; <20 percent indigenous populations – NMFS standard).

R1B. More specific measurements to be implemented on a selected basis:

1. Develop experimental design for evaluating genetic effects in consultation with NMFS.
2. Measure introgression by comparing allele frequencies between hatchery and wild.
3. Implement an appropriate experimental design to quantitatively measure outbreeding depression.

Performance Standard R2: Assess survival of captive broodstock progeny vs. wild cohorts.

Performance Indicators:

R2A. Achieve increased survival threshold for captive broodstock over wild adults – Implement RM&E plan with appropriate experimental design to measure:

1. Percent survival of viable eggs, fry, and offspring.

2. Percent survival to release.

3. Pre-release juvenile quality, equal to or exceeded physiological, morphological, and behavioral threshold compared to wild population.

4. Post-release survival, growth, condition factor, and behavioral adaptation.

R2B. Implement HGMP where appropriate.

R2C. Evaluate and implement relevant regional hatchery production guidelines.

Performance Standard R3: Assess potential depletion of existing population spawning in the wild through broodstock collection.

Performance Indicators:

R3A. Document stable or increasing trend of redd counts as index of natural spawning.

R3B. Document stable or increasing numbers of adult fish.

R3C. Document hatchery spawner to recruit ratio equal to or greater than 1.

R3D. Evaluate and implement relevant regional hatchery production guidelines.

Performance Standard R4: Assure there is a predictable egg supply to avoid poor programming of hatchery production.

Performance Indicators:

R4A. Assure that percent egg take goal is achieved in 4 out of 5 years.

R4B. Implement CDFG disease protocols in any events involving egg transfer to the hatchery.

Performance Standard R5: Evaluate habitat use and potential detrimental ecological interactions.

Performance Indicators:

R5A. For selected tributaries by species – conduct comparative evaluation of prestocking population with post stocking after five years or after one generation by measuring some of these parameters:

1. Evaluate emigration rate of anadromous stocked fish and naturally reproducing anadromous population.

2. Conduct comparative evaluation of rearing densities (# / m2) by habitat before and after stocking hatchery fish vs. wild fish.

3. Compute growth rate, condition factor, and survival of 1 above.

4. Evaluate direct intra- and inter-specific competitive interaction between stocked anadromous fish and wild resident fish.

5. Conduct snorkel surveys to quantify microhabitat partitioning by species.

6. Determine predation rate by fish.

R5B. Implement tributary M&E plan by species, and extrapolate to other subbasins.

R5C. Develop M&E plan for estuary and near shore marine habitat, incorporating experimental design in consultation with NMFS.

Performance Standard R6: Assure that program does not exceed the carrying capacity of fluvial, lacustrine, estuarine, and ocean habitats.

Performance Indicators:

R6A. Develop an appropriate freshwater M&E plan.

1. Conduct snorkel survey to quantify microhabitat partitioning.

2. Evaluate emigration rate, growth, food habits, condition factor, and survival rate.

3. Conduct control vs. treatment carrying capacity evaluation by estimating #/m2 by year class by habitat type.

R6B. Develop estuarine, and ocean research, monitoring, and evaluation plan.

Performance Standard R7: Evaluate impact on life history traits of wild and hatchery fish, from harvest and spawning escapement.

Performance Indicators:

R7A. Document stable or increasing trend of redd counts as index of natural spawning.

R7B. Document stable or increasing numbers of adult fish.

R7C. Document hatchery spawner to recruit ratio equal to or greater than 1.

Performance Standard R8: Avoid disease transfer from hatchery to wild fish.

Performance Indicators:

R8A. Establish comparative annual sampling of disease in hatchery and wild populations.

R8B. Comply with CDFG standards and NMFS guidelines.

R8C. Apply disease standards to stocking activities, including acclimation ponds and direct releases.

R8D. Evaluate incidence of drug resistant pathogens by comparing to baseline in year 1 to survey every five years.

Performance Standard R9: Assure that production cost of program does not outweigh the benefit.

Performance Indicators:

R9A. Evaluate trends in the ratio of hatchery juvenile production cost to the cost of juvenile production from habitat projects. A target ratio is equal to or less than 1 in 4 out of 5 years ± 10 percent.

Performance Standard R10: Assure that cost effectiveness of hatchery does not rank lower than other actions such as habitat restoration.

Performance Indicators:

R10A. Achieved highest numerical ratio of returning adults per cost of action (habitat, passage, hatchery).

R10B. Achieved highest ratio of intrinsic social value (satisfaction survey) of returning adults per cost of action.

3.1.11 EXPECTED SIZE OF PROGRAM

3.1.11.1 Proposed Annual Broodstock Collection Level (Maximum Number of Fish)

The program proposes to collect between 300 and 600 juvenile coho salmon annually, for potential use as broodstock following rearing in captivity until the fish reach maturity.

3.1.11.2 Proposed Annual Fish Release Levels (Maximum Number) by Life Stage and Location

Life Stage	Release Location	Annual Release Level
Eyed Eggs	NA	0
Unfed Fry	NA	0
Fry	NA	0
Fingerling	5 streams: Willow, Sheephouse, Freezout, Ward, Mill	50,000 (10,000 each stream)
Yearling	5 streams: Willow, Sheephouse, Freezout, Ward, Mill	50,000 (10,000 each stream)

3.1.12 CURRENT PROGRAM PERFORMANCE, INCLUDING ESTIMATED SMOLT-TO-ADULT SURVIVAL RATES, ADULT PRODUCTION LEVELS, AND ESCAPEMENT LEVELS. INDICATE THE SOURCE OF THESE DATA.

There are no data yet available to evaluate the performance of the current coho recovery program. For the previous coho mitigation/enhancement program that ceased production in

1999, the only data available to evaluate performance is the adult returns to each hatchery; harvest and stray rates are unknown. The estimated smolt-to-adult return (SAR) values presented below assume a rigid 3-year age at return. Three values of fingerling to yearling survival are presented, since no data are known that measured this parameter; however, there have been no fingerling releases since 1989. The previous mitigation/enhancement program defined goals for yearling releases at 110,000 as well as adult escapement goals that assumed a 1 percent SAR (100 adults to DCFH for the mitigation program and 1,000 adults to enhancement purposes). Actual coho escapement to the hatchery suggests the SAR for the Russian River system is more likely to be near 0.3 percent.

DCFH Coho Fingerling			DCFH Coho Yearling			DCFH Coho Adults		Estimated SAR for Given Ratio of Fingerling: Yearling Survival		
Release Year	**No. Released**	**Probable Rtrn Yr**	**Release Year**	**No. Released**	**Probable Rtrn Yr**	**Return Year**	**Adult Return**	**1%**	**5%**	**10%**
84/85	67,750	87/88	85/86	86,425	87/88	87/88	576	0.7%	0.6%	0.6%
85/86	42,525	88/89	86/87	123,570	88/89	88/89	534	0.4%	0.4%	0.4%
86/87	40,809	89/90	87/88	104,324	89/90	89/90	140	0.1%	0.1%	0.1%
87/88	82,211	90/91	88/89	100,680	90/91	90/91	277	0.3%	0.3%	0.3%
88/89	0	91/92	89/90	128,755	91/92	91/92	162	0.1%	0.1%	0.1%
89/90	0	92/93	90/91	110,690	92/93	92/93	578	0.5%	0.5%	0.5%
90/91	0	93/94	91/92	137,400	93/94	93/94	449	0.3%	0.3%	0.3%
91/92	0	94/95	92/93	85,859	94/95	94/95	765	0.9%	0.9%	0.9%
92/93	0	95/96	93/94	55,528	95/96	95/96	62	0.1%	0.1%	0.1%
93/94	0	96/97	94/95	27,186	96/97	96/97	148	0.5%	0.5%	0.5%
94/95	0	97/98	95/96	96,180	97/98	97/98	4	0.0%	0.0%	0.0%
95/96	0	98/99	96/97	23,380	98/99	98/99	8	0.0%	0.0%	0.0%
96/97	0	99/00	97/98	60,590	99/00	99/00	1	0.0%	0.0%	0.0%
97/98	0	00/01	98/99	0	00/01	00/01	NA	-	-	-
98/99	0	01/02	99/00	0	01/02	01/02	NA	-	-	-
Avg:	15,553	-	Avg:	87,736	-	Avg:	336	0.3%	0.3%	0.3%

Notes:
1. The original DCFH mitigation program ceased coho production in 1999; the current coho recovery program began operation in 2001.
2. Data source: DCFH Annual Reports (CDFG 1985 to CDFG 2000).

3.1.13 Date Program Started (Years in Operation), or Is Expected to Start

The current coho recovery program began in 2001.

3.1.14 EXPECTED DURATION OF PROGRAM

The existing Section 10 permit for the coho program expires on June 30, 2007 to allow time to adequately implement and analyze the proposed recovery and research actions. The permit requires annual reauthorization from NMFS.

If the current program is successful, it is expected that the program would cease when stocks are recovered to a point where significant viable populations (as determined by the National Marine Fisheries Service (NMFS) Technical Recovery Team (TRT)) of coho consistently return to historical coho streams within the basin, and are capable of self sustaining without intervention. In other words, no missing year classes would occur and runs would be large enough to be self sustaining and at carrying capacity with available habitat.

The duration of the USACE mitigation obligation to compensate for lost production is assumed to be indefinite.

3.1.15 WATERSHEDS TARGETED BY PROGRAM

The program occurs predominantly in the Russian River watershed. Broodstock collection activities extended into the adjacent Lagunitas Creek watershed during 2001, and they are expected to extend into this watershed again in 2002. Other watershed entities have expressed interest in receiving and outplanting excess juveniles that may be available from the DCFH program, but such activities will require genetic analysis and approval by NMFS under the lead of the proposing entity.

3.1.16 INDICATE ALTERNATIVE ACTIONS CONSIDERED FOR ATTAINING PROGRAM GOALS, AND REASONS WHY THOSE ACTIONS ARE NOT BEING PROPOSED

The goals for the original DCFH mitigation/enhancement program were developed to compensate for the permanent loss of spawning habitat and production capacity. Production towards these goals was ceased in 1999 in favor of a recovery program, for which several alternatives were presented in the Section 10 permit application submitted by CDFG in May 2001. The BO for the proposed program noted the preferred actions from the standpoint of minimizing effects to protected populations, most of which have been implemented in the current program.

3.2 PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS

3.2.1 LIST ALL ESA PERMITS OR AUTHORIZATIONS IN HAND FOR THE HATCHERY PROGRAM

The DCFH facility is owned by the USACE, and operated by the CDFG under a cooperative agreement with the USACE. Since hatchery operations have the potential to affect protected populations of coho, Chinook and steelhead, Russian River hatchery activities have been included in an ESA Section 7 consultation between NMFS, USACE and the SWCA. In addition, since Russian River hatchery activities are part of the State's anadromous fish hatchery program, they are included in the statewide ESA Section 10 consultation between NMFS and CDFG. The current coho recovery program is operated under the authority of Modification 2 to Permit 1067 issued by NMFS to CDFG on August 31, 2001.

3.2.2 PROVIDE DESCRIPTIONS, STATUS, AND PROJECTED TAKE ACTIONS AND LEVELS FOR ESA-PROTECTED NATURAL POPULATIONS IN THE TARGET AREA

3.2.2.1 Description of ESA-Listed Salmonid Population(s) Affected by the Program

In the target area consisting of the freshwater limits of the Russian River basin, there are three ESA-listed salmonid populations affected by the program:

- CCC steelhead
- CCC coho
- California Coast Chinook

The following descriptions include information specific to the Russian River populations of these species, where available.

Russian River Steelhead

Steelhead occupy all of the major tributaries and most of the smaller ones in the Russian River watershed. Many of the minor tributaries may provide spawning or rearing habitat under specific hydrologic conditions. Steelhead use the lower and middle mainstem Russian River primarily for migration to and from spawning and nursery areas in the tributaries and the mainstem above Cloverdale. The majority of spawning and rearing habitat for steelhead occurs in the tributaries. However, juvenile rearing has been documented in the mainstem.

Adult steelhead generally begin returning to the Russian River in November or December, with the first heavy rains of the season. Steelhead continue to enter migrate upstream into March or April. Adults have been observed in the Russian River during all months (S. White, SCWA, pers. comm. 1999). However, the peak migration period tends to be January through March.

Flow conditions are suitable for upstream migration in most of the Russian River and larger tributaries during the majority of the spawning period in most years. Sandbars blocking the river mouth in some years may delay entry into the river. However, during the times the sand barrier is closed, the flow is probably too low and water temperature may be too high to provide suitable conditions for migrating adults further up the river (CDFG 1991).

Most spawning takes place from January through April, depending on the time of freshwater entry. Steelhead spawn and rear in tributaries from Jenner Creek near the mouth, to upper basin streams including Forsythe, Mariposa, Rocky, Fisher and Corral creeks. Steelhead usually spawn in the tributaries, where fish ascend as high as flows allow (USACE 1982). Gravel and streamflow conditions suitable for spawning are prevalent in the Russian River mainstem and tributaries (Winzler and Kelly Consulting Engineers [Winzler and Kelly] 1978), although gravel mining and sedimentation have diminished gravel quality and quantity in many areas of the mainstem. In the lower and middle mainstem (downstream of Cloverdale) and the lower reaches of tributaries, water temperatures exceed 55°F by April in some years (Winzler and Kelly 1978), which may limit the survival of eggs and fry in these areas.

After hatching, steelhead spend from one to four years in freshwater. Steelhead in other streams in this ESU either migrate to ocean after the first year (as yearlings) or spend an additional year in the stream and emigrate at age 2+ (Shapovalov and Taft 1954), and steelhead in the Russian River Basin exhibit similar behavior. Fry and juvenile steelhead are extremely adaptable in their habitat selection. Requirements for steelhead rearing include adequate cover, food supply, and water temperatures. The mainstem above Cloverdale and upper reaches of the tributaries provide the most suitable habitat, as these areas generally have excellent cover, adequate food supply, and suitable water temperatures for fry and juvenile rearing. The lower sections of the tributaries provide less cover, as the streams are often wide and shallow and have little riparian vegetation, and water temperatures are often too warm to support steelhead. In the summer, these areas can dry up completely. Available cover has been reduced in much of the mainstem and many tributaries because of loss of riparian vegetation and changes in stream morphology.

Emigration usually occurs between February and June, depending on flow and water temperatures. Excessively high water temperatures in late spring may inhibit smoltification in late migrants.

Russian River Coho

Coho salmon are much less abundant than steelhead in the Russian River basin. Historically, spawning occurred in approximately 32 tributaries of the Russian River, including Dry Creek (CDFG 2002). In wet years, coho salmon have been seen as far upstream as Forsythe Creek in Redwood Valley. The DCFH produced and released an average of about 70,000 yearling coho salmon each year between 1980 and 1998, with the annual release numbers ranging between 23,000 and 182,000. The hatchery has not produced coho salmon since the 1998 release.

The coho salmon life history is quite rigid, with a relatively fixed three-year life cycle. Most coho salmon enter the Russian River in November and December and spawn in December and January. Spawning and rearing primarily occur in tributaries to the lower Russian River. The most upstream tributaries with historic coho salmon populations include Forsythe, Mariposa, Rocky, Fisher, and Corral creeks. The mainstem serves primarily as a passage corridor between the ocean and the tributary habitat.

After hatching, young coho salmon will spend about one year in freshwater before becoming smolts and migrating to the ocean. Freshwater habitat requirements for coho salmon rearing include adequate cover, food supply, and water temperatures. Primary habitat for coho salmon includes pools with extensive cover. Outmigration takes place in late winter and spring. Coho salmon live in the ocean for about a year and a half, return as three-year-olds to spawn, and then die. Factors that may limit juvenile coho salmon production are high summer water temperatures and poor summer and winter habitat quality.

Russian River Chinook

There is some debate whether Chinook salmon used the Russian River historically, though there are reports that local tribes harvested Chinook salmon regularly in the upper portions of the East Fork drainage prior to construction of Coyote Valley Dam (NMFS 2001). Chinook salmon of hatchery origin were planted in the watershed up through 1998 (CDFG 1998b). The total run of

Chinook salmon present in the basin was believed to be small. SCWA video monitoring at the Mirabel Inflatable Dam has provided the most recent data. Sampling during the 2000 study period extended late enough into the season to document the end of the Chinook run and to provide positive identification of 1,322 adult Chinook. A partial run count of 1,299 adult Chinook through November 13, 2001 (monitoring ceased prior to the end of the run) suggests that the 2001 run was substantially larger (S. White, SCWA, pers. comm. January 8, 2002).

Historic spawning distribution is uncertain, but suitable habitat formerly existed in the upper mainstem and in low gradient tributaries. Chinook salmon currently spawn in the mainstem and larger tributaries, including Dry Creek. Chinook spawning was observed well downstream of Dry Creek in November 2002, but this is not believed to be the primary spawning area (S. White, SCWA, pers. comm. 2002). Chinook salmon tissue samples were collected in 2000 by SCWA, CDFG and NMFS from the mainstem, Forsythe, Feliz and Dry creeks, and there were anecdotal reports of Chinook salmon in the Big Sulphur system.

Adult Chinook salmon begin returning to the Russian River as early as late August, with most spawning occurring after late November. Chinook salmon may continue to enter the river through December and spawn into January (S. White, SCWA, pers. comm. December 10, 1999; CDFG 2002).

Unlike steelhead and coho salmon, the young Chinook salmon begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, usually ranges from two to four months, but occasionally Chinook salmon juveniles will spend one year in fresh water (Myers *et al*. 1998). Chinook salmon move downstream from February through June). Ocean residence can be from one to seven years, but most Chinook salmon return to the Russian River as two- to four-year-old adults. Chinook salmon die soon after spawning.

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

The Russian River stock of the CCC coho salmon ESU will be directly affected by the program.

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

The ESA-listed populations of CCC steelhead and CC Chinook have potential to be incidentally affected by the coho program.

3.2.2.2 Status of ESA-Listed Salmonid Population(s) Affected by the Program

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

There are insufficient quantitative data to provide statistical evidence of abundance level relative to the definitions for critical population threshold and viable population threshold for any of the three protected Russian River populations.

The status of CCC steelhead is uncertain, since little information exists on present run sizes of trends for this ESU. However, given the substantial rates of decline for stocks where data do exist, it is anticipated that the majority of natural production in this ESU is not self-sustaining (NMFS 2001).

The most recent status review for the CCC coho salmon ESU states "The CCC ESU is presently in danger of extinction. The condition of coho salmon populations in this ESU is worse than indicated by previous reviews." (NMFS 2001).

The status of CC Chinook is uncertain since estimates of absolute population abundance are not available for most populations in the ESU. Trends in Chinook abundance are mixed for those populations that have been monitored, though in general the trends tend to be more negative in streams that are farther south along the coast (NMFS 2001).

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

No data are available for any of the three listed Russian River populations providing progeny-to-parent ratios, survival data by life-stage, or other quantitative measures of productivity.

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

Presence-absence data for coho presented in the status review update (NMFS 2001b) identify only 12 streams within the entire Russian River basin for which coho presence has been noted since 1989, as noted in the table following this paragraph. Data have been prioritized in the table to indicate streams for which 1) the most recent survey recorded coho presence; 2) the most recent survey recorded coho absence but which had an equal or greater number of surveys noting coho presence; and 3) the most recent and the majority of surveys recorded coho absence. The most recent surveys found coho present in only four streams: Ward Creek, Green Valley Creek, Purrington Creek and Laguna de Santa Rosa, all located in the lower portion of the basin.

Stream Name	Present Years	Absent Years	Survey Priority[1]
Willow Creek	1990, 95	1991, 92, 93, 94, 96, 98, 2000	3
Sheephouse Creek	1996, 1995[2]	1998	2
Freezeout Creek	1995	1994, 96, 2000	3
Ward Creek	1996		1
Green Valley Creek	1993, 94, 95, 96, 97, 99		1
Purrington Creek	1994		1
Mark West Creek	1993, 94, 95	1996, 97, 99	2
Laguna de Santa Rosa	1994		1
Santa Rosa Creek	1993, 94	1995	2
Mill Creek	1995	1996	2
Maacama Creek	1993, 94, 95	1996, 97, 99	3
Redwood Creek	1993, 94	1995, 96, 97, 99	3

Presence/absence data were modified from NMFS 2001b.

[1]First priority streams are those streams for which the last survey recorded the presence of coho salmon at some life history stage. Second priority streams are those streams for which historical presence is noted, but more recent surveys did not record presence. Third priority streams are those streams for which multiple recent surveys have not recorded the presence of coho.

[2]Presence noted in an unnamed tributary.

A reliable estimate of coho abundance within the basin has never been developed. Criteria used by NMFS (2001b) to evaluate population trends for the coho status review update required a minimum of six years of abundance data for which sample sites and survey methods were consistent over all years. Table 2-3 in Section 2.4 of the document entitled *Hatchery and Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities* (FishPro and ENTIRX 2002) provides a compilation of monitoring activities that have taken place in the Russian River basin for coho salmon since 1990. There are no streams within the Russian River basin for which there are six years of abundance data. Sampling conducted by CDFG in 2001 found very few juvenile coho, despite sampling in nine of the ten streams where coho have been documented within five years. (Coho Recovery Work Group [CRWG] 2001; CDFG 2002).

Though limited in sample size, coho data collected since 1989 indicate small numbers of coho exist within relatively isolated pockets of the Russian River. On this basis, it is suggested that coho in the Russian River basin are presently in danger of extinction. It is essential that additional data be collected immediately to confirm this assumption and provide a baseline by which to measure the recovery of the species within the basin.

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

No surveys have ever been conducted in the Russian River with regards to the proportion of hatchery-origin and natural-origin fish on natural spawning grounds. However, genetic studies are currently being conducted through the broodstock program that may elucidate this issue (CDFG 2002). Carcasses from hatchery fish are rarely recovered during carcass surveys (CDFG 2000).

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

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

Coho program activities that may lead to the take of protected salmonid populations in the target area include:

- broodstock collection, captive rearing, and spawning;
- artificial propagation, rearing, tissue sampling, transport and release of progeny;
- monitoring and evaluation activities, including capture, handling, tissue sampling, and release; and
- unintentional mortalities associated with research activities.

The collection of broodstock for the coho program proposed in this HGMP will remove up to 600 juvenile coho from the wild each year. The proposed broodstock collection activities are described in Section 2.7.2 and are very similar to the capture events conducted in 2001 under Permit 1067. The existing Permit 1067 allows for the collection of 300 juvenile coho for captive broodstock (NMFS 2001a); under the proposed coho program the broodstock take would be increased to 600 juvenile coho.

Progeny of the captive broodstock will be incubated and reared at DCFH. Prior to release, tissue samples will be collected from all progeny, and a PIT tag and/or visible implant tag will be used to allow individual identification of each fish. The annual take associated with these activities equates to the release goal of 200,000 fish.

Monitoring and evaluation efforts for the proposed coho program will be developed by the TOC prior to the first release in 2004. Several recommended M&E activities have been presented in Section 3.11. It is anticipated the final M&E plan will involve capture, handling, marking and/or tissue sampling, and release of numerous coho juveniles as part of the determination of baseline conditions and program success in both release streams and control streams. The estimated annual take for these activities is 16,500 juveniles, based on the analysis presented in the BO for Permit 1067 (NMFS 2001a).

Finally, though extreme care and Best Management Practices will be utilized for all program activities, there will be some unintentional mortalities that occur with the artificial propagation and M&E activities. The estimated annual take for these unintentional mortalities is 700 juveniles, based on the analysis presented in the BO for Permit 1067 (NMFS 2001a).

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

Information regarding past take associated with the hatchery steelhead program has not been documented and is unknown.

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

See Table 1 on page 3-66 of this HGMP.

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.

- A cumulative tally of total number of coho collected for broodstock will be completed after each capture event to insure the take does not exceed the permitted level.
- At the first indication that the artificial production component may exceed the 200,000 smolt production goal, NMFS will be notified of the condition. The TOC will debate the possible alternatives and make a recommendation to NMFS regarding disposition of any excess eggs, fingerling or smolts beyond the current 200,000 smolt goal.

- Contingency plans for addressing excessive take during M&E activities will be identified as part of the development of detailed annual M&E plans.

3.3 RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.3.1 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 CDFG and NMFS have conducted a joint review of California's anadromous fish hatcheries and developed recommendations relating to the genetic and ecological risks of artificial production (CDFG and NMFS 2001). The coho program at DCFH is consistent with recommendations made in the hatchery review.

3.3.2 LIST ALL EXISTING COOPERATIVE AGREEMENTS, MEMORANDA OF UNDERSTANDING, MEMORANDA OF AGREEMENT, OR OTHER MANAGEMENT PLANS OR COURT ORDERS UNDER WHICH THE PROGRAM OPERATES.

As described previously in Section 3.1.14, CDFG operates DCFH under Amendment No. 3 to Cooperative Agreement DACW05-82-A-0066 as amended September 30, 1991 (USACE and CDFG 1991). The period of this agreement began in October 1991 and extended through September 1999, with yearly extensions being granted thereafter.

The USACE, SCWA, and NMFS have entered into a Memorandum of Understanding (MOU) that established a framework for the consultation and conference required by the ESA with respect to the activities of the USACE and SCWA that may directly or indirectly affect coho salmon, steelhead and Chinook salmon in the Russian River.

The NMFS, USACE, CDFG, California Resources Agency, California Environmental Protection Agency, California Water Resources Control Board, North Coast Region of the California Regional Water Quality Control Board, California Regional Water Quality Control Board, Bodega Marine Laboratory, University of California at Davis, County of Sonoma, County of Marin, County of Mendocino, SCWA, North Bay Watershed Association, Russian River Watershed Association, and FISHNET 4C have entered into a MOU that established a framework for coordination and cooperation among the parties in order to advance and further the recovery planning process and the activities of the parties to this MOU relating to the recovery planning process.

A draft HGMP for the DCFH steelhead program was submitted by CDFG to NMFS in December 2000 (CDFG 2000). The draft plan is currently under review by NMFS. The draft HGMP discusses activities of the steelhead program which have potential to affect the DCFH coho program.

The CDFG has developed a draft Russian River Basin Fisheries Restoration Plan that was released in August 2002. The coho program at DCFH is consistent with recommendations made by CDFG biologists as related to the contents of the draft restoration plan.

3.3.3 Relationship to Harvest Objectives

There are no harvest objectives for Russian River coho salmon. Angling regulations allow harvest only of marked hatchery steelhead, and all captured coho must be returned to the water unharmed. This strategy is effective in minimizing direct fishing mortality to listed steelhead, coho and Chinook. However, there is likely to be some level of indirect mortality arising from injury during capture, handling and release. There are no quantitative estimates for the coho take level associated with steelhead angling in the Russian River.

3.3.3.1 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 are no fisheries benefits intended from the coho program.

3.3.4 Relationship to Habitat Protection and Recovery Strategies

Factors Affecting Natural Production

There are several varied factors believed to be affecting the natural production of steelhead, coho and Chinook in the Russian River basin. The major factor is most likely the loss or sever decrease in quality and function of essential habitat, resulting from anthropogenic watershed disturbances caused by agriculture, logging, gravel mining, urban development, water diversion, road construction, erosion and flood control, dam building, and grazing (NMFS 2001a; CDFG 2002). It is unlikely that harvest is a significant factor, since there are no fisheries that target coho. Potential effects that may have been derived from the original Russian River coho mitigation/enhancement operations are believed to be minimal, especially with implementation of CDFG policies in the late 1990's restricting inter-basin fish transfers (FishPro and ENTRIX 2000).

Habitat Protection Efforts

Ongoing habitat restoration activities have been initiated in the Russian River basin at many locations. All survey activities have been carried in accordance with techniques outlined in the California Salmonid Stream Habitat Restoration Manual (CDFG 1998). CDFG and SWCA completed stream habitat surveys for approximately 60 percent of the Russian River watershed by the spring of 2001. The remaining surveys will be completed by the end of the summer of 2003. Survey data have been utilized in preparing the Draft Russian River Basin Fisheries Restoration Plan (CDFG 2002). Once finalized, the document will list priorities for restoration. Ongoing watershed programs are funded by Federal and State agencies

3.3.5 Ecological Interactions

Organisms that Could Negatively Impact Program

Organisms that have the greatest potential to cause significant negative effects to the DCFH coho recovery program are predators (fish, birds, and marine mammals) that consume coho fingerling and smolts. Of 48 fish species recorded in the Russian River basin, 29 are exotic species and many species (both native and exotic) are predatory to salmonids (SEC 1996, as cited in NMFS

2001a). Fish rescue efforts conducted during 2000 at the Wohler infiltration ponds captured more than 630 fish, of which 86 percent were non-salmonids (SCWA 2000). The relative abundance of predator species is not known for the tributaries of the lower Russian River basin where key coho habitat occurs.

<u>Organisms that Could Be Negatively Impacted by Program</u>

The DCFH coho recovery program has potential to cause negative effects to other species through a variety of factors common to artificial propagation facilities in general, including:

- competition for food and rearing habitat
- predation
- disease transfer
- influencing outmigration behavior of natural populations
- harvest bycatch
- artificial selection
- loss of diversity
- inbreeding depression

The anticipated level of effects to various species (and especially to protected species) is discussed below. For a more detailed discussion, please see the document entitled *Hatchery and Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities* (FishPro and ENTIRX 2002).

<u>Organisms that Could Positively Impact Program</u>

There are no significant opportunities envisioned in which organisms could benefit the fresh-water rearing of coho fingerling, the out-migration of coho smolts or the upstream migration of adults returning to the release locations.

<u>Organisms that Could Be Positively Impacted by Program</u>

Since the population level of wild Russian River coho is believed to be below the critical population threshold, then any hatchery-origin coho adults that return to natural spawning areas contribute to the abundance of the wild population and reduce the risk of inbreeding depression or loss of rare alleles within the wild population.

3.4 WATER SOURCE

3.4.1 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.

Existing DCFH Water Source

Surface water is obtained for hatchery use from the stilling basin of the Warm Springs Dam. The water released from Lake Sonoma can be taken from four different intake portals, each at a different elevation in the lake, so that in the summer water can be mixed to optimize water temperature for successful hatchery operations (48-58°F). Three of the intake portals are located in the wall of the dam, while the fourth portal is generally referred to as the service gates. The highest portal is currently inoperable.

Water enters the hatchery inlet structure from an opening in the right wall of the outlet works stilling basin and flows through a combination of open channels with pipe flow to the hatchery. Water flows by a 42-inch pipe to an aeration structure near the hatchery building. The aeration structure consists of a concrete basin, containing about 24,000 cubic feet of water, with five mechanical surface aerators that degas and oxygenate the water. Water enters the aeration basin through an inlet chamber and exits through an outlet chamber to the hatchery raceways. At the aeration structure, water is aerated to increase dissolved oxygen levels in the water and allowed to settle. The water then passes through a screening process, at which point and can be routed to the hatchery building for further water treatment and use in incubation and early rearing, or to the rearing raceways for use without additional water treatment. (Generally, eggs and fry require better water quality conditions than fingerling and yearlings.)

In treating water for use in the incubators and start tanks, water from the aeration structure outlet chamber is pumped through sand and charcoal pressure filters and ultraviolet sterilization units. Additionally, if water temperatures are greater than 56°F, some of the treated water will be passed through chillers. The capacity of the water treatment system is 200 gallons per minute (gpm).

The total hatchery water demand for full capacity fish production operations is 25 cubic feet per second (cfs). When broodstock collection and holding operations are occurring, the demand increases to approximately 35 cfs, to provide flows to attract adult fish migrating upstream and to provide flows to maintain the fish in holding ponds once they enter the hatchery. Minimum releases from Lake Sonoma are set at 80 cfs in typical water years and 25 cfs under drought conditions. Since it is possible to divert all releases through the hatchery, there has consequently never been a problem to obtain all flow necessary to maintain hatchery operations. Water can be released from four different intake portals, each at a different elevation (depth) within Lake Sonoma. Water can be released directly from the bottom of the dam (elevation 220 feet mean sea level [MSL]), and at elevations of 350, 390 and 430 feet MSL. (As mentioned previously, the highest portal is not functional.) During late summer and early fall, Lake Sonoma becomes thermally stratified (*i.e.*, the warmer water tends to stay at the top of the lake, and the colder water stays at the bottom of the lake), and consequently water of varying temperature is available for release at different depths (elevations) within the lake. The portal from which water is released is determined by the hatchery manager based on water temperatures within Lake Sonoma. However, according to R. Gunter, Hatchery Supervisor, turbidity levels in the lower levels of the lake are too high to be used in the hatchery. As a result, only the two intermediate portals are typically used to provide water for the hatchery and for downstream releases. If turbidity is increased, the efficiency of the UV that is designed to kill any biological organisms not removed by the sand filter is reduced. The water supply system is equipped with a chiller to compensate for excessively warm water temperatures, should they occur.

An emergency water supply system was constructed in 1992 to be used to supply a sufficient quantity of water to the hatchery when the outlet works and power plant are not operating. When emergency water supply is needed, hatchery personnel contact the local USACE office to request activation of the system. Flow to the hatchery can be controlled by the energy dissipation valve in the stilling well at the dam. Water can be drawn from the reservoir as long as the water surface elevation is above 350 feet NGVD (National Geodetic Vertical Datum). USACE personnel follow procedures to fill the Emergency Water Supply (EWS) pipeline with water from the stilling well. The EWS pipeline can be left unwatered between uses or remain full, in standby mode, in case of unforeseen emergency water supply requirements. A standby generator is available to provide power for operations during a power outage.

The emergency water supply to the hatchery is typically in fully charged condition, and could be available immediately. However, hatchery staff are required to contact USACE to open the valve for access to the EWS pipeline, which could delay implementation. The aeration ponds can supply sufficient water to the raceways for only 8 to 10 minutes while the emergency water supply system is being implemented. Longer delays could affect the survival of the juvenile fish. Other emergency sources of water, though not as reliable as the EWS system, are available. Wells E and F, downstream of the hatchery complex along Dry Creek, were originally provided as an emergency water source. The wells are capable of supplying the hatchery with approximately 2 to 3 cfs for a short period of time. (In 1997 only one well was operational and provided the hatchery with 1.55 cfs). If no other options are available, and survival of the fish is threatened, the fish can be released into the water pollution control pond for later retrieval, or released directly into Dry Creek.

Water supply to the expansion raceways was modified in design from the original raceways to improve production capacity. Whereas the original raceway system is supplied with water from three sources (the aeration structure, non-chilled treated water, and chilled treated water), the new raceway systems receive water only from the aeration structure. In the original raceways, water passed from the raceways to a recirculation system utilizing air-lift tubes, but the high incidence of disease that followed resulted in its use being discontinued. In the expansion raceways, the water passes from the raceways to a 36-inch drainpipe that carries it to the pollution control pond. Therefore, water is continually delivered to the raceway from the aeration structure, rather than having to recirculate back through the system.

Proposed DCFH Water Source

A new water supply is being proposed for the DCFH hatchery that would tap into the existing wet well and provide two pipelines capable of delivering 50 cfs each of gravity flow reservoir water to the DCFH facilities. The new water supply will eliminate the need for the emergency water supply system and the existing emergency supply pipeline would be subsequently removed, thereby removing a dam safety issue. Design of the new water supply line is being completed in late 2002.

NPDES Permits

The NPDES permit for DCFH is #CA0024350 / I.D. No. 1B84034050N. Hatchery operations are in compliance with the NPDES permit.

3.4.2 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.

(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.")

The intake of the water supply system for DCFH is located in the reservoir upstream of the dam, and listed species are not present. There is no fish passage upstream of the dam either.

Settling basins have been installed at DCFH to assure that hatchery effluent discharges comply with the discharge standards and conditions of its NPDES permit. The discharge standards were established by the Regional Water Quality Control Board (RWQCB) based on designated beneficial uses for the subject waters. In Dry Creek and the Russian River, these beneficial uses include coldwater fish life, which reflects the general water quality requirements for the listed steelhead, coho and Chinook. The discharge standards for DCFH are as follows.

Parameter	**Effluent Limit (Daily Maximum)**
Total Suspended Solids	15 mg/L
Total Settleable Solids	0.2 mL/L/hr
pH	within 0.5 of receiving waters
Salinity (chloride)	250 mg/L
Temperature	no measurable change to receiving water
Turbidity	no increase > 20% of background
Dissolved Oxygen	> 7.0 mg/L
Flow – DCFH	15.5 million gallons/day

Compliance is monitored by sampling the facility effluent two times per month, with results submitted in a monthly report to the RWQCB. It is further stipulated that sampling occur during cleaning operations, since this is the aspect of fish production that is most likely to produce poor water quality conditions. At DCFH, it is prohibited to discharge detectable levels of chemicals used for the treatment or control of disease, other than salt (sodium chloride).

DCFH has been in continuous compliance with its NPDES permit requirements. During times of high turbidity in the influent water, the hatchery may actually discharge water less turbid than that received, thereby benefiting the receiving waters. The dissolved oxygen level in the receiving waters during times of low flows may drop below the 7mg/L limit and therefore may benefit from the hatchery maintaining an effluent limit that is greater than 7mg/L. Effluent from the hatchery will contribute to the total load of solids in the receiving waters. The settleable and suspended solid level discharged are slightly higher that incoming water, but are within the limits of the NPDES permit.

3.5 FACILITIES

3.5.1 BROODSTOCK COLLECTION FACILITIES (OR METHODS)

Broodstock for the DCFH program will be collected by capturing young of the year juvenile coho from selected streams using hand seines and possibly electrofishing techniques. Sampling will be conducted only between March 1 and November 1, and specific broodstock collection activities are generally expected to occur in July and August. The following procedures will be employed during the electrofishing, as specified in Permit 1067 (NMFS 2001a):

- pre-sampling visual surveys will be conducted where ESA-listed adults may occur to ensure minimal effects to such adults;
- hand seines will be the primary capture method, and electrofishing will only be used for initially locating coho, and where high river flows prevent use of seines;
- electrofishing equipment will have state-of-the-art electronic circuits and probes that allow for variable output of the electrical current and are designed to reduce effects to fish;
- operators will calibrate the equipment for their individual waters and should monitor conductivity, fishing effectiveness, fish response and electrical output;
- whenever possible, a net will be placed below the sampling area to increase the number of fish captured and reduce the number of stunned fish that may potentially be preyed upon;
- investigators trained in electrofishing techniques must conduct the electrofishing;
- a log will be maintained of all electrofishing activities for the purpose of improving technique and knowledge about the specific gear, fish, and waters in which the permit is used.

3.5.2 FISH TRANSPORTATION EQUIPMENT (DESCRIPTION OF PEN, TANK TRUCK, OR CONTAINER USED)

Fish transport for the DCFH coho program is used for the following activities:

- transport of captured juveniles from their capture stream to DCFH;
- transport and release of coho fingerling from DCFH to selected release points; and
- transfer of coho pre-smolts/smolts from DCFH to selected net-pen acclimation sites and/or transfer of fingerlings to appropriate release points.

Two primary transport trucks are used for DCFH operations: an 800 gallon tank truck and a 1200 gallon tank truck. Each tank truck is outfitted with four fresh flow aerators and a twin oxygen bottle / air stone assembly for oxygenation. The trucks are not outfitted with temperature control. (The transit time for DCFH/ release stream fish transport activities generally range between 45 minutes and one hour of travel, and as a result temperature control is not a significant concern.) Transport densities are monitored to stay below 2000 pound of fish per load.

Smaller scale transport units are sometimes used and include insulated tanks outfitted for use in pickup trucks. These units are primarily oxygenated using bottled oxygen and air stones. For even smaller transport needs, as may be the case with remote collection of juveniles for captive broodstock, it is typical to use an insulated cooler equipped with a small battery-powered air pump. An additional battery and spare air pump will be included on any transport trip involving captive broodstock. The transport densities used for these portable units are generally very low.

3.5.3 BROODSTOCK HOLDING AND SPAWNING FACILITIES

Juvenile captive broodstock will be held initially in the aluminum start tanks located in the DCFH hatchery building and used normally for early rearing activities. A detailed description of the tanks and water supply is provided in Section 3.5.5. The start tanks used for captive broodstock have been modified with additional screen guides to increase the number the separate groups that can be segregated within an individual tank.

Plans are currently being developed to construct a new building to enclose new tanks for the growout and maturation of the captive broodstock. The short term plan to accommodate the first age class of broodstock calls for six 16-foot diameter fiberglass start tanks providing 2-foot water depth, and six 20-foot diameter deep tanks providing 3.5-foot water depth. Each tank will be equipped with a belt feeder, and the deep tanks will additionally have automatic feeders. Underwater video cameras will be installed in each tank and will be linked to a bank of four video monitors, and there will be a high/low water level alarm for each pair of tanks. Crowder racks mounted on a central pivot will enable fish to be manually crowded and sorted. Water plumbed to the facility will be treated with a separate filter system with subsequent ozone disinfection. The specific location of the captive broodstock building has yet to be determined.

As the captive broodstock approach sexual maturity, they will be scanned with ultrasound equipment on a routine basis to determine when they are ready to spawn. On the selected spawning day, ripe fish will be loaded manually into a small transport unit and transferred to the spawning room located in the DCFH hatchery building. Spawning will be facilitated using the anesthetic tanks, sorting table, and spawning table.

3.5.4 INCUBATION FACILITIES

The egg incubation facilities are located within the DCFH hatchery building and consist of 22 stacks of 16-tray incubation units, as well as hatching jars in a variety of sizes (6-, 8-, and 10-inch diameter). The incubation trays and the hatching jars can both be used to raise the eggs to the hatching stage. The current practice is to rely primarily on the hatching jars, since they reduce or eliminate fungus growth during incubation, require less handing of the eggs and emergent fry, and have exhibited a higher survival rate to hatching than the incubation trays.

Both the incubation trays and hatching jars have two sources for water supply, one at ambient temperature and one chilled, allowing excellent control and flexibility of the water supply temperature.

3.5.5 Rearing Facilities

There are two types of rearing facilities at DCFH: start tanks located inside the hatchery building for early rearing of fry, and outdoor raceways for final rearing of fingerling and yearlings. When eggs within the incubator trays and hatching jars reach the emergent fry stage, they are moved manually into the start tanks. After six weeks in the start tanks, the fish are transferred to the raceways where they remain until final release.

The start tank system is a series of large tanks, fish feeders, and water supply. Each of the 18 start tanks is made of aluminum and measures 28 feet in length, 3 feet in width, and 22 inches in depth. There are eight juvenile rearing raceways, constructed of concrete, each with an available rearing volume measuring 72 feet in length, 9 feet in width, and 27 inches in water depth. These raceways are grouped in two sets of four raceways, laid out in pairs (side-by-side). An automatic fish feeder is located between the supply ends of each pair of raceways. Each feeder is capable of automatically supplying dry or moist pellets to the raceway, based on a program entered by hatchery personnel that sets the amount and timing of food delivery. Alternatively, the hatchery manager may choose to conduct manual food delivery to these raceways.

Due to design flaws, the raceway system supplies approximately one-half of the amount of water called for in the original specifications for the project. The raceways have a water recirculation system, but attempted use of this system resulted in disease outbreaks and high mortality and use was discontinued. As a result, rearing production of fish was lower than originally anticipated.

In 1991, DCFH was expanded to provide additional hatchery and rearing facilities as authorized in Section 95 of Public Law 93-251, to provide mitigation for the Coyote Valley Dam Project. The hatchery raceway system was expanded with the addition of 3 sets of four raceways for a total of twelve new raceways, satisfying the rearing capacity requirements of the original DCFH production program. The raceways are equipped with automatic fish feeders and are totally independent of the original raceways. The new raceways are 65 feet in length, 9 feet in width, and 5 feet in depth.

This HGMP recommends that one half of the juvenile releases for the coho captive broodstock program be released as smolts, requiring about one year of additional rearing beyond the fingerling release stage. If this recommendation is accepted, it is likely that additional rearing units and water supply will be required at DCFH to accommodate low density rearing of coho, up to the point they would be transferred to acclimation facilities.

3.5.6 Acclimation/Release Facilities

Coho salmon released as fingerlings will be released directly to suitable rearing habitats, where they are expected to overwinter and imprint before emigrating as smolts the following spring. Potential release sites will be identified by CDFG surveyors and discussed and approved by the TOC prior to the first release of coho fingerlings, scheduled to occur in 2004.

Coho salmon released as smolts will be held in net pen acclimation devices at the release site for not less than 30 days to facilitate imprinting. Net pen materials, dimensions and rearing density criteria will be established by the TOC prior to the first release of coho smolts, scheduled to occur in 2005.

3.5.7 Describe Operational Difficulties or Disasters that Led to Significant Fish Mortality

DCFH has incurred a single incident that led to significant fish mortality during the second year of that facility's operation. On September 24, 1981, a power failure at DCFH resulted in the loss of the majority of fish being raised at the facility. The event began between 7:30 and 8:00 p.m. when a severe variance in the electrical power supply resulted in a single-phase low voltage condition and finally, a power outage at the hatchery. The immediate audible/visible results of the low-voltage "brown-out" condition were actuation of the emergency alarms in the hatchery worker residence, dimmed and over bright hatchery office lights, starting of the emergency generator, stopping of the treated water pumps, and burning of parts of the electrical circuits.

At the time of the incident, juvenile fish rearing in the hatchery consisted of 9,300 Chinook salmon, 51,000 coho salmon, and 100,200 steelhead trout. No eggs were being incubated at the time.

Emergency response by hatchery personnel consisted of observations of facility and fish conditions; notification of key personnel; attempts to start pumps and generators; and solicitation of help from Pacific Gas and Electric (PG&E), the electric supply company. Hatchery personnel were unable to maintain a flow of water to the start tanks and raceways, resulting in the loss of all fish except for some of the coho salmon.

A subsequent investigation concluded that the following factors contributed to loss:

- Voltage surges resulted in damage to electrical circuits, causing the treatment pumps to stop running and thereby cutting the water source to the head box.
- The circuit breaker on the 400 kw standby generator was open and prevented transfer of emergency power to the treatment pumps. The breaker panel was not marked, and personnel were unable to locate the breaker.
- The emergency generator at the wells failed to operate because of a stuck solenoid.
- Duty personnel failed to open the valve between the aeration pond and the raceways until about 30 minutes following the power loss.
- Water losses occurred in the raceways due to poor fitting of substitute overflow pipes.
- Decisions concerning transfer or release of fish were not made in a timely fashion.

3.5.8 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.

Training of personnel now includes practice for appropriate response to emergency conditions. In addition, the facility has been modified to provide additional backup provisions, including:

- addition of a bypass pipeline for emergency water supply;
- provision for gravity flow from aeration pond to new raceways;
- additional alarm system modifications;
- a gasoline-powered pump assembly and associated collapsible pipeline to enable pumping from treatment sump to the hatchery building head box; and
- a digital day tank assembly for the generator, along with implementation of a weekly exercise routine.

As was described in Section 3.4.1, plans are in development that will provide a new water supply with redundancy (two 50-cfs pipelines) to the DCFH facility, and eliminate the need for the existing emergency water supply.

3.6 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.

3.6.1 SOURCE

The primary source for obtaining broodstock for the coho program will be from wild populations within the Russian River basin. Streams that have been identified for possible sources include Green Valley Creek, Purrington, Freezeout, Willow, Ward, Sheephouse, Dutchbill and Felta Creeks. If insufficient numbers are obtained after initial collection efforts, then additional collection may be conducted in Olema Creek, located in the Lagunitas Creek basin in Marin County. The Lagunitas Creek basin was selected by the TOC to be the preferred out-of-basin source because it is contained within the boundary of the CCC coho salmon ESU in close proximity to the Russian River basin. NMFS has concluded from available data that the basin has an abundance of coho greater than the viable population threshold, and hence the population will not be significantly affected by an annual removal of approximately 150 to 300 individuals. An additional benefit of including some broodstock from the Lagunitas Creek basin is its potential for increasing the genetic variability of the Russian River stock, which has been suggested by NMFS geneticists as desirable based on preliminary data (C. Garza, NMFS, pers. comm. 2001). Initial consideration for broodstock sources had also been given to the Albion and Noyo basins in Mendocino County, and they may be reconsidered in the future if there is any indication of a decrease in the coho population trend in the Lagunitas basin.

3.6.2 SUPPORTING INFORMATION

3.6.2.1 History

In 1999, a policy was implemented for DCFH production programs requiring that all broodstock be obtained solely from adults captured within the Russian River. Prior to 1999, broodstock for the DCFH programs were derived in part by adult capture within the Russian River, and via stock transfers from a variety of sources (R. Gunter, CDFG, pers. comm. 1999). Fish planted into the Russian River prior to implementation of the DCFH program in 1982 had little likelihood of being derived from Russian River broodstock due to the lack of collection facilities.

Out-of-basin coho salmon stocks were first planted into the Russian River Basin beginning in the 1930's, and their use continued through 1998 (CDFG 1998). Some of the more distant origins that were recorded for out-of-basin broodstock sources included the Alsea River (Oregon) in 1972, and Soos Creek (Washington) in 1978. There is no information regarding the survival of fish from these outplants. Since the DCFH coho program started in 1982, out-of-basin broodstock sources have been limited to the northern California basins of the Noyo River, Klamath River, and Eel River.

A summary of Russian River outplants and their source of broodstock through 1998 is presented in the following table, based on Steiner (1996) and annual reports of DCFH operations (CDFG 1996b, 1997, 1998b). Based on this information, Russian River adults are known to be the source of broodstock for at least 33 percent of all historical coho releases going back to the 1930s. There is no known information regarding the survival of fish from outplants prior to the DCFH program. Even so, given the magnitude and duration of historical stock transfers, it is likely that naturally spawning coho within the Russian River represent a genetic conglomerate of many stocks, although data are unavailable to quantify the degree of introgression. Similarly, the adults used as broodstock likely are themselves descendants of many stocks. While the history of stock transfers in the Russian River suggests that genetic integrity has been compromised, the recent policy of collecting broodstock from returns to the Russian River should allow selection and genetic drift to give rise to Russian River specific stocks.

Broodstock Source	Years Outplanted	Total Outplants[1]
Russian River	1983, 85-98	752,372
Alsea River	1972	58,794
Eel River	1987, 90	25,112
Klamath River	1975, 81-83, 86-88	451,370
Noyo River	1970, 72-74, 82-84, 86-93, 97-98	613,056
Soos Creek	1978	8,420
Unknown		403,340
Total		**2,312,464**
% Russian River Origin[2]	**33%**	

[1]Data compiled from SEC (1996) and CDFG (1996b, 1997, and 1998b). Some historical records are incomplete. This compilation is intended to convey general magnitude of hatchery planting rather than exact numbers.

[2]As planting records are incomplete, this is only an estimate based on numbers presented in this table, assuming the "unknown" is not Russian River. Out-of-basin sources were planted extensively in the past, but this practice was diminished and then discontinued in more recent years.

Implementation of the Russian River coho recovery program in 2001 began with the collection of 227 young of the year (YOY) juvenile coho from three different Russian River tributaries. As this number did not meet the minimum broodstock goals, an additional broodstock collection effort was subsequently conducted in Olema Creek in the Lagunitas Creek basin south of the Russian River basin. The Olema efforts captured 120 YOY coho. The actual selection of broodstock for the coho recovery program will be determined by the TOC prior to spawning, based primarily on results of genetic screening for relatedness of individuals to be conducted by NMFS Santa Cruz Lab. Olema Creek will remain the preferred out-of-basin source as long as there is no indication of a negative trend in the coho population.

3.6.2.2 Annual Size

The proposed broodstock collection goal as described in this HGMP is to collect 300 to 600 juvenile coho annually. The current goal as described in Permit 1067 is to collect 200 to 300 juvenile coho annually. Justification for the proposed increase is presented in Section 3.7.4.

3.6.2.3 Past and Proposed Level of Natural Fish in Broodstock

With the original coho mitigation/enhancement program, there was no way to determine (with absolute certainty) whether coho entering the DCFH trap were of hatchery or natural origin. Returning fish were spawned indiscriminately in this respect and it is likely that natural-origin fish were incorporated into spawning.

Under the current broodstock collection protocol, only natural-origin fish are used as broodstock.

3.6.2.4 Genetic or Ecological Differences

Genetic variation in coho salmon across the entire Pacific Northwest was examined (Hedgecock *et al*. 2000). A surprising lack of variation was found in the mtDNA control region and non-coding nuclear DNA (both genes and anonymous DNA). A region of mtDNA that is known to be highly variable in other salmonids yielded only four haplotypes from California to Kamchatka, Russia. Two of these haplotypes were geographically widespread and two were found in single individuals in California or Russia. Samples were relatively small (N < 24 per region). The author suggested that modern coho arose recently from a single ancestral population, historical coho populations were very small, or both.

Several Russian River samples were analyzed with five microsatellite loci in a preliminary focus on local coho salmon populations (Banks *et al*. 1999). Substantial genetic variation was identified between populations, between populations from the same location but in different year classes as well as between nearby geographic locations. Two more northern samples were included for comparison (Noyo egg station and Hare Creek, Mendocino County). It should be noted that the Olema Creek population samples supplied by Banks were comprised only of juveniles, and sampling was conducted in only four reaches, so it is possible multiple individuals from the same family were sampled. The results cited are preliminary; data presented have critically low sample size for some population samples, and require characterization at more loci before strong inferences can be made. Results from current studies being completed by NMFS should provide information that is more robust.

Tests for homogeneity found substantial heterogeneity among populations; no population samples could be pooled except the Green Valley sample from 1997, the Warm Springs Hatchery sample from 1995/96 ($p = 0.064$) and one other exception. The coho in Green Valley in 1997 were a surprise because no YOY were captured in 1994, so the 1994 year class had been assumed to be extirpated (M. Fawcett, pers. comm., cited in Banks *et al*. 1999). Because the 1997 Green Valley sample was homogeneous with the 1995/96 sample from Warm Springs Hatchery, these juveniles may have been spawned from hatchery strays. In contrast, the 1998 Green Valley sample was more closely related to the northern samples (Noyo egg station and Hare Creek), which in turn are more closely related (and proximately located) to each other. Therefore, the 1998 Green Valley sample may represent a more wild stock. The Olema sample for 1997 was homogenous with the Warm Spring hatchery sample from 1996/97 ($p = 0.096$). Warm Springs Hatchery samples from 1995/96 and 1996/97 were markedly heterogeneous ($p = 0.004$), as were the two Green Valley samples from 1997 (96/97 broodyear) and 1998 (97/98 broodyear) ($p = 0.000$). This may be due to genetic drift, as substantial variance and low numbers of returning spawners to a site have been documented.

A preliminary analysis of samples from the Russian River and streams in Marin County (directly to the south) was conducted in 2001 to assist the CDFG collection effort for the Warm Springs Hatchery coho broodstock program (P. Siri, pers. comm. 2001, Hedgecock *et al*. 2001). (Samples analyzed were not from the 2001 collection program). Coho collected in the late 1990s from the Eel, Noyo, and Russian (Green Valley Creek) rivers, and Lagunitas, Olema and Scott creeks were analyzed with seven microsatellite loci. (A species identification test was applied to ensure all samples were identified correctly.)

Significant deviations from random mating expectations occurred in 6 of 14 populations. This level of deviation from Hardy Weinberg equilibrium, in addition to high levels of homozygosity in individuals in adult populations, was striking and unusual, and occurred for both juvenile and adult populations. Prior inbreeding is one possible explanation. When the adult populations of Green Valley and 1997 Eel River populations were reconstructed from the juvenile samples, the Eel river population had a good fit to Hardy Weinberg equilibrium, but the Green Valley population did not. This suggests that broodstock should be genotyped prior to spawning in the hatchery to minimize further inbreeding. Relatedness coefficients were calculated for 3 populations to test for sibling relationships, including the Green Valley population. The Green Valley coho had a high degree of relatedness, suggesting a high level of inbreeding. The 1997 Lagunitas population had a large number of homozygotes, suggesting this may be a small, inbred population as well. The 1996 Eel River population had some homozygotes, but a larger number occurred in the 2000 Noyo and 1997 Lagunitas populations, suggesting small populations.

Genetic distances between sites indicate that population structure appears to conform to geography (Hedgecock *et al*. 2001). Populations from the Central California ESU north of San Francisco Bay formed a cluster, joined next by Scott Creek (Santa Cruz County) and last by the Eel River sample (the Eel River is in the Northern California/Southern Oregon ESU to the north). This suggests that the use of central California coastal stocks (Noyo to Olema) to restock the Russian River is justified.

The NMFS Santa Cruz Laboratory is also undertaking a comprehensive genetic assessment of population structure and demography for coastal populations of coho salmon in central

California, and will develop baseline genetic information for use in future monitoring and propagation efforts. The research project is designed to evaluate and document differences between the genetic composition of wild fish and artificially introduced fish.

3.6.2.5 Reasons for Choosing

A preference is given to Russian River coho salmon in order to insure the genetic integrity of remnant coho salmon populations.

3.6.3 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 coho program will perform genetic analyses of all fish collected for the program to assess information about their origin and appropriateness as a captive broodstock source.

3.7 BROODSTOCK COLLECTION

3.7.1 LIFE-HISTORY STAGE TO BE COLLECTED (ADULTS, EGGS, OR JUVENILES)

The coho recovery program will collect only young of the year juvenile coho.

3.7.2 COLLECTION OR SAMPLING DESIGN

The coho program proposes to collect 300 to 600 juvenile coho annually to supply the captive broodstock program. Between 150 and 300 juveniles will be collected from the Russian River basin, and the same number of juveniles will be subsequently collected from the Lagunitas basin. Determination of the specific streams that will be sampled each year will be developed by the TOC.

Broodstock will be collected from a total random selection of juvenile coho salmon encountered during each of several capture events. In order to preserve the naturally reproducing component of the stock, capture events conducted within a pool with persistent water will collect no more than 50 percent of the juvenile fish encountered, with a maximum capture of 10 coho per pool. In pools that area biologists estimate will eventually recede completely, the broodstock capture may collect 100 percent of all juveniles encountered with a maximum capture of 10 coho per pool. Where many coho are present within a stream section with either persistent or receding water (such as Green Valley Creek), many pools within the reach will be sampled to obtain a broader representation of the yearclass and to reduce chances of relatedness between individuals. Detailed aspects of the capture protocol are expected to follow the same protocol used by CDFG during the 2001 coho broodstock collection efforts (CDFG 2001).

3.7.3 IDENTITY

All coho fingerling or smolts released as part of the coho recovery program will be marked, some percentage with a PIT tag. All juvenile fish collected as part of the broodstock collection efforts will be evaluated for marks and assayed with PIT tag scanning equipment. Any captured coho that found to contain a mark will be released back to their capture location.

3.7.4 PROPOSED NUMBER TO BE COLLECTED

3.7.4.1 Program Goal

The proposed broodstock collection goal as described in this HGMP is to collect 300 to 600 juvenile coho annually. The current goal as described in Permit 1067 is to collect 200 to 300 juvenile coho annually.

A benefit-risk analysis recently completed to assess Russian River coho program alternatives recommends a conservative broodstock collection goal of 500 to 600 juvenile coho annually (FishPro and ENTRIX 2002). The reasoning lies in the many critical uncertainties and assumptions that must be made regarding survival and performance both in the hatchery and in the natural environment. Some of these uncertainties include prespawning mortality and fecundity of the broodstock, discussed in Section 3.9.1.1, and the survival of released coho fingerling to the smolt stage, discussed in Section 3.10.3. The TOC should conduct an annual review of the assumptions relating to captive broodstock requirements and adjust numbers as needed to maintain management goals.

3.7.4.2 Broodstock Collection Levels for the Last Twelve Years, or for Most Recent Years Available

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
2001	NA	NA	NA	NA	347

Data source: DCFH

3.7.5 DISPOSITION OF HATCHERY-ORIGIN FISH COLLECTED IN SURPLUS OF BROODSTOCK NEEDS

Any hatchery-reared juveniles will be returned to the point of capture.

3.7.6 FISH TRANSPORTATION AND HOLDING METHODS

A transport truck will be on standby at the capture location, ready to transport captured fish to DCFH. The DCFH transport trucks were described in Section 3.5.2; a vehicle will be used that is the appropriate size relative to the anticipated capture success of a given location. Efforts will be made to have the receiving water of the transport vessel match the stream temperature. When the transport vehicle reaches DCFH, an acclimation period will be enacted as necessary if the vehicle haul water does not match the temperature of the facility receiving water.

The transit time for hauling from the capture locations to DCFH is estimated to be one to two hours.

3.7.7 Describe Fish Health Maintenance and Sanitation Procedures Applied

Any transport truck, prior to use for broodstock transport, is disinfected with iodophore to prevent disease transmission. Similarly, all surgically related equipment (*i.e.* needles for egg harvest, and tissue collection utensils) used for broodstock spawning are disinfected in alcohol or iodophore prior to use. Overall fish health maintenance and sanitation procedures include daily pond cleaning, including that for captive brood holding facilities. All cleaning equipment and nets are disinfected in Argentyne (iodine based disinfectant) prior to use, and separate cleaning instruments are designated to each raceway and holding unit. In addition, weekly prophylactic salt flushes are given to coho throughout the duration of captive broodstock holding.

Captured juveniles brought to DCFH will be quarantined for a period as prescribed by CDFG pathologists. During the quarantine period, the fish will be screened for the presence of specific pathogens, and they will be treated as directed by the pathologists.

3.7.8 Disposition of Carcasses

Carcasses arising from hatchery mortalities are generally disposed of through the DCFH solid waste disposal system.

3.7.9 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.

Risk aversion measures include the following:

- Close attention will be made to seining and electrofishing techniques.
- Captured fish will be transported in a manner that minimizes fluctuations in water quality and the effects of handling and stress.
- These ESA-listed fish will be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. The transfer of fish will be conducted using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.
- Juvenile fish will not be captured or handled if the water temperature exceeds 70 degrees Fahrenheit at the capture site.

3.8 Mating

3.8.1 Selection Method

The program TOC will evaluate the most applicable strategies to increase genetic diversity during the initial captive brood maturation period, and will make a recommendation prior to the first spawning anticipated in late 2003 or early 2004. Genetic analyses will be conducted for all fish used in the program, and the results of the analyses will be used to dictate the combinations of mature coho to use in the spawning process.

Spawner ripeness will be determined by trained personnel using standard fish husbandry techniques and ultrasound technology.

3.8.2 MALES

The majority of coho salmon mature in their third year, but some fish, typically males, will mature a year early. It is possible that some captive brood will mature early, and/or it may be able to induce precociousness through hormone treatments. It is also possible that some captive brood will mature late due to slower growth rates in captivity (ODFW 2001). The TOC will evaluate the potential benefits of using precocious or late-maturing broodstock to transmit genetic material between year classes, thereby increasing genetic diversity and/or supplementing weak year classes.

3.8.3 FERTILIZATION

The artificial fertilization protocol will follow the dry spawning technique. Egg lots will be fertilized and disinfected with iodophore. Ovarian fluid will be collected from spawned females for pathological analysis. Fertilized eggs of each female will be incubated separately in hatching jars until pathological analysis is completed. This will allow hatchery personnel to isolate, treat, and/or remove specific pathogens to prevent their transmission into the DCFH environment.

3.8.4 CRYOPRESERVED GAMETES

It has been recommended that cryopreservation of milt be undertaken for this program. The TOC will evaluate the potential benefits of this measure and associated equipment and cost requirements for implementation, and provide the findings in the first annual report for the program.

3.8.5 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.

The proposed mating methods described above will minimize the likelihood of genetic effects in the coho recovery program.

3.9 INCUBATION AND REARING

3.9.1 INCUBATION

3.9.1.1 Number of Eggs Taken and Survival Rates to Eye-Up and/or Ponding

The first egg take is anticipated to occur in late 2003 or early 2004. Number of eggs taken will be dependent on prespawning survival of the captive broodstock females. Of 344 juveniles collected in September 2001, there were 308 on hand as of May 2002. Gender proportions have not yet been determined, but assuming a 1:1 sex ratio there were approximately 154 females on hand as of May 2002. The coho program permit application assumed a spawn of 100 females (NMFS 2001a), which suggests that a prespawning mortality of approximately 35 percent will still provide the target broodstock goal. Other captive broodstock programs for salmonids have exhibited a wide range of prespawning mortality. For example, a captive spring Chinook program operated by the Oregon Department of Fish and Wildlife (ODFW) has experienced an average prespawning mortality approaching 40 percent (T. Hofnagel, ODFW, pers. comm. 2001), while a captive coho pilot program conducted at the ODFW Alsea Hatchery experienced a prespawning loss of only 17 percent (ODFW 2001).

Anticipated fecundity for the captive broodstock is 2,300 eggs per female as stated in the permit application (NMFS 2001a). Management guidelines for the original coho mitigation/enhancement program at DCFH had assumed a fecundity of 2,000 eggs per female (FishPro and ENTRIX 2000). Other captive broodstock programs have noted that the captive fish are generally smaller than their wild counterparts (especially during the initial stages of a captive rearing program) and, as fecundity is generally related to the size of the fish, the fecundity of captive broodstock is also generally lower than wild fish (M. Cheney, ODFW, pers. comm. 2001). The average fecundity observed with the Alsea captive coho pilot project was 1,909 (ODFW 2001).

The coho program permit application assumed an egg take of 230,000 and the availability of 200,000 fingerling, suggesting an overall mortality of 17 percent from green egg to fingerling. The Alsea captive coho pilot project experienced high egg mortality for all spawn groups, with an average egg loss of 37.7 percent (ODFW 2001). The uncertainty of survival that will be experienced during the various stages of the DCFH coho recovery program is the reasoning for recommending a more conservative broodstock collection goal of 600 fish to meet target release goals of 200,000 juveniles, at least in the initial years of the program. Alternatively, if broodstock collection numbers are not increased, it is possible that there will be a decrease in number of juveniles released and that the associated outplant density will decrease.

3.9.1.2 Cause for, and Disposition of Surplus Egg Takes

At the first indication that the program may exceed the current 200,000 smolt production goal, NMFS will be notified of the condition. The TOC will discuss the possible alternatives and make a recommendation to NMFS regarding disposition of any excess eggs, fingerling or smolts beyond the current 200,000 smolt goal.

3.9.1.3 Loading Densities Applied during Incubation

Vertical flow incubators (Heath Trays) are no longer used at DCFH. Eggs are reared instead in acrylic hatch jars, which are fabricated on site. The following are the usable volume capacities for the most commonly used production hatch jar sizes: six inch – 254.4 cubic inches, eight inch – 452.2 cubic inches, ten inch – 706.5 cubic inches, and twelve inch – 1017.36 cubic inches. Generally the loading density in the hatchery jars ranges 50 percent of capacity. The flows in the hatchery jars vary from three to twelve gpm and adjustment can be made for individual units.

Eggs from each coho female will be incubated in a separate hatching jar until lab tests for bacterial kidney disease (BKD) are completed. Like eggs are pooled (positives and negatives) or discarded based on lab tests. The pooled eggs are then loaded into hatching jars of a size that is appropriate for the total volume of eggs in each pooled lot.

3.9.1.4 Incubation Conditions

Water quality is tested biweekly at each facility and analyzed in the laboratory at DCFH. Chloride tests are performed weekly at each facility. Additional samples for suspended solids are submitted for analysis to the CDFG Lab in Rancho Cordova.

Incubation temperatures do not typically fluctuate as temperature can be controlled by selecting various intakes in the reservoir or by using the refrigeration chillers. Water is highly aerated with dissolved oxygen levels of around 9 to 10 mg/l. Silt is controlled through the use of sand filters; however, due to a highly colloidal suspended matter, the filters are only marginally effective. The turbidity is a parameter monitored in the biweekly analysis.

3.9.1.5 Ponding

Swimup and ponding are volitional using the hatch jar method. Generally the incubation water will range between 51 to 54 degrees F. Upon swimup, the larval *coho will flow out of the hatch jar into the nursery tank in which the hatch jar is located. Coho which are released as fingerlings will be reared in the nursery tanks until the time of release. Coho which are to be released as smolts will be reared in the nursery tanks for about six weeks, at which time they will be transferred into larger rearing units.

3.9.1.6 Fish Health Maintenance and Monitoring

The design of the hatch jars at DCFH provides for the automatic removal of egg mortalities. Dead eggs rise to the surface and are carried out with the gentle current of water flowing through the hatch jar. Any remaining white eggs are removed manually using a hand held pipette.

Due to the use of clear acrylic in the hatch jar construction process, visual monitoring can be carried out continuously. Hatch jar incubation also reduces the amount of chemicals used in disease treatment. Traditionally, formalin and/or salt would be required for combating fungal infections with eggs incubating in Vertical Flow incubators (Heath Incubators). The current of water that envelops incubating eggs in the hatch jars allows for gentle movement of the developing eggs, which reduces the incidence of fungus. No additional treatment procedures other than flow adjustment are necessary during the duration of incubation.

All harvested eggs are disinfected as well, using methods developed by DFG pathology. Feeding practices are continuously monitored and feeds are continuously rotated and inventoried. Overcrowding is prevented and routine pathology health assessments are carried out to maintain the health of all hatchery stocks.

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

Isolation incubation will be performed to minimize transmission of BKD and other pathogens among eggs and fry. Eggs will be incubated using water treated with UV purification to prevent exposure to pathogens. In addition, the treated water is filtered with sand / gravel filters and temperature controlled. Vertical flow incubators have been phased out in favor of acrylic hatch jars, which have the following advantages:

- Eggs are continuously agitated (gently) to reduce fungal invasion.
- Chemical treatment of the eggs is eliminated.
- Eggs can be monitored readily (clear jars only).
- Higher egg to alevin survival ratios can be achieved.
- Eliminates handling sac-fry when moving from incubator to troughs.

3.9.2 REARING

3.9.2.1 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.

Survival rate data will not be generated until the first group of fingerling are produced in early 2004.

Management guidelines for the original coho mitigation/enhancement program at DCFH had assumed a fecundity of 2,000 eggs per female, and a survival rates from unfertilized egg to stocked yearling of 50 percent. These management guidelines were often conservative to assure that production goals were attained; actual in-hatchery performance at DCFH is uncertain.

For the DCFH steelhead program, survival rates from ponding as fry to fingerling size is 87 percent survival. Survival rates from fingerling to yearling smolt release averages 78 percent survival. These percentages are an average of the past twelve years, slight variations occur annually. Calculations are based on fry at swimup to six weeks of age, at six weeks of age the juveniles are referred to as fingerling, and are classified as fingerling until they reach 20 fish per pound, at which time they are classified as yearlings. Yearling smolts are classified as such when they approach 4-5 fish per pound.

3.9.2.2 Density and Loading Criteria (Goals and Actual Levels)

Rearing pond densities for fish to be released will be managed so they do not exceed a maximum density of 2.25 lbs fish/ft^3. Lower densities will be maintained whenever possible.

Rearing pond densities for the captive broodstock will be managed so they do not exceed a maximum density of 1.0 lbs fish/ft^3.

3.9.2.3 Fish Rearing Conditions

All coho rearing conditions are monitored daily. Temperature regimes do not fluctuate critically as temperature of rearing water can be manipulated; temperature will rarely vary more than 5 degrees over the entire duration of the rearing program. Daily temperature variation rarely ranges more than a single degree. Dissolved oxygen of influent and effluent is analyzed in the laboratory weekly (Winkler Titration) and can be checked as needed at other times with a dissolved oxygen meter. Other water quality data that are collected during laboratory analysis includes pH, turbidity, chloride, suspended and settleable solids.

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

Detailed fish growth information for the first crop of captive brood has not yet been calculated.

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

Hepatosomatic index and body moisture content data has not been routinely collected by staff at the DCFH facility. Monthly growth rates are evaluated using standard CDFG protocol for taking weight count estimates without sacrificing the fish sampled (as a hepatosomatic index would require).

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

Fish feeds include a diet of extruded fish pellets that may be dry or moist, which are prepared by Bio-Oregon. Detailed information relating to feed rate and feed conversion for the first crop of captive brood has not yet been compiled.

3.9.2.7 Fish Health Monitoring, Disease Treatment, and Sanitation Procedures

All fish reared are monitored by CDFG pathologists and certified prior to release. Treatment methods are prescribed by fish pathologists for disease outbreaks and treatment protocols are carried out by hatchery staff. Weekly salt flushes are given throughout the duration of rearing. Depending upon the cause of an outbreak, treatment methods may vary however, chemical treatments for external parasites are limited to the use of salt, formalin and hydrogen peroxide. Bacterial infections could include the use of penicillin G or oxytetracycline. Sanitation procedures include:

- All cleaning equipment and nets are disinfected in Argentyne (iodine based disinfectant) prior to use and separate cleaning instruments are kept for each raceway.

- Overall fish health maintenance and sanitation procedures include daily pond cleaning, which also facilitates daily conditioning exercise to the ponded fish through fluctuating flow regimes.

- In addition, weekly prophylactic salt flushes are given to all life stages of coho throughout the duration of rearing.

- Feeding practices are continuously monitored and feeds are continuously rotated and inventoried.

- Overcrowding is prevented and routine pathology health assessments are carried out to maintain the health of all hatchery stocks.

3.9.2.8 Smolt Development Indices (*e.g.* Gill ATPase Activity), if applicable

Smolt development indices are not a proposed monitoring item for the coho program.

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

Photoperiods of outdoor rearing facilities (containing salmonids ranging in size from fingerlings to smolts) follow the natural environment at both facilities. Additional “natural” rearing methods as described by the Conservation Hatchery Conceptual Framework have not been significantly adopted at DCFH. However, the routine operations of these facilities already includes some of the recommended procedures for the “Conservation Hatchery” strategy: broodstock selection, shaded ponds, health monitoring, release timing coordinated with smoltification and lunar phase, and daily exercise periods.

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

Fish will be reared to a size that mimics the size of natural fish of the same age, to minimizing the risk of predation and competition with the natural fish upon release.

3.10 RELEASE

3.10.1 PROPOSED FISH RELEASE LEVELS

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	0	NA	NA	NA
Unfed Fry	0	NA	NA	NA
Fry	0	NA	NA	NA
Fingerling	50,000 (10,000 each stream)	TBD	Mar - Apr	5 streams: Willow, Sheephouse, Freezout, Mill, Ward
Yearling	50,000 (10,000 each stream)	TBD	Jan - Apr	5 streams: Willow, Sheephouse, Freezout, Mill, Ward

3.10.2 SPECIFIC LOCATION(S) OF PROPOSED RELEASE(S)

Release point: 5 streams: Willow, Sheephouse, Freezout, Mill, Ward

Major watershed: Russian River

Basin or region: Central Coast Region of California

3.10.3 Actual Numbers and Sizes of Fish Released by Age Class through the Program

The first feasible period for fingerling fish releases is anticipated in Spring 2004, and yearlings would not be ready for release until Spring 2005.

In the BO for Permit 1067 (NMFS 2001a), the preferred release strategy is noted to be the release of smolts, with a second preference for the release of fingerlings. A factor in this preference may be the anticipated mortality of 90 percent of fingerling before they reach the yearling stage, as is commonly assumed for wild populations (NMFS 2001a). A preliminary study evaluating the survival of unfed hatchery coho fry used to supplement a population found that approximately 0.7 to 1.3 percent of the unfed fry survived to the smolt stage (Jackson and Loomis 2002). It is suggested that if there are sufficient numbers to allow for release of both smolts and fingerling, then a tagging regime will be necessary that allows comparison between the two release strategies.

3.10.4 Actual Dates of Release and Description of Release Protocols

The first fish release is anticipated in Spring 2004. Release protocols for both fingerling and smolt releases will be developed by the TOC.

3.10.5 Fish Transportation Procedures, if Applicable

Juvenile fish are typically loaded into transport vehicles manually or through the use of an Aqualife Harvester fish pump. Time in transit to the lower Russian River basin from DCFH will generally be 1 to 2 hours.

Transport is conducted in either the 800- or 1,200-gallon tank truck. The tank trucks are outfitted with four fresh flow aerators and a twin oxygen bottle / air stone assembly for oxygenation, but are not outfitted with temperature control (refrigeration). Transport densities do not exceed 2,000 pounds of coho.

Smaller scale transport units are sometimes used at either facility and include insulated tanks outfitted for use in pickup trucks. These units are primarily oxygenated using bottled oxygen and air stones or microspore tubing. No temperature control (refrigeration) is used for these smaller units and densities (fish transported) are generally very low.

3.10.6 Acclimation Procedures

Coho salmon released as fingerlings would be acclimated for 72 hours to monitor mortality and then released.

Coho salmon released as smolts would be acclimated in net-pens at the release site for at least 30 days prior to their release. The net pens will be monitored daily during this period.

3.10.7 Marks Applied, and Proportions of the Total Hatchery Population Marked, to Identify Hatchery Adults

All juveniles will be marked, and some percentage will be cataloged and tagged with PIT tags to allow for individual identification. The TOC will evaluate the potential benefits of using Soft Visible Implant Alphanumeric (VI-alpha) tags in future crops, as these tags allow immediate visual identification of marked fish.

3.10.8 Disposition Plans for Fish Identified at the Time of Release as Surplus to Programmed or Approved Levels

At the first indication that the program may exceed the current 200,000 smolt production goal, NMFS will be notified of the condition. The TOC will discuss the possible alternatives and make a recommendation to NMFS regarding disposition of any excess eggs, fingerling or smolts beyond the current 200,000 smolt goal.

3.10.9 Fish Health Certification Procedures Applied Pre-Release

All fish released are inspected for condition and disease by CDFG pathologists prior to certification for release.

3.10.10 Emergency Release Procedures in Response to Flooding or Water System Failure

An assortment of small volume pumps are available at DCFH for low volume water supply needs. In the event of a total water system failure, a variety of emergency backup measures can be initiated by personnel depending on the extent and duration of the emergency. Two alternative water sources may be used, on of which can permit full operation of the hatchery facilities - the emergency bypass water pipeline and well water. While well water is a possible alternative source of water for the hatchery, its suitability as a sole source in an emergency situation is most likely inadequate as the well water is flat (low oxygen) and is prone to harboring dissolved methane gas.

In the event of an emergency situation calling for complete activation of the emergency water supply bypass pipeline, hatchery personnel must first contact the USACE office to request the emergency water supply bypass pipeline be charged. Charging of the line is controlled by the energy dissipation valve in the stilling well at the dam which is not available to hatchery personnel. The emergency water supply is generally charged and ready for immediate use, however, hatchery staff are required to contact USACE during an emergency to open the valve for access to the emergency water supply bypass pipeline, which will delay delivery of emergency water, especially during an emergency after hours, when the USACE offices are closed.

The aeration pond can supply sufficient water to the raceway as during an emergency, as it drains, for a maximum of 8 to 30 minutes. During this 8 to 30 minutes, hatchery staff must contact an employee of the USACE to provide access to the EWS system and then must initiate steps to operate the emergency water bypass. Delays of any length longer than this period of time (maximum 30 minutes) will result in mortalities to steelhead raised at DCFH, with degree of loss dependent upon time of year. A standby generator is available to provide power for operations during a power outage, however, failure of this generator would result in a condition which would require the use of the emergency water supply bypass line. Power system failures requiring the operation of the standby generator are the most common operational difficulties encountered at DCFH occurring with fairly regular frequency during winter storms.

Wells E and F were initially provided as an emergency water source and are capable of providing the hatchery with a partial water source. This source of water is unsuitable as a single source supply to the hatchery due to elevated temperatures, low dissolved oxygen and dissolved methane gas. In addition, operation of the wells would not be possible in the event of a power failure, as the backup generator operating the wells has to be taken offline.

A third source of water is available and will automatically begin to fill the aeration pond if the aeration pond level begins to drop to a crucial level. This will occur only when the water system failure is not accompanied by a power failure. The source supply for this provision is the wastewater control pond, which is not highly desirable as it is untreated water and may harbor pathogens. This provision will also function on standby power.

If the above backup systems are not available, and survival of the fish is threatened, the fish can be released into the water pollution control pond or released directly into Dry Creek. A large scale release of this type would undoubtedly be difficult to implement, would require considerable efforts on behalf of hatchery staff and would inundate the water system with large numbers of salmonid fish. Retrieval of these fish would be difficult at best.

3.10.11 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.

To minimize competition between hatchery-reared and naturally spawned fish, fingerling and smolt releases will occur where there are no known populations or current year classes of wild fish.

Fingerling and smolt releases will be of a size similar to their wild counterparts at the same age.

3.11 MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

3.11.1 MONITORING AND EVALUATION OF "PERFORMANCE INDICATORS" PRESENTED IN SECTION 3.1.10

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

The Performance Indicators presented in Section 3.1.10 are reproduced in the table below, along with an indication of the present status of data collection efforts relating to these activities. The status of "Ongoing" indicates that activities are currently being undertaken that address the issue, although these activities may not be under the direct supervision or funding umbrella of the USACE/CDFG hatchery program. The status of "NEEDED" indicates that data collection efforts have yet to be implemented. Plans and methods for many recommended data collection activities have been compiled in the document entitled *Hatchery and Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities* (FishPro and ENTRIX 2002). Where appropriate, the last column indicates a cross-reference between the Performance Indicators of Section 3.1.10 and the Activities described in the existing M&E plan. In cases where there is no cross reference, the need exists to develop a plan that will adequately assess the issues.

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B1A.	Use number of adults necessary to achieve MEPS. Trend target in 4 out of 5 years + 10%	Needed	3.2
B1B.	Evaluate whether life history characteristics were maintained by comparing baseline at year 1 with 5 year survey, or after one generation	Needed	3.2
B1C.	Evaluate broodstock genetically in year 1 and compare after 5 years, or one generation, in terms of DNA or allozyme profile	Ongoing	3.2
B1D.	Captive broodstock – implement RM&E plan	Needed	1.2, 2.1
B1E.	Cryopreservation - implement RM&E plan	Ongoing	3.3
B1F.	Promote regional gene bank to preserve existing populations not under threat of extinction	Ongoing	3.3
B2A.	Manage for increasing trend of redd counts as index of natural spawning	Needed	2.1
B2B.	Manage for increasing numbers of adult fish	Needed	2.1
B2C.	Manage for increasing trend in juvenile anadromous fish rearing densities in #'s/m2 by habitat	Needed	2.1
B2D.	Manage for increasing trend in nutrients from adult carcasses in tributaries	Needed	2.1
B2E.	Manage for increasing F2 spawners	Needed	2.1
B3A.	Develop a project with a regional perspective for a multi-year funded research plan with funding support	Ongoing	5.3
B3B.	Describe funding umbrella to provide context for individual project research	Ongoing	5.3
B3C.	Develop plan consistent with management goals, objectives and strategies.	Ongoing	5.3
B4A.	Develop comprehensive regionally coordinated RM&E plan that includes a website for all hatcheries in the basin	Ongoing	5.2
B4B.	Develop a research study plan	Ongoing	5.2
B4C.	Integrate hatchery and programs into management plan within 3 years	Ongoing	5.3
B4D.	Improve marine survival and yield of adults in the fishery or spawning grounds	Needed	2.1
B4E.	Establish research priorities by evaluating performance indicators which haven't been met. Standard is adaptive management	Needed	1.1
B5A.	Assure that mitigation and policy obligations of the hatchery are met	Ongoing	None
B6A.	Assure that hatchery performance standards established in the DCFH / CVFF Management Plan are achieved	Ongoing	1.1.1
B6B.	Relevant state-wide hatchery performance standards are achieved	Ongoing	1.1.1
B7A.	Evaluate effectiveness of performance indicators using adaptive management in order to more accurately measure performance through audit process.	Ongoing	5.2

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B7B.	Evaluate and implement relevant regional hatchery production guidelines	Ongoing	5.2
B8A.	Manage the process to accomplish declining expenditures for administrative overhead	Ongoing	None
B8B.	Achieve annual budgeting based on a results-oriented, performance-based management framework	Ongoing	5.3
B8C.	Assure that annual reports address program performance based on indicators	Ongoing	5.2
B8D.	Conduct hatchery audits as scheduled and integrate results into future funding and program decisions	Ongoing	5.2
B8E.	Document implementation of regional policies and procedures and hatcheries	Ongoing	5.3
B9A.	Develop an overall economic impact assessment to compute direct, indirect and induced effects from Russian River hatchery production	Needed	None
R6A.	Develop an appropriate RM&E plan to assure program does not exceed the carrying capacity of freshwater habitats	Needed	2.1.3
R6B.	Develop a reservoir, estuarine, and ocean research, monitoring, and evaluation plan	Needed	2.2.3
R1A.	Assess genetic effects, initially through stray rates as a surrogate for a thorough and more complex measurement of genetic impact	Needed	3.2, 1.2.3
R1B.	Implement more specific genetic impacts measurements on a selected basis	Ongoing	3.1. 3.2
R2A.	Achieve increased survival threshold for captive broodstock over wild adults	Needed	1.2, 2.1
R2B.	Implement HGMP where appropriate	Needed	5.3
R2C.	Evaluate and implement relevant regional hatchery production guidelines	Needed	5.3
R3A	Document stable or increasing trend of redd counts as index of natural spawning	Needed	2.1
R3B	Document stable or increasing numbers of adult fish.	Needed	2.1
R3C	Document hatchery spawner to recruit ratio equal to or greater than 1	Needed	2.1
R3D	Evaluate and implement relevant regional hatchery production guidelines	Needed	5.3
R4A.	Achieve percent egg take goal in 4 out of 5 years	Ongoing	1.1.1
R4B.	Implement CDFG disease protocols in any events involving egg transfer to the hatchery	Ongoing	1.1.1
R5B.	Implement tributary RM&E plan by management plan by specific hatchery by species, and extrapolated to other management plans and the other hatchery in the basin	Ongoing	2.1, 2.2
R5C.	Develop RM&E plan for estuary and near shore marine habitat	Needed	2.2

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
R6A.	Select tributaries – conduct comparative evaluation of prestocking population with post stocking after five years or after one generation	Needed	2.1.2, 4.2.1
R7A.	Document stable or increasing trend of redd counts as index of natural spawning	Ongoing	2.1.2
R7B.	Document stable or increasing numbers of adult fish.	Ongoing	2.1.1, 2.1.2
R7C.	Document hatchery spawner to recruit ratio equal to or greater than 1	Needed	4.1.1
R8A.	Establish comparative annual sampling of disease in hatchery and wild populations	Ongoing	4.2.1
R8B.	Comply with CDFG standards and NMFS guidelines	Ongoing	1.1.1
R8C.	Apply disease standards to stocking activities	Ongoing	1.1.1
R8D.	Evaluate incidence of drug resistant pathogens by comparing to baseline in year 1 to survey every five years	Needed	4.2.2
R9A.	Evaluate trends in the ratio of hatchery juvenile production cost per cost of juvenile production from habitat projects by management plan by hatchery per adult production	Needed	None
R10A.	Achieve highest numerical ratio of returning adults per cost of action (habitat, passage, hatchery)	Needed	None
R10B.	Achieve highest ratio of intrinsic social value (satisfaction survey) of returning adults per cost of action	Needed	None

Many methods coming into use that can reduce potential effects of hatchery fish on wild populations require greater understanding of the natural population than is currently available within the Russian River. As an example, before planting recovery program coho within a stream, it will be essential to know the carrying capacity and current abundance in proposed release areas. Certain hatchery evaluation parameters are unquestionably the responsibility of the hatchery owner, but it must also be recognized that many evaluation parameters that may be more strongly related to resource management may fall under the stewardship responsibility of the State and Federal fisheries resource agencies. It is felt to be critical to the optimal operation of Russian River fish production facilities, as well as to the recovery of protected species, that the activities described in the *Monitoring and Evaluation Plan for Russian River Fish Facilities* be fully implemented. This implementation will require significant coordination to establish relevant and fair delegation of tasks to various parties. The following table provides a synopsis of activities presented in the M&E Plan, along with initial concepts relating to project implementation:

- each activity's relative priority;
- whether there is any ongoing effort related to the activity;
- the entity which would appear to be the responsible party for supervising the data collection and reporting efforts; and
- the existing or potential funding source for the activity.

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
OBJECTIVE 1.	**DETERMINE IF THE HATCHERY PRODUCTS ARE MEETING PROGRAM GOALS AND EXPECTATIONS.**				
TASK 1.1	MONITOR THE IN-HATCHERY SURVIVAL AND THE HATCHERY OPERATIONAL PRACTICES FOR EACH RELEASE GROUP.				
Activity 1.1.1	Develop hatchery annual operation plan to ensure consistency of hatchery production approaches and quantification of results achieved.	Medium	On-going	CDFG	USACE
Subactivity 1.1.1.1	Determine egg-to-fry, fry-to-par, parr-to-smolt survival rates for each release group.	Medium	On-going	CDFG	USACE
Subactivity 1.1.1.2	Document numbers, size, time of release, and release location for all fish.	Medium	On-going	CDFG	USACE
Subactivity 1.1.1.3	Conduct periodic monitoring for size during rearing.	Medium	On-going	CDFG	USACE
Subactivity 1.1.1.4	Participate in planning processes for ponding and rearing.	Medium	On-going	CDFG	USACE
Subactivity 1.1.1.5	Prepare and submit tag, mark and release reports.	Medium	On-going	CDFG	USACE
TASK 1.2	ESTIMATE THE NUMBER OF ADULTS PRODUCED BY EACH REARING AND RELEASE STRATEGY.				
Activity 1.2.1	Mark all hatchery-reared fish so they can be detected as smolts and as adults.	High	On-Going	CDFG	USACE
Subactivity 1.2.1.1	Use CWT, PIT tags or other special marks for a portion of special hatchery coho release groups, so they can be detected wherever they are recovered.	High	Needed	CDFG	TBD
Activity 1.2.2	Estimate abundance of hatchery coho departing as smolts, for both fingerling and smolt release groups.	High	Needed	CDFG	TBD
Activity 1.2.3	Quantify the number of hatchery produced coho adults returning to the Russian River basin.	High	Needed	CDFG	TBD
Subactivity 1.2.3.1	Operate traps and ladders at hatcheries to estimate escapement of hatchery-produced coho.	High	Needed	CDFG	USACE
TASK 1.3	ESTIMATE SURVIVAL FROM SMOLT-TO-ADULT SURVIVAL FOR VARIOUS TREATMENTS.				
Activity 1.3.1	Estimate smolt-to-adult survival for each treatment based on smolt abundance from Activity 1.2.2 and adult abundance in Activity 1.2.3 and 2.1.	High	Needed	CDFG	USACE

Note: TBD = Funding source to be determined during future negotiations.

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 1.3.2	Use monitoring and evaluation results to revise parameters in the life-history simulation model used to predict stocking rates.	High	Needed	CDFG	USACE
TASK 1.4	ESTIMATE TOTAL HARVEST OF RUSSIAN RIVER HATCHERY PRODUCED FISH.				
Activity 1.4.1	Monitor harvest-rate of Russian River hatchery fish in any ocean fisheries.	Low	On-Going	CDFG	CDFG
Activity 1.4.2	Survey fishermen in the Russian River basin to estimate total catch of hatchery origin steelhead trout.	Medium	Needed	CDFG	USACE
Activity 1.4.3	Analyze the age and spatial distribution for freshwater landings to determine how they differ between groups from different release strategies.	Low	Needed	CDFG	CDFG
Activity 1.4.4	Develop run prediction and harvest monitoring to allow harvest of abundant fish returns	Low	Needed	CDFG	CDFG
OBJECTIVE 2.	**DETERMINE THE STATUS AND PERFORMANCE OF NATURAL PRODUCTION IN THE RUSSIAN RIVER BASIN.**				
TASK 2.1	QUANTIFY THE ESCAPEMENT/ABUNDANCE OF HATCHERY AND NATURALLY PRODUCED RETURNING ADULTS TO THE RUSSIAN RIVER BASIN.				
Activity 2.1.1	Quantify adult escapement to the mouth of the Russian River.	Low			
Activity 2.1.2	Quantify the escapement/abundance of hatchery- and naturally-produced returning coho adults to the tributary specific areas.	High	Needed	CDFG	TBD
Subactivity 2.1.1.1	Conduct stratified random spawning ground surveys.	Medium	Needed	CDFG	TBD
Subactivity 2.1.1.2	Operate fish counting facilities to provide an annual non-biased and precise quantification of adult coho abundance.	High	Needed	CDFG	TBD
Subactivity 2.1.1.3	Conduct mark-recapture studies to estimate adult coho escapement as a back-up population estimate if direct measurement is not achieved.	Low			
Subactivity 2.1.1.4	Collect biological information of fork length, sex, scales, general fish health, examine for marks/tags, scan with PIT tag and CWT scanners, and collect fin tissue sample for DNA analysis (see Objective 3) from all adult coho captured in individual tributaries.	High	Needed	CDFG	TBD

Note: TBD = Funding source to be determined during future negotiations.

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 2.1.3	Conduct juvenile density surveys.	High	Needed	CDFG	TBD
Activity 2.1.4	Operate juvenile emigration traps to estimate coho production.	High	On-Going	CDFG	TBD
Subactivity 2.1.4.1	Tributary specific juvenile emigration trapping.	High	Needed	CDFG	TBD
Subactivity 2.1.4.2	Russian River basin emigration monitoring at Mirabel Dam	High	On-Going	SCWA	SCWA
TASK 2.2	COLLECT PHYSICAL HABITAT, STREAM TEMPERATURE, AND DISCHARGE DATA TO CORRELATE WITH STAFF GAUGE INFORMATION IN ALL TRIBUTARIES DIRECTLY MONITORED FOR ADULT ESCAPEMENT AND JUVENILE PRODUCTION.				
Activity 2.2.1	Install constant recording thermographs and document hourly water temperature at the facility sites, year-round.	Medium	Needed	CDFG	TBD
Activity 2.2.2	Install a staff gauge and collect stream discharge information that is sufficient to develop discharge curves for each key tributary.	Low			
Activity 2.2.3	Implement environmental monitoring and assessment program for habitat conditions throughout the entire Russian River basin.	High	On-Going	CDFG	CDFG
OBJECTIVE 3.	**GENETICS EVALUATION.**				
TASK 3.1	GENETIC SAMPLE COLLECTION AND ANALYSIS.				
Activity 3.1	Collect samples.	High	On-Going	CDFG, Various	Various, TBD
Activity 3.2	Analyze samples.	High	On-Going	NMFS	TBD
TASK 3.2	APPLY DNA DATA TO IMMEDIATE MANAGEMENT NEEDS.				
Activity 3.2.3	Determine the stocks.	High	Needed	NMFS	TBD
Activity 3.2.2	Determine the extent to which the hatchery stock is representative of the naturally spawning stock.	High	Needed	CDFG	TBD
Activity 3.2.1	Determine the reproductive success of naturally-spawning hatchery-reared fish.	High	Needed	CDFG	TBD
TASK 3.3	APPLY DNA DATA TO LONG-TERM MANAGEMENT NEEDS.				
Activity 3.3.1	Confirm that the hatchery program is consistently representative of the naturally spawning stock.	Low			

Note: TBD = Funding source to be determined during future negotiations.

Activity	Description	Priority	Status	Responsible Entity	Funding Source
Activity 3.3.2	Determine whether hatchery operations are decreasing, maintaining, or increasing the effective population size in both the hatchery and naturally spawning stocks.	High	Needed	CDFG	TBD
Objective 4.	**Estimate Ecological Impacts to Fish Populations.**				
Task 4.1	Determine if there is Evidence that Non-Target Fish Populations in Outplanted Streams are Influenced by Competition or Predation Interactions with the Supplemented Populations.				
Activity 4.1.1	Monitor short- and long-term changes in the relative density of competitor fish species in treatment and reference streams in conjunction with ongoing parr monitoring studies. Determine whether these changes are correlated with hatchery outplant activities.	Medium	Needed	CDFG	TBD
Subactivity 4.1.1.1	Snorkel and count fish by species each season, and classify into size intervals.	Medium	Needed	CDFG	TBD
Subactivity 4.1.1.2	Conduct small-scale studies to determine microhabitat utilization.	Low			
Task 4.2	Determine if there is Evidence that Non-Target Fish Populations in Treatment Streams are Influenced by Disease Transmission from the Supplemented Populations.				
Activity 4.2.1	Conduct routine sampling to establish ambient levels of infectious and non-infectious diseases between free-living hatchery and natural fish under natural conditions.	High	Needed	CDFG	TBD
Subactivity 4.2.1.1	Determine the frequency of common fish pathogen presence and virulence in Russian River hatchery produced fish.	Medium	On-Going	CDFG	TBD
Subactivity 4.2.1.2	Determine the frequency of common fish pathogen presence and virulence among naturally produced fish in the Russian River basin.	High	Needed	CDFG	TBD
Activity 4.2.2	If a disease outbreak is detected, increase sampling intensity to determine its prevalence and full effect on hatchery and wild fish.	Medium	On-going	CDFG	CDFG
Subactivity 4.2.2.1	Identify and assess factors that caused disease outbreak.	Medium	On-going	CDFG	CDFG
Subactivity 4.2.2.2	Determine potential adverse effects of any disease outbreak.	Medium	On-going	CDFG	CDFG

Note: TBD = Funding source to be determined during future negotiations.

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
OBJECTIVE 5.	**EFFECTIVELY COMMUNICATE MONITORING AND EVALUATION PROGRAM APPROACH AND FINDINGS TO RESOURCE MANAGERS.**				
TASK 5.1	DATA MANAGEMENT AND DISSEMINATION.				
Activity 5.1.1	Provide data summary to the joint NMFS/CDFG salmonid research database.	Medium	On-going	CDFG	USACE
Activity 5.1.2	Provide data summary to the CDFG Natural Diversity Data Base (NDDB).	Medium	On-going	CDFG	USACE
Activity 5.1.3	Report Coded-Wire Tagging summary reports to the Regional Mark Information System (RMIS) database.	Medium	On-going	CDFG	USACE
TASK 5.2	COMMUNICATION OF RESULTS AND TRANSFER OF TECHNOLOGY.				
Activity 5.2.1	Develop annual Statement of Work.	Low	On-Going	CDFG	USACE
Activity 5.2.2	Develop quarterly reports.	Low	On-Going	CDFG	USACE
Activity 5.2.4	Develop Endangered Species Act Section 7 summary reports.	Medium	On-Going	CDFG	USACE
Activity 5.2.5	Develop annual reports.	High	On-Going	CDFG	USACE
Activity 5.2.6	Develop five-year summary report.	Medium	On-Going	CDFG	USACE
Activity 5.2.7	Develop peer-reviewed journal publications.	Low			
Activity 5.2.8	Participate in regional conferences and workshops.	Low			
TASK 5.3	DEVELOP AND MAINTAIN OPEN COMMUNICATIONS WITH ALL RESOURCE MANAGERS (COORDINATION).				
Activity 5.3.1	Participate in the coho supplementation program TOC and the basin-wide monitoring and evaluation TOC.	High	On-Going	CDFG	USACE
Activity 5.3.2	Facilitate hatchery annual review and operating plan modification through an Annual Operating Plan.	High	On-Going	CDFG	USACE
Activity 5.3.3	Attend coordination meetings regarding hatchery production and salmonid recovery.	High	On-Going	CDFG	USACE
Subactivity 5.3.3.1	Attend meetings of the Joint Hatchery Review Committee.	High	On-Going	CDFG	USACE
Subactivity 5.3.3.2	Attend meetings of the Russian River Coho Salmon Recovery Work Group.	High	On-Going	CDFG	USACE
Subactivity 5.3.3.3	Attend meetings of additional salmonid recovery teams as they come into existence.	High	On-Going	CDFG	USACE

Note: TBD = Funding source to be determined during future negotiations.

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

Significant coordination efforts are required to identify available funding, staffing, and support logistics as a means to allow full implementation of the monitoring and evaluation program.

3.11.1.3 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.

M&E activities will implement the relevant special conditions and general conditions included in Permit 1067.

3.12 RESEARCH

3.12.1 OBJECTIVE OR PURPOSE

The efforts required under Objective 3 - Genetic Evaluation in the M&E plan described above may be considered to be research. The genetic evaluation activities being conducted in association with the hatchery program described in this HGMP include the following activities:

Genetic sampling of tissues taken from the hatchery stocks has been ongoing for several years. Tissues are randomly sampled from hatchery stocks and evaluated using genetic analysis tools developed by the U.C. Davis Bodega Marine Laboratory. The majority of this work has focused on salmon stocks entering into DCFH, however, tissues were taken from the 99/00 brood year of steelhead at DCFH.

In addition, CDFG takes tissue samples from wild fish and hatchery fish found within the Russian River. A random sample is selected from fish captured in the wild during routine biological surveys. Efforts are made to ensure that a representative sample is taken from each reach surveyed and reaches selected are representative of the habitat available on each tributary. In addition, a specially-funded program currently exists to collect tissues from steelhead above and below barriers.

It is anticipated that these samples may contribute to genetics research recently initiated at the NMFS Santa Cruz Laboratory. In support of the ESA TRT, the lab has started a large-scale evaluation of genetic population structure for steelhead populations in the Northern California/CCC ESUs. The study involves the collection of molecular genetic data from samples of 50 individuals from approximately 40 watersheds in the study area. Samples are being collected by field crews from the Santa Cruz Laboratory and collaborators such as CDFG. Genetic markers for which data are being collected include 12 microsatellite markers and sequences from two immunogenetic regions (MHC loci). These data will be used to estimate genetic distances and construct trees of population relatedness. Rates of migration and change in effective population size will also be estimated. A parallel effort for coho salmon is also underway.

With time, it is hoped that research will be able to answer the following genetics informational needs identified in the CDFG Draft Russian River Basin Fisheries Restoration Plan:

- Broad sampling across basin.
- A comparable genetic baseline for Russian River salmonids.
- Genetic assessment of hatchery runs.
- Genetic assessment of wild runs.
- Genetic comparison of fish from above barriers vs. hatchery and wild fish below barriers.
- Genetic comparison of fish from tributaries that have had very little stocking influence (ex. check database).
- Genetic comparison of multiple year returns to both hatcheries.
- Genetic comparison of Russian River salmonids to salmonids from nearest basins.
- Genetic comparison of Lake Sonoma steelhead to the hatchery run (to identify divergence in the hatchery population).
- Genetic identification of local adaptations (if technology is available).
- Identification of closely related stocks.
- A comparison of stock transfers (only over the course of hatchery operations) and present hatchery run to determine degree of integration and the influence of these stocks on the hatchery funs genetic makeup.

3.12.2 Cooperating and Funding Agencies

Tissue analysis conducted by the Bodega Marine Lab using samples collected up through 2000 has been funded by the SCWA.

Since 2001, genetic tissue analysis is being carried out at the NMFS Santa Cruz Lab and is funded by NMFS. Tissue sample collection and the funding for these efforts is supplied through the staff and budgets of the DCFH, the CDFG Hopland Research Center and the CDFG Salmonid Tissue Archive. (SCWA also supplied the NMFS Santa Cruz Lab with Chinook and steelhead tissue samples collected during research sampling in 2001 and it will provide additional samples in the future.)

3.12.3 Principal Investigator or Project Supervisor and Staff

The principal investigator for the activities at Bodega Marine Lab is Dennis Hedgecock. The principal investigator for the activities at the NMFS Santa Cruz Lab is Carlos Garza. Activities relating to sampling of DCFH and CVFF fish is supervised by Royce Gunter, Jr., while CDFG sampling of wild Russian River fish is supervised by Bob Coey at the Hopland Research Station.

3.12.4 STATUS OF STOCK, PARTICULARLY THE GROUP AFFECTED BY PROJECT, IF DIFFERENT THAN THE STOCK(S) DESCRIBED IN SECTION 3.2

The status of the affected stocks is the same as was described in Section 3.2.

3.12.5 TECHNIQUES: INCLUDE CAPTURE METHODS, DRUGS, SAMPLES COLLECTED, TAGS APPLIED

Collection of tissues for the above-mentioned research activities are similar whether the tissues are collected from hatchery stocks or from fish in tributaries of the Russian River. Collection methods are as follows:

> Juvenile Fish: For the sampling of hatchery stock, fish are netted from the rearing vessel and anaesthetized in a bath of MS222. Collection of juvenile fish in the field is accomplished using electrofishing (generally using the Smith Root Model 12 backpack electrofisher). In the field, the anesthetic bath is not used due to the MS222 quarantine period required prior to re-release. Whether in the field or in the hatchery, approximately one square millimeter of tissue is removed from the caudal fin using clean instruments. The tissue is placed in a vial of buffer for cold storage or the tissue is placed in filter paper for dry storage. Juvenile fish are released alive back into the rearing unit or stream reach from which they were collected.
>
> Adult Fish: Adult fish being held in the hatchery receive a fin punch for identification during sorting, regardless of tissue sampling requirements. If tissues are needed for analysis, this section of tissue removed for identification is submitted. Anesthesia of adults in the hatchery is accomplished using carbon dioxide. Sampling of adult fish in the field is conducted on carcasses.

3.12.6 DATES OR TIME PERIOD IN WHICH RESEARCH ACTIVITY OCCURS

Collection of adult salmonid tissues at the hatchery facility generally occurs during the holding and spawning period of the subject species. Tissue collection for hatchery juveniles can be conducted at any time of the year but is most often performed at the same time as mass marking procedures.

Collection of tissues from fish captured in tributaries of the Russian River typically begins in late summer (August) and ceases immediately prior to winter storms.

3.12.7 CARE AND MAINTENANCE OF LIVE FISH OR EGGS, HOLDING DURATION, TRANSPORT METHODS

Natural steelhead (listed fish) sampled for tissues using the above techniques are held in water from the location of capture, in an insulated container and aerated with a battery powered aerator. Fish are held for a short duration (5-10 minutes) and tissue collection is processed in small batches as fish are captured. No fish are transported for this type of sampling.

3.12.8 Expected Type and Effects of Take and Potential for Injury or Mortality

With regard to the tissue sampling activities described above, the most significant potential for injury or mortality occurs with the electrofishing necessary for sampling of wild juveniles. Estimates of mortality due to electrofishing activities are less than 1 percent, not including estimates of delayed trauma or delayed mortality. Often any mortalities that are incurred are attributed to fish that appear to be physiologically compromised based on observable fitness, physical abnormality, or a previously weakened state.

3.12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 3.2 and the attached "Take Table" (Table 1).

Levels of estimated take are presented in Table 1 (page 3-66).

3.12.10 Alternative Methods to Achieve Project Objectives

Because the caudal fin tissue of salmonid fish readily regenerates, the removal of small amounts of tissue for genetic analysis is not likely to compromise the health of the individuals sampled to a great degree. A less invasive approach to tissue sampling has not been forthcoming; however, as genetic analysis tools are rapidly developing, CDFG and the TOC will keep abreast of the latest technology available and employ the techniques that procure the necessary data while causing the least effect to the protected fish.

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

The most closely related species to threatened stocks of coho in the Russian River are Chinook salmon and steelhead trout. In the BO for the coho program, NMFS estimates the unintentional lethal take associated with the coho research activities to be 700 fish. Since research on Russian River Chinook and steelhead will be limited to tissue sampling and will not involve the broodstock collection efforts of the coho program, the estimated mortality from tissue sampling of Chinook and steelhead is the 1 percent mortality associated with electroshocking. Assuming a conservative field sampling effort of 500 juvenile fish of each species, the estimated mortality is five Chinook and five steelhead.

3.12.12 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.

Risk aversion measures include the following:

- Close attention will be made to electrofishing techniques.
- These protected fish will be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. The transfer of fish will be conducted using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.
- Juvenile fish will not be captured or handled if the water temperature exceeds 70º F at the capture site.

3.13 ATTACHMENTS AND CITATIONS

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3.15 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:_____________

Table 1 Estimated Listed Coho Take Levels by Hatchery Activity (NMFS 2001a)

Listed species affected: Coho Salmon **ESU/Population:** Central California Coast/Russian River **Activity:** DCFH Coho Recovery Program				
Location of hatchery activity: DCFH **Dates of activity:** Year-round **Hatchery program operator:** CDFG				
	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)		16,500		
Removal (*e.g.* broodstock) e)		600		
Intentional lethal take f)				
Unintentional lethal take g)		700		
Other Take (specify) h)		200,000		

d. Annual M&E activities
e. Collection for captive broodstock
g. Unintentional mortalities associated with research activities
h. Juvenile coho propagated, reared and released as part of this program

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

APPENDIX A

DEFINITION OF TERMS REFERENCED IN THE HGMP TEMPLATE

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

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

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

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

F_2 - Refers to the generations removed from the parental generation. F_1 refers to the progeny of a given parental cross; F_2 refers to the offspring of those progeny.

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

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

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

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

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

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

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

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

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

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

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

Natural origin recruit (NOR) - See "Natural fish."

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

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

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

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

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

Stock - See "Population."

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

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