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
Yountville, California

Prepared by:

FISHPRO, a Division of HDR
Portland, Oregon

In association with:

ENTRIX, INC.
Walnut Creek, California

October 25, 2004

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BA	Biological Assessment
BKD	bacterial kidney disease
BML	Bodega Marine Laboratory
BMPs	Best Management Practices
BO	biological opinion
BRA	Benefit/Risk Analysis
CDFG	California Department of Fish and Game
cfs	cubic feet per second
CC Chinook	California Coastal Chinook salmon
CCC	Central California Coast
CRWG	Coho Recovery Work Group
CVFF	Coyote Valley Fish Facility
CWT	coded wire tag
DCFH	Don Clausen Fish Hatchery
DO	dissolved oxygen
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWS	Emergency Water Supply
fpp	fish per pound
ft^3	cubic foot
gpm	gallons per minute
GIS	Geographic Information System
HGMP	Hatchery and Genetic Management Plan
km	kilometer
KW	kilowatt
lb	pound
M&E plan	Monitoring and Evaluation (plan)
MCIWPC	Mendocino County Inland Water and Power Commission
MCRRFCD	Mendocino County Russian River Flood Control and Water Conservation Improvement District
MEPS	minimum effective population size
mg/l	milligrams per liter

MOU	Memorandum of Understanding
MSL	mean sea level
mtDNA	Mitochondrial DNA
NCRWQCB	North Coast Regional Water Quality Control Board
NGVD	National Geodetic Vertical Datum
NDDB	Natural Diversity Data Base
NMFS	National Marine Fisheries Service, now known as NOAA Fisheries
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
ODFW	Oregon Department of Fish and Wildlife
PG&E	Pacific Gas and Electric
PIT	passive integrated transponder
RMIS	Regional Mark Information System
RRCSRP	Russian River Coho Salmon Recovery Program
SAR	smolt-to-adult return
SCWA	Sonoma County Water Agency
SEC	Steiner Environmental Consulting
SWRCB	State Water Resources Control Board
TOC	Technical Oversight Committee
TRT	Technical Recovery Team
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UV	ultraviolet
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 contract 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 National Marine Fisheries Service [NOAA Fisheries] 2001). Fish production goals for DCFH were established in 1974 to compensate for the estimated loss of coho salmon and steelhead production behind the Warm Springs Dam, and additional fish production capabilities were included in the hatchery program goals to enhance harvest opportunities for coho salmon and Chinook salmon (U.S. Fish and Wildlife Service [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 coho salmon, steelhead, 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 ensure 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 NOAA Fisheries.

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, because 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 coho salmon, steelhead, 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.

NOAA Fisheries 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 NOAA Fisheries, CDFG, and USACE to support the ESA Section 7 Consultation process.

This document presents a draft HGMP for coho salmon and steelhead for the Russian River fish production facilities. Presentation is in the standard NOAA Fisheries 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 as Attachment 1 at the back of this document. This attachment was developed by NOAA Fisheries and is included with the template materials provided to those preparing HGMPs. Attachment 2 provides several figures that detail the piping and water distribution facilities at DCFH and CVFF.

2.1 GENERAL PROGRAM DESCRIPTION

2.1.1 NAME OF HATCHERY OR PROGRAM

DCFH Steelhead Program, also referred to as the Warm Springs Hatchery Steelhead Program.

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

Steelhead Trout (*Oncorhynchus mykiss*), Russian River Hatchery Stock. The Russian River Hatchery Stock steelhead were not listed as part of the Central California Coastal (CCC) steelhead Evolutionarily Significant Unit (ESU) because "information concerning this stock is sparse, and therefore this stock's relationship to the entire ESU is uncertain" (43945 Federal Register [FR] 62, No. 159/Monday, August 18. 1997). Therefore, this hatchery steelhead stock is not listed under the ESA.

2.1.3 RESPONSIBLE ORGANIZATION AND INDIVIDUALS

Lead Contact

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

USACE, SCWA, Mendocino County Russian River Flood Control and Water Conservation Improvement District (MCRRFCD), and NOAA Fisheries have entered into a Memorandum of Understanding (MOU) that sets a framework for a Section 7 Consultation under the ESA. The MOU acknowledges the involvement of other agencies, including CDFG, the State Water Resources Control Board (SWRCB), the North Coast Regional Water Quality Control Board (NCRWQCB), the State Coastal Conservancy, and the Mendocino County Inland Water and Power Commission (MCIWPC).

SCWA is designated as the non-federal representative to prepare the biological assessment (BA) for the consultation, which is assessing project activities that may directly or indirectly affect coho salmon, steelhead, and Chinook salmon in the Russian River. The BA includes an evaluation of the existing DCFH fish facility operations as well as proposed operations to be implemented following the consultation process.

All hatchery activities associated with this HGMP will be coordinated with Shirley Witalis (shirley.witalis@noaa.gov), the NOAA Fisheries Hatchery contact, located in the Sacramento, CA offices of NOAA Fisheries.

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

Annual operation of the DCFH steelhead program is funded entirely by the USACE, San Francisco District. SCWA has contributed to funding for the Section 7 ESA Consultation process.

Operations and maintenance activities for the program are conducted by the CDFG. The staffing level includes:

- Nine permanent positions, including one Senior Hatchery Supervisor, one Fish Hatchery Manager II, four Fish and Wildlife Technicians, and one Office Technician;
- Five temporary positions; and
- One Senior Fisheries Technician.

The annual operating budget funded by USACE for the DCFH program in recent years has averaged around $1,300,000. This value includes the budgets for both the coho salmon and steelhead programs conducted at DCFH, and it also includes approximately $400,000 expended annually for the steelhead satellite program conducted at the 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 geographic information system (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 1 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. 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 lifecycle that involve 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 lifestages (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 CCC steelhead (including both natural and hatchery stocks of the Russian River basin) is underway at both the NOAA Fisheries 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). Results of the research conducted at Sonoma State University are anticipated to be released to the public by the end of 2004.

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 a 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.

2.1.10 List of Program "Performance Indicators," by "Benefits" and "Risks"

The following two lists of performance indicators are proposed as a means of assessing the performance standards addressing hatchery benefits and hatchery risks. These indicators are adapted from the list suggested in the Artificial Production Review (NPPC 1999), selecting from indicators that are relevant to an isolated harvest program. At present, there is no firm timeline for completing the implementation of these performance indicators. It is assumed that final definition and implementation of the performance indicators will be included in the Section 7 Consultation with NOAA Fisheries.

2.1.10.1 Performance Indicators Addressing Benefits

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 5 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 numbers/harvest/year
- Units of effort/year
- Established baseline at Year One, compare with 5-year survey

In 2004, CDFG began to analyze Russian River data that has been collected from the CDFG angler report card program. Continued implementation of this assessment program is contingent on securing adequate funding for a dedicated staff position.

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 a maximum ratio of wild fish allowed in the harvest (see B2D).

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 the maximum allowed number. This maximum allowable take of wild fish is being addressed in a CDFG Fisheries Management Evaluation Plan for CCC steelhead, currently under development.

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

Performance Standard B3: Fulfill mitigation goals.

Performance Indicator:

B3A. Document that mitigation goals of the hatchery are met.

This performance indicator warrants discussion between the USACE and relevant fisheries agencies including CDFG and NOAA Fisheries. The existing mitigation agreements developed for both DCFH and CVFF include 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 coho salmon and Chinook salmon 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. Revised goals should be consistent with the requirements of the Endangered Species Act. 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. Assure that hatchery performance standards established in the DCFH/CVFF Management Plan are achieved.

B4B. Assure that statewide hatchery performance standards (as identified by CDFG) 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
- Fishing 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

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

The implementation of a harvest management plan requires specific knowledge regarding the abundance and productivity of spawning aggregates. The managers recognize a general need to monitor the status and growth rate of spawning aggregates in order to identify “weak stocks” that might require specific protection within the framework of a harvest management plan. Development of such a program is contingent on securing adequate funding.

Performance Indicators:

R1A. Monitor life-history characteristics of weak populations for change from baseline by comparing at Year 1 with 5-year survey or after one generation.

R1B. 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 (number 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

R1C. Using the data from R1B, analyze the following four parameters of a Viable Salmonid Population (McElhaney et al. 2000): 1) fish abundance; 2) population productivity; 3) population spatial structure; and 4) genetic and life-history diversity of the fish population.

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

<u>Performance Standard R2</u>: 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 the hatchery population stray rate. NOAA Fisheries suggests it is desirable that hatchery stray rates be no greater than 5 percent (Flagg et al. 2000).

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

1. Experimental design for evaluating genetic effects in consultation with NOAA Fisheries.

2. Measure introgression by comparing allele frequencies between hatchery and wild. (Results of recent research conducted at Sonoma State University should be released in 2004 that will expand the current knowledge base for the Russian River basin.)

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 (including Dry Creek and the East Fork Russian River, which are the only areas where releases of hatchery steelhead occur), conduct comparative evaluation of areas where hatchery smolt releases do and do not occur by measuring some of these parameters:

1. Evaluate emigration rate of hatchery steelhead smolts and naturally-reproducing anadromous populations.

2. Conduct comparative evaluation of rearing densities number per meter squared (#/m^2) 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 hatchery steelhead smolts and wild fish. (Such evaluations could include comparisons of natural-origin steelhead condition factor, diet, rearing density, and microhabitat use before and after the release of hatchery-origin steelhead.)

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

6. Compute prey composition in diet of 1, above.

7. Determine predation rate on hatchery 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 the Russian River Estuary (Estuary) and near-shore marine habitat, implementing experimental design recommended by NOAA Fisheries.

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 #/m^2 by year class and by habitat type.

R5B. Conduct an annual review for the results of recent research, monitoring, and evaluation of the carrying-capacity of the Russian River Estuary and relevant ocean conditions. Such a study should be designed to evaluate:

1. The carrying capacity of the estuary under closed and open conditions;

2. The potential to broaden the scope of existing studies to include freshwater habitat;

3. Population structure before and after estuary breeching; and

4. Estuary conditions during extended summer high water conditions.

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

Performance Indicators:

R6A. Determine trend of redd counts as index of natural spawning (positive, negative, or transitional).

R6B. Determine positive, negative, or transitional trend in numbers of adult fish.

R6C. Determine whether hatchery-spawner-to-recruit ratio is less than, equal to, or greater than 1.

<u>Performance Standard R7</u>: 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 fish health policies and procedures (CDFG 2000b) and fish health protocols recommended by NMFS (Hard et al. 1992).

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 5 years.

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

Lifestage	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	East 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 consistently available to evaluate performance are the adult returns to each hatchery; harvest and stray rates are currently unknown, although the steelhead report card program may provide Russian River specific harvest information for steelhead. The estimated smolt-to-adult return (SAR) values presented below assume a rigid 3-year age at return. Since no data are available to estimate fingerling to yearling survival parameter, values of 1 percent, 5 percent, and 10 percent were assumed. Fingerling releases were discontinued in 1999. The estimated SAR values exhibit considerable annual variability, which is expected due to natural variability in factors that affect survival such as rainfall, ocean conditions, estuary closure, and instream habitat conditions. Estimated SAR values at DCFH and CVFF range from a low of 0.1 percent to a high of 2.1 percent; the "typical" SAR for each facility is estimated to be 0.8 percent for DCFH and 1.1 percent for CVFF, as determined by an average of 16 years of return data for DCFH and 10 years of return data for CVFF. A detailed SAR analysis completed by CDFG for the six return years spanning 1995 to 2000 yielded similar results, showing a range in SAR values of 0.69 percent to 1.6 percent at DCFH and 0.43 percent to 2.5 percent at CVFF (CDFG 2000a).

Existing mitigation agreements define goals for yearling releases (300,000 fish at DCFH and 40,000 pounds [or approximately 200,000 fish] at CVFF) as well as adult escapement (6,000 adults to DCFH and 4,000 adults to CVFF). In the process of satisfying both conditions of the goals, the goals inherently require a minimum SAR value of 2 percent. 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	Fingerling Released	Probable Rtrn Yr	Release Year	Yearling 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	46,062	01/02	99/00	300,000	01/02	01/02	4,120	1.4%	1.4%	1.3%
99/00	0	02/03	00/01	336,320	02/03	02/03	3,342	1.0%	1.0%	1.0%
00/01	0	03/04	01/02	284,378	03/04	03/04	6,864	2.4%	2.4%	2.4%
01/02	0	04/05	02/03	317,636	04/05	04/05	-	-	-	-
02/03	0	05/06	03/04	325,503	05/06	05/06	-	-	-	-
03/04	0	06/07	04/05	-	06/07	06/07	-	-	-	-
Avg:	547,561	-	Avg:	297,672	-	Avg:	3,037	0.9%	0.9%	0.8%

Source: DCFH annual reports (DCFH 1986-2004).

Note: Year extends from July 1 of first year through June 30 of second year.

CVFF Steelhead Fingerling			CVFF Steelhead Yearling			CVFF Steelhead Adults		Estimated SAR for Given Ratio of Fingerling:Yearling Survival		
Release Year	Fingerling Released	Probable Rtrn Yr	Release Year	Yearling Released	Probable Rtrn Yr	Return Year	Adult Return	5%	10%	25%
-	-	-	-	-	-	92/93	310	-	-	-
-	-	-	-	-	-	93/94	440	-	-	-
-	-	-	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	2,270	1.0%	0.9%	0.9%
98/99	164,770	01/02	99/00	229,451	01/02	01/02	3,346	1.4%	1.4%	1.2%
99/00	0	02/03	00/01	211,801	02/03	02/03	2,047	1.0%	1.0%	1.0%
00/01	0	03/04	01/02	206,264	03/04	03/04	4,964	2.4%	2.4%	2.4%
01/02	0	04/05	02/03	212,513	04/05	04/05	-	-	-	-
02/03	0	05/06	03/04	195,625	05/06	05/06	-	-	-	-
03/04	0	06/07	04/05	-	06/07	06/07	-	-	-	-
Avg:	134,932		Avg:	214,600		Avg:	2,255	1.2%	1.2%	1.1%

Source: CVFF annual reports (CVFF 1993-2004).
Note: Year extends from July 1 of first year through June 30 of second year.

Raw Data for Russian River Steelhead Harvest Effort from Returned Angler Report Cards

Year	Total Anglers	Total Trips	Hatchery Origin		Natural Origin	
			Catch	Release	Catch	Release
1999	143	454	128	53	107	100
2001	65	211	158	103	80	78
2002	140	569	278	138	111	109

Expanded Estimates of Russian River Steelhead Harvest Effort Based on Returned Angler Report Cards

Year	Total Anglers	Total Trips	Hatchery Origin		Natural Origin	
			Catch	Release	Catch	Release
1999	2,544	8,078	2,277	943	1,904	1,779
2001	1,661	5,393	4,038	2,633	2,045	1,994
2002	2,652	10,780	5,267	2,614	2,103	2,065

Assumptions:
1. Returned cards are representative of all cards purchased; therefore, expansions produce unbiased estimates of total harvest.
2. Anglers accurately and truthfully reported catch and release rates.
3. Species identification and origin (hatchery versus wild) are accurate.
4. Poaching, defined as angling without obtaining a card, is negligible.

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 USACE Contract No. DACW07-03-R-0011, as accepted in April 2004 (USACE 2004). The period of this contract extends through September 2004, with an option of four yearly extensions being granted through the same contract.

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 the 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 contract with the USACE. Because hatchery operations have the potential to affect protected populations of coho salmon, steelhead, and Chinook salmon, Russian River hatchery activities have been included in an ESA Section 7 Consultation between NOAA Fisheries, USACE, and 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 NOAA Fisheries 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, three ESA-listed salmonid populations are affected by the program:

- CCC coho salmon
- CCC steelhead
- California Coastal Chinook (CC Chinook) salmon

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

Russian River Coho Salmon

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 approximately 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 3-year lifecycle. 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 approximately 1 year in fresh water 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 3-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. Little is known regarding the duration that coho reside in the estuary, and how/if this habitat is used to a great extent during smoltification.

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 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 generally 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 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 (13° C) by April in some years (Winzler and Kelly 1978), which may limit the survival of eggs and fry in these areas. At the same time, steelhead observed during diver surveys in the Ukiah and Canyon reaches appeared healthy and vigorous when water temperatures were within a degree of 72° F (22° C), suggesting that steelhead may rear in suitable habitat within the mainstem Russian River through the summer (Cook 2003).

After hatching, steelhead spend from 1 to 4 years in fresh water. Steelhead in other streams in this ESU either migrate to the ocean after the first year (as yearlings) or spend an additional year in the stream and emigrate at age 2+ (Shapovalov and Taft 1954); 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 Chinook Salmon

Although there is some debate over whether Chinook salmon used the Russian River historically, local tribes reportedly harvested Chinook salmon regularly in the upper portions of the East Fork drainage prior to the 1958 construction of Coyote Valley Dam (NMFS 2001a). Chinook salmon of hatchery origin were planted in the watershed sporadically during the 1970s and nearly every year between 1982 and 1998 (FishPro and ENTRIX, Inc. 2000). The total run of wild 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 salmon run and to provide positive identification of 1,322 adult Chinook salmon. A partial run count of 1,299 adult Chinook salmon 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). Between August 8 and December 10, 2002, a total of 5,466 adult Chinook salmon were observed (Chase et al. 2003).

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. A Chinook salmon spawning study conducted in the fall of 2002 documented Chinook redds in the mainstem from the Forks to downstream of Healdsburg Dam (Cook 2003). Redd surveys in 2003 found Chinook redds in the mainstem Russian River and in Dry Creek (Cook 2004). Chinook salmon 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. November 2002). Chinook salmon tissue samples were collected in 2000 by SCWA, CDFG, and NOAA Fisheries 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 coho salmon and steelhead, the young Chinook salmon begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, usually ranges from 2 to 4 months, but occasionally Chinook salmon juveniles will spend

1 year in fresh water (Myers et al. 1998). Chinook salmon move downstream from February through June. Ocean residence can be from 1 to 7 years, but most Chinook salmon return to the Russian River as 2- to 4-year-old adults. Chinook salmon die soon after spawning.

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

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

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

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

2.2.2.2 Status of ESA-Listed Salmonid Population 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, because little information exists on present run sizes or 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 2001a).

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 2001a).

The status of CC Chinook salmon is uncertain because estimates of absolute population abundance are not available for most populations in the ESU. Trends in Chinook salmon 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 2001a).

Provide the most recent 12-year progeny-to-parent ratios, survival data by lifestage, 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 lifestage, 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 that constructed the redds, but it is feasible that the raw data may include information regarding dates of the survey that, based on typical spawn-timing for Russian River salmonids, would allow an estimate of whether the redds were those of steelhead or salmon. During the 1999/2000 spawning season, six steelhead redds were identified by CDFG in Dry Creek (CDFG 2000a).

Adult salmonids were counted using video monitoring at existing adult ladders at Mirabel Dam during the period of 1999 through 2002. The dam is seldom inflated during much of the steelhead spawning migration period; as a result, most of the migration occurs outside of the sampling period. 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)	Unidenti-fied 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
2002	Aug 6	Dec 10	127	5,466	39	52	10	9

Source: Chase et al. 2000; Chase et al. 2001; Chase et al. 2002; Chase et al. 2003.

Juvenile steelhead and Chinook salmon were collected in screw traps during the period of 1999 to 2002. Results indicated that the number of wild steelhead smolts was substantially greater than the count of hatchery steelhead smolts in 1999 to 2001, although this may be a reflection of a study period that occurs primarily after the latest (mid-April) release dates of hatchery smolts. The number of hatchery smolts was substantially greater than the count of wild smolts in 2002, and the study period began on March 1, within the period of hatchery releases. The substantial number of young-of-the-year (YOY) steelhead may be associated with high tributary flow conditions, may indicate that some spawning and juvenile rearing occurs in the Lower and Middle mainstem, or may indicate that steelhead fingerling migrate to rearing areas in the Estuary.

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 YOY	Chinook Wild Smolts
1999	Apr 21	May 29	19.5	31	107	69	193
2000	Apr 8	Jun 29	81	68	134	763	1,361
2001	Apr 20	Jun 7	46	8	53	150	3,722
2002	Mar 1	Jun 27	113	1,825	250	5,843	19,319

Source: Chase et al. 2000; Chase et al. 2001; Chase et al. 2002; Chase et al. 2003.

SCWA initiated a population-monitoring program designed to detect trends in salmonid populations referred to as the Russian River Basin Steelhead and Coho Salmon Monitoring Program (Pilot Study). It began in fall 1999 with a pilot study to collect abundance and habitat data in Santa Rosa, Millington, and Mark West creeks (Cook et al. 2002). Three Rosgen (1996) channel types were sampled, including B2, C4, and F4 channels. No coho salmon were observed during electrofishing surveys, while steelhead were captured in all three study streams and in most sample units. A total of 6,835 steelhead (21.5 percent of the fish sampled) were captured during the 3-year study. The population trend from 1999 to 2001 in Santa Rosa and Millington creeks included a peak in 2000 with relatively lower numbers observed in 1999 and 2001. This trend was likely affected by annual rainfall. Because surveys were conducted during a single year in Mark West Creek, no population trends could be evaluated.

Snorkeling surveys were conducted in Sheephouse Creek in 2000 and Green Valley Creek in 2001 (Cook et al. 2002). No coho salmon were observed in Sheephouse Creek. The estimated population of YOY steelhead was 680, ± 60 (450 YOY observed). A total of 195 steelhead greater than 1 year (age 1+) were observed on an approximate 3.3-kilometer (km) reach, but it was not possible to estimate the total population. Surveys were conducted in Green Valley Creek after CDFG collected 212 coho salmon for a hatchery captive broodstock program. A total of 230 YOY steelhead, 78 age 1+ steelhead, and 422 YOY coho salmon were observed.

Cook (2003) examined the extent of potential rearing habitat in the mainstem of the Russian River from Ukiah to Healdsburg in 2002. Steelhead were observed throughout the mainstem, but distribution was correlated with water temperatures. Maximum water temperatures increased in a downstream direction and were correlated with lower fish counts. Steelhead were almost exclusively found in riffle and cascade habitats.

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 wild coho salmon, steelhead, and Chinook salmon 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. Greater detail regarding protocols for handling, holding, transporting, and releasing adult fish is provided in Section 2.7.

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 coho salmon, steelhead, and Chinook salmon 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 labor hours expended in recreational fishing as compared to other hatchery activities, there is a "moderate" potential of harassing or harming listed natural coho salmon, steelhead, and Chinook salmon through bycatch. The angling season on the Russian River below the confluence with the East Fork 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. Nonetheless, preliminary data from the steelhead report card program indicate that ratio of natural origin to hatchery origin steelhead caught in recreational fisheries ranges from 0.40:1 to 0.84:1 (see Sections 2.1.12 and 2.3.3.1); and 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. In fact, retention of natural steelhead in recreational fisheries ranges from 1.8 to 6.5 percent of the total natural origin incidental catch (see Sections 2.1.12 and 2.3.3.1).

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 lifestage (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 of this HGMP at the end of Section 2.15.

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 trap will be terminated early if the observed mortality of handled listed fish exceeds 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 USACE Contract No. DACW07-03-R-0011, as accepted in April 2004 (USACE 2004). The period of this contract extends through September 2004, with an option of four yearly extensions being granted through the same contract.

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

The USACE, SCWA, and NOAA Fisheries have entered into a 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.

A number of governmental agencies and institutions have entered into an MOU that establishes 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. These organizations include the NOAA Fisheries, USACE, CDFG, California Resources Agency, California Environmental Protection Agency, SWRCB, NCRWQCB, U.C. Davis Bodega Marine Laboratory (BML), County of Sonoma, County of Marin, County of Mendocino, SCWA, North Bay Watershed Association, Russian River Watershed Association, and FISHNET 4C.

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 coho salmon, steelhead, and Chinook salmon (CDFG 1996). However, there is likely to be some level of indirect mortality arising from injury during capture, handling, and release. Based on preliminary information from the steelhead report card program, retention of natural origin steelhead has ranged from 0.5 to 3.0 percent of the total catch or from 1.4 to 8.5 percent of steelhead retained in the recreational fishery. It is notable that on average 52 percent of captured hatchery origin steelhead and 96 percent of captured natural origin steelhead are released.

2.3.3.1 Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last 12 years (1988 to 1999), if available.

There are few quantitative data for harvest levels and rates of Russian River steelhead. In 1997, CDFG initiated a sport fishing punch-card program that generated data that could be useful to such an analysis, preliminary data from 1999, 2001, and 2002 follow, however these data have yet to be rigorously analyzed, and the veracity of the assumptions should be formally assessed.

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.

Raw Data from Returned Angler Report Cards

Year	Total Anglers	Total Trips	Hatchery Origin		Natural Origin	
			Catch	Release	Catch	Release
1999	143	454	128	53	107	100
2001	65	211	158	103	80	78
2002	140	569	278	138	111	109

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Year	Total Anglers	Total Trips	Hatchery Origin		Natural Origin	
			Catch	Release	Catch	Release
1999	2,544	8,078	2,277	943	1,904	1,779
2001	1,661	5,393	4,038	2,663	2,045	1,994
2002	2,652	10,780	5,267	2,614	2,103	2,065

Assumptions:

1. Returned cards are representative of all cards purchased, therefore expansions produce unbiased estimates.
2. Anglers accurately and truthfully reported catch and release rates.
3. Species identification and origin (hatchery versus wild) is accurate.
4. Poaching, defined as fishing without obtaining a card, is negligible.

2.3.4 Relationship to Habitat Protection and Recovery Strategies

2.3.4.1 Factors Affecting Natural Production

There are several varied factors affecting the natural production of coho salmon, steelhead, and Chinook salmon in the Russian River basin. The major factor is most likely the loss or severe 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 1990s restricting inter-basin fish transfers (FishPro and ENTRIX, Inc. 2000).

2.3.4.2 Habitat Protection Efforts

Ongoing habitat restoration activities have been initiated in the Russian River basin at many locations downstream of Warm Springs and Coyote Valley dams. All survey activities have been conducted in accordance with techniques outlined in the California Salmonid Stream Habitat Restoration Manual (CDFG 1998). CDFG, SWCA, and their partners and volunteers completed surveys of approximately 96 percent of the streams in the watershed between 1994 and 2003. Inventories in the remaining 10 streams could not be completed due to inability to secure landowner permission. 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 state and federal agencies. Although this effort has been directed at coho salmon restoration, it is anticipated that benefits will affect steelhead as well.

2.3.5 ECOLOGICAL INTERACTIONS

2.3.5.1 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, otters, birds, and marine mammals) that consume steelhead smolts. Measures should be taken to limit these sources of mortality to the extent possible. Common steelhead predators include the Sacramento pikeminnow, otters, largemouth bass, and avian predators.

2.3.5.2 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
- Outbreeding depression

The anticipated level of effects to various species (and especially to protected species) is discussed below. For a more detailed discussion, see the document entitled *Hatchery and*

Genetics Management: Monitoring and Evaluation Plan and Benefit Risk Analyses for Russian River Fish Production Facilities (FishPro and ENTRIX, Inc. 2002).

2.3.5.3 Organisms that Could Positively Impact Program

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 outmigration of smolts or upstream migration of adults destined for the hatchery.

2.3.5.4 Organisms that Could Be Positively Impacted by Program

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.

2.4.1.1 DCFH Water Source

Attachment 2 provides flow schematics, hydraulic schematics, and piping diagrams of the DCFH process water system that can be useful in understanding the following descriptions.

Surface water is obtained for hatchery use from the stilling basin of Warm Springs Dam. The water released from Lake Sonoma can be taken from four different intake portals. 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. Each portal is located at a different elevation in the lake. When the lake is low, the highest portal may be exposed and no longer available to supply water. (This portal was repaired in 2002 after having been out of service for some time, and it is now operable when submerged.) Water release rates from the various portals is commonly proportioned so that the temperature of the combined flow is between 48 and 58°F, which provides good conditions for hatchery operations.

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 via a 42-inch pipe to an aeration structure near the hatchery building. The aeration structure consists of a concrete basin, containing approximately 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 (DO) levels in the water and then is allowed to settle. The water then passes through a coarse screen, at which point it can be routed to the hatchery building for further water treatment and used in incubation and early rearing, or to the rearing raceways for use without additional water treatment. Generally, eggs and fry are more sensitive to suboptimal 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 (UV) 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. Because it is possible to divert all releases through the hatchery, it has not been a problem to obtain all flow necessary to maintain hatchery operations even under drought conditions. When broodstock collection and adult holding operations are conducted under the 25 cfs limitation of drought conditions, the hatchery manager will typically adjust flow regulation gates and weirs at the aeration basin to ensure that adequate flow is still maintained to the holding ponds and ladder.

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 above mean sea level [MSL]), and at elevations of 350, 390, and 430 feet MSL. However, because the water level in Lake Sonoma is often lower than elevation 430 feet above MSL, the highest portal is at times exposed and cannot be used for releases. 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, turbidity levels in the lower levels of the lake are often higher than desirable for use in the hatchery (R. Gunter CDFG, pers. comm. August 19, 1999). As a result, only the two intermediate portals are typically used to provide water for the hatchery and for downstream releases.

An emergency water supply (EWS) system was constructed in 1992 to supply a sufficient quantity of water to the hatchery when the outlet works and power plant are not operating. When EWS 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 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 EWS requirements. A standby generator is available to provide power for operations during a power outage.

The EWS 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 EWS 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 of water, but this limited supply would support only approximately 10 percent of the typical facility demand. As another option, two 75 HP pumps located near the effluent discharge location (normally used to prevent backflow inundation of the facility under high stream flow conditions) can recirculate effluent water from the settling basins to the aeration structure. 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, nonchilled 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 EWS system and the existing emergency supply pipeline would be subsequently removed, thereby removing a dam safety issue. A feasibility study to determine the best design option is planned for 2005-2006, with possible construction starting in December 2007 or later (USACE 2003).

2.4.1.2 CVFF Water Source

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 DO levels in the water. Attachment 2 includes a piping diagram of the CVFF process water system that illustrates the water supply and distribution system.

When the power plant is not operating, 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. If for any reason the 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 due to the need for tunnel maintenance. Preliminary tunnel maintenance activities were completed by the City of Ukiah during 2002, but additional work is needed before the gravity-flow water supply system can be returned to service as a functional water supply source.

2.4.1.3 National Pollutant Discharge Elimination System (NPDES) Permits

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 NOAA FISHERIES 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 NCRWQCB 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 coho salmon, steelhead, and Chinook salmon. 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/1/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
DO	> 7.0 mg/l
Flow – DCFH	15.5 million gallons/day
Flow – CVFF	7.11 million gallons/day

mg/l = milligrams per liter

Compliance is monitored by sampling the facility effluent two times per month, with results submitted in a monthly report to the NCRWQCB. It is further stipulated that sampling occur during cleaning operations, because 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 DO level in the receiving waters during times of low flows may drop below the 7 milligrams per liter (mg/l) limit and therefore may benefit from the hatchery maintaining an effluent limit that is greater than 7 mg/l. Effluent from the hatchery will contribute to the total load of solids in the receiving waters. The settleable and suspended solids 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)

2.5.1.1 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 that provide 1-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 approximately 3.5 feet. As they enter the crowder channel, fish pass through a pivoting bar gate which prohibits them from returning down the ladder.

2.5.1.2 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 fishway 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 that allows them to swim upstream. When the fish pass the bar rack, the rack closes and the fish are 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. No problem has occurred with fish recruitment into the ladder without the barrier, most likely because the river terminates at the outlet works approximately 0.25 mile upstream of the ladder.

2.5.1.3 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.

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;
- River return of wild fish, spawned males, and all females and males in excess of broodstock needs.

Two primary transport trucks are used for DCFH and CVFF operations: an 800-gallon tank truck and a 1,200-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 equipment, but the tanks are well-insulated. The transit time for DCFH/CVFF fish-transport activities generally requires less than 45 minutes of travel and occurs during the cooler months of December through April. Transport loads show no change in water temperature when discharged, so there is no need to chill the water with ice. Transport densities are monitored to stay below 1,300 pounds of fish per load for the 800-gallon truck and 1,800 pounds of fish per load for the 1,200-gallon truck.

Smaller-scale transport units are sometimes used at either facility consisting of 150-gallon or 350-gallon insulated tanks outfitted for use in pickup trucks. The 150-gallon units are oxygenated using bottled oxygen and air stones and are loaded to carry no more than 50 pounds of fish. The 350-gallon unit has a fresh-flow aerator and is operated to carry a maximum load of 500 pounds of fish.

DCFH and CVFF training for transport operations includes instruction on response to unforeseen delays, such as truck breakdowns or traffic hold-ups. Staff are instructed to 1) notify the DCFH office immediately to begin procedures for sending out backup transport trucks (or other arrangements as appropriate); 2) begin monitoring of water temperatures and DO levels in the tank; 3) determine the nearest stream-release location; and 4) if the environmental conditions within the tank approach conditions that are lethal for fish, go to the release location and release the fish.

2.5.3 BROODSTOCK HOLDING AND SPAWNING FACILITIES

2.5.3.1 DCFH Facilities

Broodstock holding and spawning facilities include six concrete holding ponds located outdoors under a shelter, and sorting and spawning facilities located inside the hatchery building. A crowder channel acts as a conveyance route between these two areas, and also serves as the trap and initial holding area for fish before they are sorted.

Spawning for steelhead is conducted once a week. As a result, the maximum holding period for fish that have entered the trap is also 1 week. On spawning day, all fish located in the trap are crowded to the spawning area and sorted. Following this, all steelhead broodstock previously sorted to the holding ponds for ripening are directed into the crowder channel and put through a similar crowding and sorting cycle.

A mechanical crowder located in the crowder 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. 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. Steelhead selected as broodstock that are ripe for spawning will be slid to a spawning table beyond the sorting facilities. Steelhead selected as broodstock that are not ripe for spawning are slid into a fish return tube that transports them back to one of the adult holding ponds. (These unripe broodstock may remain in the holding ponds up to 3 weeks, with periodic cycles through the crowder channel and sorting table until found ripe for spawning.) Another adult holding pond is used to receive excess steelhead not needed as broodstock, and a temporary tank holds any wild fish that are found in the trap.

Because 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. Once spawned, female steelhead are released to Dry Creek via tubes located in the hatchery building. Spawned males are returned to the same designated adult holding pond providing temporary holding for excess steelhead. As soon as sorting and spawning operations are completed for the day (or the next morning in some cases), transport trucks are used to haul and release all wild fish collected from the trap, as well as all spawned male steelhead and excess steelhead. The wild fish are given priority and released to tributary streams of Dry Creek as soon as possible. Afterwards, spawned males and excess males and females are released to the Russian River near Cloverdale, approximately 10 miles upstream of the confluence with Dry Creek.

2.5.3.2 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 that can 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 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, origin, sex, and maturation. For fish identified to be CVFF hatchery steelhead, 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) designate it as an excess fish and release it for increased angling opportunity. CVFF females that are used for spawning are subsequently released directly to the East Fork Russian River using a fish transfer tube, as these spawned-out females rarely re-enter the fish ladder before beginning their return migration to the ocean. Spawned CVFF males, on the other hand, are handled in the same fashion as excess male and female steelhead, being manually loaded from the spawning table (or sorting table) into an adjacent transport truck. At the end of each spawning session, fish in the transport truck are hauled and released into the Russian River between Geyserville and Ukiah (that is, the reach of the mainstem upstream from DCFH but downstream from CVFF) as a means to maximize the angling potential. Wild steelhead captured at the CVFF trap are sorted into separate transport trucks and are released to the West Fork Russian River above Mumford Dam. It is rare to capture Chinook at the CVFF trap since the ladder and trap are not operated during the period of peak adult Chinook migration, but in the event that Chinook capture occurs, the fish are sorted into separate transport trucks and are released to the mainstem Russian River above Pieta Creek (located in Mendocino County). Fish other than steelhead or Chinook that are captured in the CVFF trap are released back to the East Fork Russian River with the use of fish transfer tubes. CVFF broodstock and holding facilities also include a fish transfer tank designed for loading fish from the southern adult holding tank directly into transfer trucks. The system utilizes a 3-ton overhead crane to raise, lower, and move the fish transfer tank. However, this system has not been used in recent years. Instead, fish have been manually loaded into transport 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 (4-, 8-, and 12-inch diameter). When trays were used, steelhead eggs were placed in the trays at a maximum loading of 16,000 eggs (or 80 ounces with an average size of 200 eggs per ounce). Trays were flushed with iodine twice a day until embryos reached the eyed-egg stage. Recently, however, the preferred practice is to use only the hatching jars, because 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. Steelhead eggs are typically incubated at 52°F.

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 6 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 16 feet long, 3 feet wide, and 22 inches deep. There are eight juvenile rearing raceways, constructed of concrete, each with an available rearing volume measuring 72 feet long, 9 feet wide, and 27 inches deep. 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 long, 9 feet wide, and 5 feet deep.

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 approximately 1 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. The numbers of fish in each group reflect the bell-shaped curve seen in the pattern of adult returns to the facility, but the size of fish arriving at CVFF typically averages 5 fish per pound (fpp), regardless of the group. Each group is held in the CVFF raceways for approximately 30 days, resulting in four release groups spanning January to April. This 30-day residency occurs when juvenile steelhead typically go through the physiological process known as smoltification, which prepares them for the transition from fresh water in the stream to salt water 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.

There have been no significant fish mortalities at CVFF. However, 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 most 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 51,000 coho salmon, 100,200 steelhead trout, and 9,300 Chinook salmon. 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 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 kilowatt (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 approximately 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.

The facility has been modified to provide additional backup provisions, including:

- Addition of a bypass pipeline for EWS;
- 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, simulating a power outage.

Training of personnel now includes routine practice drills for appropriate response to emergency conditions. These practice drills are conducted two times per year.

Technically, the steelhead program does not involve listed natural fish within the confines of the hatchery, other than unintentional trapping of natural fish that may occur during broodstock collection operations. Natural fish are released as soon as possible following unintentional capture, using the means and locations as described in Section 2.5.3. There is very low likelihood for take of listed fish due to equipment failure or other catastrophic event under the DCFH 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 Steelhead (from DCFH returns)

2.6.2 SUPPORTING INFORMATION

2.6.2.1 History

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 (Steiner Environmental Consulting [SEC] 1996). 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. A detailed review of hatchery records revealed that, prior to 1980, at least seven out-of-basin steelhead stocks were introduced to the Russian River, most of them from hatcheries in the North Coast region. These out-of-basin broodstock sources (with the last known year of planting noted in parentheses) included the Eel River (1972), Prairie Creek (1927), Mad River (1981), San Lorenzo Creek (1973), Scott Creek (1911), and Washougal River, Washington (1981) (SEC 1996, DCFH 1996-1998). Data are currently insufficient to determine whether these outplants survived or returned as adults, or to establish the extent of residual integration within present stocks. It is anticipated that the results of genetic studies carried out by NOAA Fisheries and Sonoma State University will provide this information.

Implementation of the DCFH steelhead program in 1981 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. Therefore, the steelhead program had no difficulty in complying with a new policy implemented in 1999, which requires that all broodstock for all DCFH production programs be obtained solely from adults captured within the Russian River. There have been no outplants of out-of-basin steelhead stocks from DCFH since 1981.

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 time-frame, 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[3]	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
Unknown[2]	-	8,934,122
Washougal	1980-81	270,360
Total Outplants		**33,363,119**
Percent Russian River Origin[2, 3]		**54%**

Notes:

1. Data compiled from SEC (1996) and DCFH (1996, 1997, and 1998). 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, using the conservative assumption that all unknown broodstock sources come from outside the Russian River basin. It was common in the past for hatcheries to plant fish in many basins. This practice has diminished since the 1980s and was discontinued in the Russian River in 1999.
3. The first outplants from DCFH occurred in 1981, and the first outplants from CVFF occurred in 1992. The only outplants from the DCFH/CVFF program using out-of-basin broodstock are Mad River and Washougal outplants that occurred in 1981. All steelhead outplants prior to 1981 were transferred in to the basin from other facilities and directly released in the Russian River.

2.6.2.2 Annual Size

The annual size of the broodstock pool is approximately 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. Marked adult steelhead have been returning to the DCFH and CVFF facilities since 1999.

Previous to the advent of mass marking, returning fish were spawned indiscriminately with respect to hatchery or natural origin, and it is likely that natural fish were incorporated into spawning. However, estimates calculated with adult return data collected since 1999 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 National Fish Hatchery and two tributaries in the Sacramento River basin cluster distinctly from other steelhead in this ESU. A significant cluster includes samples from several streams within the CCC steelhead ESU (Lagunitas, Scott, San Lorenzo, Alameda, Arroyo Hondo, and Gaviota), but also includes samples from streams located outside the ESU boundary, including 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 mitochondrial DNA (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 mtDNA and nuclear DNA in naturally-spawning coastal steelhead in California. Data for both mtDNA and a single microsatellite locus, Omy 77, gave significant differentiation between three broad bioregions, north coast, central coast (Russian River to Point Sur), and south coast. 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 the microsatellite locus Omy77 was detected.

The 1996 NMFS Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby et al. 1996) concluded that it is likely that most natural production in the CCC Steelhead ESU is not self-sustaining in the larger river systems. That is, natural production is dependent upon hatchery production to provide most of the instream population abundance. Genetic introgression likely occurs in the natural population, along with inbreeding, loss of rare alleles, and genetic drift.

2.6.2.5 Reasons for Choosing

Historic

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.

Present Selective Criteria

DCFH:

Broodstock is chosen from a weekly 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, the probability of deleterious levels of inbreeding within the hatchery stock are thought to be minimized due to the large number of steelhead used for broodstock. Nonetheless, mass-marking strategies and genetic analyses are being considered as a means to further decrease inbreeding. Although management has been continuously evaluating methods for identifying related individuals using marks that are readily visible, 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. Nonetheless, there is no current method for determining the degree of relatedness of returning fish, nor is there any method for readily identifying sibling fish visually.

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.

Adult collection and spawning protocols at DCFH and CVFF require systematic collection across the entire adult return period. Weekly capture goals are formulated using a distribution curve of adult returns, based on a running mean of adult returns during that week over the past several years. (A 9- to 11-year mean has been used in recent years, routinely showing that most of the adult return occurs within a 16-week period.) Steelhead program guidelines routinely aim to collect and spawn a minimum of 180 females at DCFH and a minimum of 120 females at CVFF, and generally 2.5 to 3 times those numbers for males. These spawn numbers represent more individuals than are necessary to achieve egg-take goals from a strict fecundity approach, and instead reflect an effort to increase genetic diversity. Maintenance of genetic diversity is also represented in the practice of including jacks in the male broodstock pool. Jacks are included as broodstock in approximately the same proportion as appears in the population of returning hatchery adults, which in recent years has been approximately 0.6 percent of the male 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. To increase diversity, enough males are collected to provide a 3.0:1 spawning ratio with the females (B. Wilson, CDFG, pers. comm. August 30, 2002).

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**

Source: B. Wilson, CDFG, pers. comm. August 30, 2002

2.7.4.2 Broodstock Collection Levels for the Past 12 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	2	NA	NA	NA	0	0
1991/1992	342	848	5	NA	NA	NA	0	0
1992/1993	365	905	5	106	263	2	0	0
1993/1994	342	848	5	123	305	2	0	0
1994/1995	292	724	4	92	228	2	0	0
1995/1996	250	620	4	118	293	2	0	0
1996/1997	241	598	4	117	290	2	0	0
1997/1998	157	389	2	107	265	2	0	0
1998/1999	184	456	3	107	265	2	0	0
1999/2000	184	456	3	128	317	3	0	0
2000/2001	146	362	2	148	367	3	0	0
2001/2002	179	445	3	169	420	3	0	0
2002/2003	192	477	3	146	363	2	0	0
2003/2004	269	668	4	167	415	3	0	0

Notes:

1. CDFG operating year extends from July 1 of first year through June 30 of second year.
2. Data regarding females spawned compiled from DCFH and CVFF annual reports (DCFH 1991-2004; CVFF 1993-2004).
3. Total number of males (including jacks) estimated by assuming spawning ratio of 3 males:1 female (B. Wilson, CDFG, pers. comm. August 30, 2002).
4. Number of jacks estimated assuming a 0.6 percent presence in the male population.

2.7.5 Disposition of Hatchery-Origin Fish Collected in Surplus of Broodstock Needs

All surplus hatchery-origin adult steelhead collected at DCFH and CVFF are relocated into the Russian River between Geyserville and Ukiah for increased angling opportunity. There is no information at this time regarding natural spawning of excess hatchery steelhead in this release area.

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 1 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. Once removed from the carbon dioxide bath, adult steelhead will typically recover from the sedated condition after approximately 3 minutes. 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 generally 30 minutes to 1 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 the following iodophore procedure developed by CDFG pathology (Dr. W. Cox, CDFG, pers. comm. July, 2003).

1. Spawn eggs into colander and separate from ovarian fluid.
2. Rinse eggs once with 0.9 percent saline (30 to 60 seconds).
3. Add sperm and fertilize for 5 minutes.
4. Rinse once in 0.9 percent saline to remove excess sperm and other materials (30 to 60 seconds).
5. Rinse once in 100 parts per million iodophore solution (1 minute).
6. Disinfect eggs for 30 minutes, in 100 parts per million iodophore solution.
7. Rinse iodophore from eggs using clean or sterilized hatchery water (30 to 60 seconds).
8. Finish water hardening in clean water.

Bacterial kidney disease (BKD) screening is not carried out routinely on hatchery steelhead due to the low incidence of infection from this pathogen. However, each spawning season, each facility typically collects a single sample for BKD analysis, compiled from the ovarian fluid of approximately 20 hatchery adult females. This sample is 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.

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, which involves ultimate disposal at the municipal disposal facilities. All adult steelhead carcasses and any rearing mortalities that have undergone adequate depuration following chemical treatment could presumably be used to provide nutrient-loading in streams, although no programs in the Russian River basin are known to be seeking carcasses for this purpose at present.

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.

Listed natural fish are not handled excessively when they are captured in the DCFH and CVFF traps, and they are returned to the Russian River unspawned within 24 hours of sorting. The release location for natural fish has been selected to reduce potential interaction with hatchery adults, thereby reducing the risk of possible genetic effects due to interbreeding. Each spawning season, each facility typically collects a single sample for BKD analysis, compiled from approximately 20 hatchery adult females. This monitoring measure contributes to improved health conditions in both the hatchery and natural fish populations.

2.8 MATING

2.8.1 SELECTION METHOD

Spawning fish are chosen randomly on a weekly basis 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(s) is used to ensure fertilization. Spawning does occur on a particular day, and spawners are taken randomly from any ripe fish on a particular day. It should be noted that, for steelhead, the minimum effective number of breeders (50 to 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. The potential benefits of utilizing wild fish for broodstock requires further discussion, and it is anticipated that genetic studies undertaken by NOAA Fisheries and Sonoma State University will assist in determining the optimal number of wild fish to be incorporated into the brood.

2.8.2 MALES

Multiple males are used to fertilize the eggs harvested from a single female, with the average rate being 3 males to 1 female. Most steelhead broodstock are 3-year-old fish. In an effort to maintain genetic diversity, jacks (presumed to be 2-year-old precocious males) are incorporated into the spawn in approximately the same proportion as occurs in the run. Based on DCFH return records for 1981 to 2003, this proportion is approximately 0.3 percent of the total hatchery steelhead returns or approximately 0.6 percent of the male hatchery returns.

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 0.3 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	NA
1990/1991	795,000	83%	NA	NA
1991/1992	1,710,000	83%	NA	NA
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%
2001/2002	895,000	83%	845,000	83%
2002/2003	960,000	83%	730,000	83%
2003/2004	1,345,000	83%	835,000	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.
3. Egg-take data from annual reports (DCFH 1990-2004; CVFF 1993-2004).

The number of eggs taken for each facility are indicated in the previous table. The decrease in the number of eggs harvested at DCFH since 1996 reflects the present policy of releasing only mass-marked smolts that can be identified as hatchery origin (no fingerlings or other lifestages 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 lifestages.

In general, survival rates to eye-up average 93 percent of the original number harvested. Subsequent survival rates show a consistent 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 12 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 protect against catastrophic loss during that particular day's activities, as well as to provide a buffer against routine losses through the remainder of the hatchery-rearing cycle. During each spawning session, after the eggs have been water-hardened, an inventory is performed and the egg count is adjusted to approximately 130 percent of the release number expected from that lot. At the eyed-egg stage, another inventory is performed, at which time the egg count is adjusted to 115 percent of the release number. All surplus eggs are destroyed by disposal into the sewer system.

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 3 to 12 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: 6-inch to 254.4 cubic inches, 8-inch to 452.2 cubic inches, 10-inch to 706.5 cubic inches, and 12-inch to 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 are typically quite stable and close to the desired optimum of 54°F, as temperature can be controlled by selecting various intakes in the reservoir or by using the refrigeration chillers. Water is highly aerated with DO levels of 9 to 10 mg/l. Silt is controlled through the use of sand filters. The turbidity is a parameter monitored in the biweekly analysis, providing an indicator as to whether the sand filters are performing effectively. During the first major storm each winter, typically in December, releases from Lake Sonoma may be very high in turbidity and the filters may become overloaded. During these events, the staff is especially careful to monitor silt conditions in the incubation facilities, but the condition is generally manageable and does not warrant filter upgrade or replacement.

2.9.1.5 Ponding

Swimup and ponding are volitional using the hatch jar method. Generally, at 51° F to 54° 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 fpp (6 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 that 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 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 lifestage (fry to fingerling; fingerling to smolt) for the most recent 12 years (1988 to 1999), or for years dependable data are available.

Survival rates from ponding as fry to fingerling size is 87 percent. Survival rates from fingerling to yearling smolt release averages 78 percent. These percentages are an average of the past 12 years, and slight variations occur annually. Calculations are based on fry at swimup to 6 weeks of age; at 6 weeks of age, the juveniles are referred to as fingerling and are classified as such until they reach 20 fpp, at which time they are classified as yearlings. Yearling smolts are classified as such when they approach 4 to 5 fpp.

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/cubic foot (ft^3). Overcrowding is prevented by monitoring stocking density. This procedure is conducted every 2 weeks by sampling each pond to determine the average length and weight for fish, and, in conjunction with mortality counts kept for each pond, subsequently calculating the biomass loading in the pond. Fish from a single pond are split and spread into more ponds as necessary to prevent pond densities from exceeding the density limit.

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 to 12 months), temperature rarely varies more than 5 degrees. Daily temperature variation is rarely more than a single degree. DO of influent and effluent is analyzed in the laboratory weekly (Winkler Titration) and can be checked as needed at other times with a DO meter. Other water quality data collected during laboratory analysis include: pH, turbidity, chloride, and 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. 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. As a result of fish growth information, fish may be split and graded into additional rearing units so that density limits are not exceeded and size variation is reduced (see Section 2.9.2.2).

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 have 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 body weight/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, and are prepared by Bio-Oregon. Feeding is scheduled by electric timers set to dispense feed automatically eight times over the course of a day. Fish feed conversion rates for the past 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

Note: Year extends from July 1 of first year through June 30 of second year.

2.9.2.7 Fish Health Monitoring, Disease Treatment, and Sanitation Procedures

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, in addition to removing accumulated solids and fish feces, also puts the ponded fish through fluctuating flow regimes and is suggested as a possible benefactor to fish condition. In addition, weekly prophylactic salt flushes are given to all lifestages 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 can be called in to do health assessments. Treatment methods are prescribed by fish pathologists for disease outbreaks and treatment protocols are carried out by hatchery staff. Depending on the cause of an outbreak, treatment methods may vary. 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 oxytetracycline. Carcasses from fish mortalities are frozen and subsequently disposed of through the commercial disposal service.

Prior to release, all fish reared at DCFH and CVFF are monitored by CDFG pathologists and certified as acceptable for release.

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 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 conceptual framework for conservation hatcheries (Flagg and Nash 1999), have not been significantly adopted at either facility. However, the routine operations of these facilities already include some of the recommended procedures: broodstock selection, shaded ponds at DCFH, volitional release at CVFF, imprinting at both facilities, health monitoring, and release timing coordinated with smoltification and lunar phase. Additionally, fish experience daily exercise periods when cleaning activities increase water velocity.

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)

fpp = fish per pound

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

DCFH

Release point: Dry Creek, 3 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
1981/1982	0	NA	253,436	372	53,380	5
1982/1983	0	NA	226,710	298	102,662	6
1983/1984	0	NA	459,970	217	124,146	5
1984/1985	0	NA	608,680	941	155,305	4
1985/1986	0	NA	539,157	131	212,365	8
1986/1987	0	NA	1,316,469	272	237,753	3
1987/1988	0	NA	720,579	775	224,963	4
1988/1989	0	NA	578,780	813	233,979	4
1989/1990	0	NA	347,347	630	212,769	4
1995/1996	0	NA	134,000	2,000	316,758	4
1996/1997	0	NA	279,088	733	312,388	4
1997/1998	0	NA	119,681	229	348,734	4
1998/1999	0	NA	210,832	40	341,339	4
1999/2000	0	NA	0	NA	300,000	4
2000/2001	0	NA	0	NA	336,320	4
2001/2002	0	NA	0	NA	284,378	3
2002/2003	0	NA	0	NA	317,636	4
2003/2004	0	NA	0	NA	555,093	5
Avg – all years	**0**	**NA**	**400,637**	**381**	**271,111**	**4**
Avg – releases	**0**	**NA**	**511,925**	**487**	**271,111**	**4**

Data source: DCFH 1982-2004

Note: Year extends from July 1 of first year through June 30 of second year.

CVFF Fish Releases

Release Year	Eggs/ Unfed Fry	Average Size	Fry and Fingerling	Average Size	Yearling	Average Size
1992-1993	0	NA	0	NA	165,469	6
1993-1994	0	NA	227,313	623	213,872	5
1994-1995	0	NA	107,667	452	235,416	5
1995-1996	0	NA	76,670	11	224,702	5
1996-1997	0	NA	122,188	206	206,333	5
1997-1998	0	NA	110,981	301	242,438	5
1998-1999	0	NA	164,770	152	231,320	5
1999-2000	0	NA	0	NA	229,451	5
2000-2001	0	NA	0	NA	211,801	5
2001-2002	0	NA	0	NA	206,264	4
2002-2003	0	NA	0	NA	212,513	5
2003-2004	0	NA	0	NA	195,625	
Avg - all years	**0**	**NA**	**67,466**	**145**	**214,600**	**5**
Avg - releases	**0**	**NA**	**134,932**	**291**	**214,600**	**5**

Data source: CVFF 1993-2004

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	4/20/94	6/29/94	5/17/94	5/17/94	11/23/94	11/23/94	1/6/94	4/7/94
1995	4/4/95	6/23/95	8/22/95	8/22/95	none	none	1/27/95	3/29/95
1996	3/19/96	7/12/96	9/21/96	9/22/96	9/5/96	9/22/96	12/13/95	3/15/96
1997	4/12/97	7/10/97	8/1/97	9/19/97	10/13/97	10/13/97	10/9/96	4/10/97
1998	5/28/98	7/29/98	10/1/98	10/6/98	9/29/98	10/1/98	12/26/97	4/25/98
1999	none	none	none	none	none	none	1/14/99	5/11/99
2000	none	none	none	none	none	none	1/15/00	4/18/00
2001	none	none	none	none	none	none	12/20/00	3/23/01
2002	none	none	none	none	none	none	1/7/02	4/11/02
2003	none	none	none	none	none	none	12/30/02	3/26/03
2004	none	none	none	none	none	none	1/14/04	4/14/04

fpp = fish per pound
Data source: DCFH 1994-2004

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	5/17/94	6/29/94	9/27/94	9/27/94	none	none	2/6/94	4/8/94
1995	4/26/95	6/23/95	none	none	none	none	1/27/95	3/28/95
1996	4/9/96	7/12/96	8/1/96	9/19/96	none	none	1/14/96	2/16/96
1997	4/24/97	7/7/97	none	none	none	none	1/3/97	4/6/97
1998	5/28/98	7/22/98	10/6/98	10/6/98	9/30/98	9/30/98	1/25/98	4/23/98
1999	none	none	none	none	none	none	1/14/99	4/9/99
2000	none	none	none	none	none	none	2/1/00	3/31/00
2001	none	none	none	none	none	none	12/24/00	3/22/01
2002	none	none	none	none	none	none	1/10/02	4/9/02
2003	none	none	none	none	none	none	12/31/02	3/25/03
2004	none	none	none	none	none	none	1/20/04	4/14/04

fpp = fish per pound
Data source: CVFF 1993-2004

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 1-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, roughly 45 minutes.

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 1 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 (2-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. Additionally, both facilities have emergency procedures in the event of water system failure.

2.10.10.1 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: the emergency water system (EWS), or the well water system. The EWS can permit full operation of the hatchery facilities, but the well water system is capable of supplying only about 10 percent of the total hatchery demand.

In an emergency situation calling for complete activation of the EWS, hatchery personnel must contact the USACE office to request the EWS pipeline be opened. The inability for hatchery personnel to activate the EWS directly causes some delay in the delivery of emergency water, and the delay can become critical when the emergency occurs outside normal business hours, when the USACE offices are closed. Normally, the EWS pipeline is charged and ready for immediate use, but in some cases the EWS pipeline must first be charged, causing additional delay. Nonetheless, the EWS can provide an effective, large-scale backup water system when the main water system fails.

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 that would require the use of the EWS bypass line. Power system failures requiring the operation of the standby generator are the most common operational difficulties encountered at DCFH, occurring fairly regularly 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 DO, 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.

2.10.10.2 CVFF

A portable emergency generator is installed and located at the facility to run two water supply pumps in case 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, the DCFH steelhead program releases only smolts, with the expectation that smolts migrate directly to the ocean and reduce the potential for residualism and continued freshwater rearing. 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. (Note that releases resulting from the return of excess broodstock are addressed in the broodstock section, Section 2.7.)

Outbreeding depression is a genetic concern caused by the loss of localized genetic adaptations, resulting in decreased fitness. It 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. 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

"RECOMMENDED" indicates that data collection efforts have yet to be implemented. At present, there is no firm timeline for completing the implementation of these performance indicators. It is assumed that final definition and implementation of the performance indicators will be included in the Section 7 Consultation with NOAA Fisheries.

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, Inc. 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.

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 substantial genetic benefit 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; however, 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 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 that 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.

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B1.	**Provide a predictable and stable opportunity for harvest.**		
B1A.	Assess contribution to the recreational fishery.	Recommended	1.4.2
B2.	**Provide fish for harvest in a manner that eliminates effects on wild populations.**		

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B2A.	Develop harvest management plan for hatchery fish.	Recommended	1.4.4
B2B.	Compute ratio of wild fish to harvest.	Recommended	1.4.2, 2.1.2
B2C.	Document total harvest of hatchery fish.	Recommended	1.4
B2D.	Determine that total harvest of wild steelhead does not exceed upper maximum of absolute number of wild fish.	Recommended	1.4
B2E.	Assure that hatchery broodstock goals are met 4 out of 5 years ± 10%.	Ongoing	1.2.3, 1.3.1
B3.	**Fulfill mitigation/policy obligations.**		
B3A.	Mitigation goals of the hatchery are met.	Not Feasible at Present	none
B4.	**Achieve within-hatchery performance standards.**		
B4A.	Hatchery performance standards established in the DCFH/CVFF Management Plan are achieved.	Ongoing	1.1.1
B4B.	Relevant statewide hatchery performance standards are achieved.	Ongoing	1.1.1
B5.	**Enhance local, state, regional, and national economies.**		
B5A.	Establish increasing trend in the value of harvest.	Recommended	none
R1.	**Implement a harvest management plan to protect weak populations where mixed population fisheries exist.**		
R1A.	Maximum allowable effect to weak populations not exceeded in 4 out of 5 years ±10%.	Recommended	2.1.1
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.	Recommended	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.	Recommended	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.	Recommended	2.1.2
R2.	**Assess detrimental genetic effects among hatchery vs. wild where interaction exists.**		
R2A.	Assess genetic effects, initially through stray rates as a surrogate for a thorough and more complex measurement of genetic effect.	Recommended	3.2, 1.2.3
R2B.	More specific genetic effects measurements to be implemented on a selected basis.	Ongoing	3.1. 3.2
R3.	**Assure there is a predictable egg supply to avoid poor programming of hatchery production.**		
R3A.	Achieved percent egg take goal in 4 out of 5 years.	Ongoing	1.1.1

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
R3B.	Implemented CDFG disease protocols in any events involving egg transfer to the hatchery.	Ongoing	1.1.1
R4.	**Evaluate habitat use and potential detrimental ecological interactions.**		
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.	Recommended	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
R5.	**Assure that program does not exceed the carrying-capacity of fluvial, lacustrine, estuarine, and ocean habitats.**		
R5A.	Develop an appropriate M&E plan to assure program does not exceed the carrying-capacity of freshwater habitats.	Recommended	2.1.3
R5B.	Reservoir, estuarine, and ocean research, monitoring, and evaluation plan developed.	Recommended	2.2.3
R6.	**Evaluate effect on life-history traits of wild and hatchery fish, from harvest and spawning escapement.**		
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.	Recommended	4.1.1
R7.	**Avoid disease transfer from hatchery to wild fish.**		
R7A.	Established comparative annual sampling of disease in hatchery and wild populations.	Recommended	4.2.1
R7B.	Complied with CDFG standards and NOAA Fisheries 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.	Recommended	4.2.2

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 HGMP to ensure consistency of hatchery production approaches and quantification of results achieved.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.1	Determine egg-to-fry, fry-to-parr, parr-to-smolt survival rates for each release group.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.2	Document numbers, size, time of release, and release location for all fish.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.3	Conduct periodic monitoring for size during rearing.	Med	Ongoing	CDFG	USACE
Subactivity 1.1.1.4	Participate in planning processes for ponding and rearing.	Med	Ongoing	CDFG	USACE
Subactivity 1.1.1.5	Prepare and submit tag, mark and release reports.	High	Ongoing	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	Ongoing	CDFG	USACE
Subactivity 1.2.1.1	Use coded wire tag (CWT), or other special marks for a portion of special hatchery release groups, so they can be detected wherever they are recovered.	Med	Rec	CDFG	USACE
Activity 1.2.2	Estimate abundance of hatchery fish departing as smolts.		Rec		
Activity 1.2.3	Quantify the number of hatchery produced adults returning to the Russian River basin.	Med	Rec	CDFG	USACE
Subactivity 1.2.3.1	Operate ladders at hatcheries to estimate escapement of hatchery-produced fish.	High	Ongoing	CDFG	USACE

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
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	Rec	CDFG	USACE
Activity 1.3.2	Use monitoring and evaluation results to revise parameters in the life-history simulation model used to predict stocking rates.	Med	Rec	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	Ongoing	CDFG	CDFG-OP
Activity 1.4.2	Survey fishermen in the Russian River basin to estimate total catch of hatchery origin steelhead trout.	Med	Rec	CDFG	CDFG-FM SHRC
Activity 1.4.3	Analyze age to determine how they differ between groups from different release strategies.	Med	Rec	CDFG	USACE
Activity 1.4.4	Develop run prediction and harvest monitoring to allow harvest of abundant fish returns.	Med	Rec	CDFG	CDFG-FM
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.	Med	Rec	CDFG	TBD
Subactivity 2.1.2.1	Conduct stratified redd surveys.	Low			

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Subactivity 2.1.2.2	Collect biological information of fork length, sex, scales, general fish health, examine for marks/tags, scan with CWT scanners, and collect fin tissue sample for DNA analysis (see Objective 3) from all adult fish captured in individual tributaries.	Med	Rec	CDFG/UC	FRGP
Activity 2.1.3	Conduct juvenile density surveys, in coordination with monitoring efforts for coho program.	Low	Rec	CDFG/UC	FRGP
Activity 2.1.4	Operate juvenile emigration traps to estimate production, in coordination with monitoring efforts for coho program.		Rec		
Subactivity 2.1.4.1	Tributary specific juvenile emigration trapping, in coordination with coho monitoring program.	Low	Rec	CDFG	FRGP
Subactivity 2.1.4.2	Russian River basin monitoring at Mirabel Dam.	High	Ongoing	SCWA	SCWA
TASK 2.2	COLLECT PHYSICAL HABITAT, STREAM TEMPERATURE, AND DISCHARGE DATA TO CORRELATE WITH STAFF GAGE 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, in coordination with monitoring efforts for the coho program.	Low			
Activity 2.2.2	Install a staff gage and collect stream discharge information that is sufficient to develop discharge curves for each key tributary, in coordination with monitoring efforts for the coho program.	Low			
Activity 2.2.3	Implement environmental monitoring and assessment program for habitat conditions throughout the entire Russian River basin, in coordination with monitoring efforts for the coho program.	Low			
OBJECTIVE 3.	**GENETICS EVALUATION.**				
TASK 3.1	GENETIC SAMPLE COLLECTION AND ANALYSIS.				
Activity 3.1	Collect samples.	High	Ongoing	CDFG	USACE
Activity 3.2	Analyze samples.	High	Ongoing	NOAA	USACE

Activity	Description	Priority	Status	Responsible Entity	Funding Source
Task 3.2	Apply DNA Data to Immediate Management Needs.				
Activity 3.2.3	Determine the stocks.	High	Needed	NOAA	NOAA
Activity 3.2.2	Determine the extent to which the hatchery stock is representative of the naturally-spawning stock.	High	Rec	NOAA	NOAA/USACE
Activity 3.2.1	Determine the reproductive success of naturally-spawning hatchery-reared fish.	Low			
Task 3.3	Apply DNA Data to Long-Term Management Needs.				
Activity 3.3.1	Assess that the hatchery program is consistently representative of the naturally-spawning stock.	High	Rec	NOAA	NOAA/USACE
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.	Med	Rec	NOAA	NOAA
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 predatory fish species in release streams in conjunction with ongoing parr monitoring studies. Determine whether these changes are correlated with hatchery outplant activities.	High	Rec	SCWA	SCWA
Subactivity 4.1.1.1	Snorkel and count fish by species each season, and classify into size intervals.	Low			
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 among free-living hatchery and natural fish under natural conditions.	Med	Rec		

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Subactivity 4.2.1.1	Determine the frequency of common fish pathogen presence and virulence in Russian River hatchery produced fish.	Med	Ongoing	CDFG	CDFG
Subactivity 4.2.1.2	Determine the frequency of common fish pathogen presence and virulence among naturally produced fish in the Russian River basin.	Med	Rec		
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	Rec	CDFG	CDFG
Subactivity 4.2.2.1	Identify and assess factors that caused disease outbreak.	High	Rec	CDFG	CDFG
Subactivity 4.2.2.2	Determine potential adverse effects of any disease outbreak.	High	Rec	CDFG	CDFG
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 NOAA Fisheries/CDFG salmonid research database.	High	Ongoing	CDFG	USACE
Activity 5.1.2	Report Coded-Wire Tagging summary reports to the Regional Mark Information System (RMIS) database.	High			
TASK 5.2	COMMUNICATION OF RESULTS AND TRANSFER OF TECHNOLOGY.				
Activity 5.2.1	Develop annual Statement of Work.	Med	Rec	CDFG	USACE
Activity 5.2.2	Develop quarterly reports.	Low		CDFG	USACE
Activity 5.2.4	Develop ESA Section 7 summary reports.	High	Ongoing	SCWA	SCWA
Activity 5.2.5	Develop annual reports.	High	Ongoing	CDFG	USACE
Activity 5.2.6	Develop five-year summary report.	High	Ongoing	CDFG	USACE
Activity 5.2.7	Develop peer-reviewed journal publications.	Low			
Activity 5.2.8	Participate in regional conferences and workshops.	Low			

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
TASK 5.3	DEVELOP AND MAINTAIN OPEN COMMUNICATIONS WITH ALL RESOURCE MANAGERS (COORDINATION).				
Activity 5.3.1	Facilitate hatchery annual review and operating plan modification through an HGMP.	High	Ongoing	CDFG	USACE
Activity 5.3.2	Attend coordination meetings regarding hatchery production and salmonid recovery.	High	Ongoing	CDFG	USACE
Subactivity 5.3.2.1	Attend meetings of the Joint Hatchery Review Committee.	High	Ongoing	CDFG	USACE
Subactivity 5.3.2.2	Attend meetings of additional salmonid recovery teams as they come into existence.	Med		CDFG	USACE

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 BML. The majority of this work has focused on salmon stocks entering into DCFH; however, tissues were taken from the 1999/2000 brood year of steelhead at DCFH. (Year extends from July 1 of first year through June 30 of second year.)

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 Sonoma State University, analyzing steelhead populations occurring above and below impassable barriers on the Russian River. Warm Springs Dam is one of ten 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, it 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 NOAA Fisheries 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 salmon samples taken in 2000/2001 and 2001/2002 seasons. Genetic markers for which data are being collected include 18 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 (CDFG 2002):

- 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.
- 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 runs genetic makeup.

2.12.2 Cooperating and Funding Agencies

Tissue analysis conducted by the BML has been funded by SCWA.

Samples supplied by CDFG for analysis at the BML 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 NOAA Fisheries Santa Cruz Lab is funded by NOAA Fisheries.

2.12.3 Principal Investigator or Project Supervisor and Staff

The principal investigator for the activities at BML 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 NOAA Fisheries 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:

<u>Juvenile Fish</u>: For the sampling of hatchery stock, fish are netted from the rearing vessel and anaesthetized in a chemical 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 1 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.

<u>Adult Fish</u>: 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 to 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 incurred are attributed to fish that appear to be physiologically compromised based on observable fitness, physical abnormality, or a previously weakened state. An overall mortality associated with tissue sampling is not known at this time.

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 "Take Table" (Table 1).

Levels of estimated take are presented in Table 1, which follows Section 2.15.

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 coho salmon and Chinook salmon. In the Biological Opinion (BO) for the coho salmon program, NOAA Fisheries estimated the unintentional lethal take associated with the coho research activities at 700 fish. Since research on wild Russian River steelhead and Chinook salmon will be limited to tissue sampling and will not involve the broodstock collection efforts of the coho salmon program, the estimated mortality from tissue sampling of wild steelhead and Chinook salmon 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 steelhead and 5 Chinook salmon.

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° F at the capture site.

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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 Lifestage (*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

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 evolutionarily significant unit (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

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E-mail:	ccrwshbio@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 salmon 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 CDFG and NOAA Fisheries in 2001 to assure interagency coordination and public outreach for coho salmon recovery activities within the basin. The lead contacts for agency representation on the TOC committee are:

Name (and title):	Jeffrey Jahn, Fishery Biologist
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Address:	777 Sonoma Avenue, Suite 325 Santa Rosa, CA 95404
Telephone:	(707) 575-6097
Fax:	(707) 578-3435
E-mail:	Jeffrey.Jahn@noaa.gov

Name (and title):	Brannon Ketcham, Hydrologist
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Name (and title):	Carlos Garza, Research Geneticist
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Name (and title):	Bob Coey, Senior Fisheries Biologist
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Name (and title):	Peter LaCivita, Regional Fishery Biologist
Agency:	U.S. Army Corps of Engineers San Francisco District
Address:	333 Market Street, 7th Floor San Francisco, CA 94105
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Fax:	(415) 977-8695
E-mail:	Peter.E.LaCivita@usace.army.mil

The USACE, SCWA, MCRRFCD, and NOAA Fisheries have entered into a MOU that sets a framework for a Section 7 Consultation under the ESA. The MOU acknowledges the involvement of other agencies, including CDFG, SWRCB, NCRWQCB, the State Coastal Conservancy, and MCIWPC.

SCWA is designated as the nonfederal representative to prepare the BA for the consultation, which is assessing project activities that may directly or indirectly affect coho salmon, steelhead, and Chinook salmon in the Russian River. The BA includes an evaluation of the existing DCFH fish facility operations as well as proposed operations to be implemented following the consultation process.

All hatchery activities associated with this HGMP will be coordinated with Shirley Witalis (shirley.witalis@noaa.gov), the NOAA Fisheries Hatchery contact, located in the Sacramento, CA offices of NOAA Fisheries.

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

Annual operation of the DCFH steelhead program is funded entirely by the USACE, San Francisco District. SCWA has contributed to funding for the Section 7 ESA Consultation process.

Operations and maintenance activities for the program are conducted by the CDFG. The staffing level includes:

- Nine permanent positions, including one Senior Hatchery Supervisor, one Fish Hatchery Manager II, four Fish and Wildlife Technicians, and one Office Technician;
- Five temporary positions; and
- One Senior Fisheries Technician.

The annual operating budget funded by USACE for the DCFH program in recent years has averaged $1,300,000. This value includes the budgets for both the coho salmon and steelhead programs conducted at DCFH, and it also includes approximately $400,000 expended annually for the steelhead satellite program conducted at the CVFF.

The DCFH coho salmon program includes a broodstock collection component, which involves both preliminary assessment of streams for broodstock donor capability and subsequent broodstock capture activities. These coho salmon broodstock collection 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 salmon program is an "integrated recovery" program, based on the definitions provided in Attachment 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 salmon program was originally implemented in 1982 as a mitigation program to compensate for lost habitat capacity of naturally-producing coho salmon resulting from the construction of the Warm Springs Dam. The program used artificially-produced coho salmon to provide harvest opportunities and a source for program broodstock. In October 1999, a meeting between USACE, CDFG, and NOAA Fisheries established an interim operations plan for the 1999/2000 operating year (extending from July 1 through June 30) 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 NOAA Fisheries 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 NOAA Fisheries under Section 10(a)(1)(A) of the ESA, authorizing "take" for the purposes of scientific research or enhancement activities, and a BO was issued to CDFG on August 31 (NMFS 2001a). Initiation of the program occurred in September 2001.

The purpose of this pilot coho salmon 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 on the effective use of artificial propagation.

3.1.8 JUSTIFICATION FOR THE PROGRAM

NOAA Fisheries has indicated that the remaining coho salmon population in the Russian River basin is currently below the viable population threshold, suggesting that the risk 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 NOAA Fisheries in the BO for the Section 10 permit authorizing the coho salmon 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 NPPC as a means of assessing the benefits and risks of artificial production programs (NPPC 1999). Only those standards relevant to an integrated recovery program (such as the DCFH coho salmon 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.

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 and lacustrine 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.

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"

The following two lists of performance indicators are proposed as means of assessing the performance standards addressing hatchery benefits and hatchery risks. These indicators are adapted from the list suggested in the Artificial Production Review (NPPC 1999). At present, there is no firm timeline for completing the implementation of these performance indicators. The performance indicators and implementation schedule are being developed jointly by CDFG and NOAA Fisheries with input by the Hatchery Operations, Genetics, and Monitoring and Evaluation subcommittees of the Russian River Coho Recovery Workgroup. The University of California has received funding via the CDFG Fishery Restoration Grants Program to assist with monitoring efforts for future broodstock releases. CDFG is currently developing the scope of that contract with input by the subcommittee and USACE, which will aid in evaluating the effectiveness of the program.

3.1.10.1 "Performance Indicators" Addressing Benefits

<u>Performance Standard B1</u>: Conservation of genetic and life-history diversity.

Performance Indicators:

B1A. Assure that the number spawned is greater than the number of adults necessary to achieve minimum effective population size (MEPS). A positive performance would result if target is achieved within 10 percent in 4 out of 5 years.

B1B. Evaluate whether life-history characteristics of returning supplementation fish 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 (numbers 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 NOAA Fisheries 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.

<u>Performance Standard B2</u>: 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 numbers divided by square meter 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.

<u>Performance Standard B3</u>: 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.

<u>Performance Standard B4</u>: 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 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 programs into CDFG Russian River Basin Fisheries Restoration Plan (CDFG 2002) 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 have not been met. Standard is adaptive management.

<u>Performance Standard B5</u>: 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 NOAA Fisheries. The existing mitigation obligations include production goals for coho salmon enhancement that have been discontinued under an interim operating agreement and should be revised to reflect current program goals and strategies. The mitigation obligations of the USACE should be formally revised to reflect the current program and to provide the budget necessary to achieve 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.

<u>Performance Standard B6</u>: Achieve within-hatchery performance standards.

Performance Indicators:

B6A. Assure that hatchery performance standards established in the HGMP are achieved.

B6B. Assure that statewide hatchery performance standards (as identified by CDFG) are achieved at DCFH.

<u>Performance Standard B7</u>: 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.

<u>Performance Standard B8</u>: 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.

3.1.10.2 "Performance Indicators" Addressing Risks

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

Performance Indicators:

R1A. Implement measurement of specific genetic effects on a selected basis:

1. Develop experimental design for evaluating genetic effects in consultation with NOAA Fisheries.

2. Measure introgression by comparing allele frequencies between hatchery and wild.

3. Implement an appropriate experimental design to quantitatively measure outbreeding depression.

<u>Performance Standard R2</u>: Assess survival of captive broodstock progeny vs. wild cohorts.

Performance Indicators:

R2A. Achieve increased survival threshold for captive broodstock over wild adults – Implement an M&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. Evaluate and implement relevant regional hatchery production guidelines.

<u>Performance Standard R3</u>: 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 greater than or equal to 1.

<u>Performance Standard R4</u>: 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.

<u>Performance Standard R5</u>: 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 5 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 (number divided by square meter) by habitat before and after stocking hatchery fish vs. wild fish.
3. Compute growth rate, condition factor, and survival of parameter 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.

<u>Performance Standard R6</u>: Assure that program does not exceed the carrying-capacity of fluvial and lacustrine 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 experiments to determine carrying capacity.

<u>Performance Standard R7</u>: 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 fish health policies and procedures (CDFG 2000b) and fish health protocols recommended by NOAA Fisheries (Hard et al. 1992).

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 5 years.

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 Lifestage and Location

Lifestage	Release Location	Annual Release Level
Eyed Eggs	NA	0
Unfed Fry	NA	0
Fry	NA	0
Fingerling (advanced size)	100,000 (20,000 each stream)	5 streams: Willow, Sheephouse, Freezeout, Mill, Ward
Yearling	0	0

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.

No data are yet available to evaluate the performance of the current coho salmon recovery program. For the previous coho salmon mitigation/enhancement program that ceased production in 1999, the only data available to evaluate performance are the DCFH release numbers in conjunction with adult returns to each hatchery; harvest and stray rates are unknown. The estimated SAR values presented below assume a rigid 3-year age at return. Since no data are available to estimate fingerling to yearling survival parameter, values of 1 percent, 5 percent, and 10 percent were assumed. The previous mitigation/enhancement program defined goals of 110,000 for yearling releases, 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 salmon escapement to the hatchery suggests the SAR for the Russian River system is more likely to be near 0.4 percent. It should be noted that SARs are highly variable. This variation is contributed by a number of sources, acting independently or in concert, including; precipitation, ocean conditions, estuary habitat, and instream habitat.

DCFH Coho Salmon Fingerling			**DCFH Coho Salmon Yearling**			**DCFH Coho Salmon Adults**		**Estimated SAR and 95% Confidence Intervals 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%**
81/82	66,400	84/85	82/83	30,820	84/85	84/85	76	0.2%	0.2%	0.2%
82/83	82,987	85/86	83/84	32,305	85/86	85/86	0	0.0%	0.0%	0.0%
83/84	3,800	86/87	84/85	30,310	86/87	86/87	472	1.6%	1.5%	1.5%
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	0	NA	NA	NA
98/99	0	01/02	99/00	0	01/02	01/02	0	NA	NA	NA
99/00	0	02/03	00/01	0	02/03	02/03	0	NA	NA	NA
Avg	**55,212**	**-**	**Avg**	**77,125**	**-**	**Avg**	**224**	**0.36% (0.15%-0.56%)**	**0.34% (0.15%-0.54)**	**0.34% (0.15%-0.54%)**

Notes:

1. Year extends from July 1 through June 30.
2. The original DCFH mitigation program ceased coho salmon production in 1999; the current coho salmon recovery program began operation in 2001.
3. Average values calculated for releases reflect the average of releases when releases occurred (i.e., greater than 0). The average calculated for adult returns is the average of all returns regardless of value.
4. Source: DCFH 1982 to 2003.

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

The current coho salmon recovery program began in 2001.

3.1.14 Expected Duration of Program

The existing Section 10 permit for the coho salmon 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 NOAA Fisheries.

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 NOAA Fisheries TRT) of coho salmon consistently return to historical coho salmon 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

Broodstock collection activities have been conducted since 2001, in both the Russian River and Olema Creek. Collection will continue in these locations through 2005 when the program will be re-evaluated.

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 toward 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 contract with the USACE. Since hatchery operations have the potential to affect protected populations of coho salmon, steelhead, and Chinook salmon, Russian River hatchery activities have been included in an ESA Section 7 Consultation between NOAA Fisheries, USACE, and SWCA. In addition, because 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 NOAA Fisheries and CDFG. The current coho salmon recovery program is operated under the authority of Modification 2 to Permit 1067 issued by NOAA Fisheries 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, three ESA-listed salmonid populations are affected by the program:

- CCC coho salmon
- CCC steelhead
- CC Chinook salmon

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

Russian River Coho Salmon

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 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 3-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 approximately 1 year in fresh water 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 3-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 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 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 occur 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 farther 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 generally 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 (13° C) by April in some years (Winzler and Kelly 1978), which may limit the survival of eggs and fry in these areas. At the same time, steelhead observed during diver surveys in the Ukiah and Canyon reaches appeared healthy and vigorous when water temperatures were within a degree of 72° F (22° C), suggesting that steelhead may rear in suitable habitat within the mainstem Russian River through the summer (Cook 2003).

After hatching, steelhead spend from 1 to 4 years in fresh water. 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); 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 generally 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 Chinook Salmon

Although there is some debate over whether Chinook salmon used the Russian River historically, local tribes reportedly harvested Chinook salmon regularly in the upper portions of the East Fork drainage prior to the 1958 construction of Coyote Valley Dam (NMFS 2001a). Chinook salmon of hatchery origin were planted in the watershed sporadically during the 1970s and nearly every year between 1982 and 1998 (FishPro and ENTRIX, Inc. 2000). The total run of wild 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 salmon run and to provide positive identification of 1,322 adult Chinook. A partial run count of 1,299 adult Chinook salmon 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). Between August 8 and December 10, 2002, a total of 5,466 adult Chinook salmon were observed (Chase et al. 2003).

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. A Chinook salmon spawning study conducted in the fall of 2002 documented Chinook redds in the mainstem from the Forks to downstream of Healdsburg Dam (Cook 2003). Redd surveys in 2003 found Chinook redds in the mainstem Russian River and in Dry Creek (Cook 2004). Chinook salmon 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. November 2002). Chinook salmon tissue samples were collected in 2000 by SCWA, CDFG, and NOAA Fisheries 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 coho salmon and steelhead, young Chinook salmon begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, generally ranges from 2 to 4 months, but occasionally Chinook salmon juveniles will spend 1 year in fresh water (Myers et al. 1998). Chinook salmon move downstream from February through June. Ocean residence can be from 1 to 7 years, but most Chinook salmon return to the Russian River as 2- to 4-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 salmon have the potential to be incidentally affected by the coho salmon 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 2001a).

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 2001a).

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

Provide the most recent 12-year progeny-to-parent ratios, survival data by lifestage, 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 lifestage, 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 salmon presented in the status review update (NMFS 2001b) and updated by unpublished CDFG data identify only 15 streams within the entire Russian River basin for which coho salmon 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 salmon presence; 2) the most recent survey did not detect coho salmon but which had an equal or greater number of surveys noting coho salmon presence; and 3) the most recent and the majority of surveys recorded coho salmon absence. The most recent surveys in 2003 found coho salmon present only in Green Valley Creek.

Stream Name	Present Years[1]	Years None Detected	Survey Priority[2]
Willow Creek	1990, 95	1991, 92, 93, 94, 96, 98, 2000, 01, 02, 03	3
Sheephouse Creek	1996, 1995[3]	1998, 2001, 03	2
Freezeout Creek	1995	1994, 96, 2000, 01, 02, 03	3
Ward Creek	1996	2001, 02, 03	1
Dutch Bill Creek	2002	2001, 03	1
Green Valley Creek	1993, 94, 95, 96, 97, 99, 2000, 01, 02, 03	1998	1
Purrington Creek	1994	2001, 03	1
Mark West Creek	1993, 94, 95, 2001	1996, 97, 99, 2002, 03	2
Laguna de Santa Rosa	1994	2003	1
Santa Rosa Creek	1993, 94	1995, 2001, 03	2
Mill Creek	1995	1996, 2001, 02, 03	2
Wine Creek	1998	2001, 02, 03	3
Unnamed (Turtle)[3]	1996	2001, 02, 03	3
Maacama Creek	1993, 94, 95	1996, 97, 99, 2003	3
Redwood Creek	1993, 94, 2001	1995, 96, 97, 99, 2002, 03	3

1. Presence/absence data were modified from NMFS 2001b with CDFG unpublished data.
2 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 salmon.
3. Presence noted in an unnamed tributary.

A reliable estimate of coho salmon abundance within the basin has never been developed. Criteria used by NMFS (2001b) to evaluate population trends for the coho salmon 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 ENTRIX, Inc. 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 salmon, despite sampling in nine of the ten streams where coho salmon were documented within five years. (Coho Recovery Work Group [CRWG] 2001; CDFG 2002).

In 2001 and 2002, 32 and 28, respectively, of the historic coho salmon streams within the Russian River were sampled for juvenile coho salmon. Coho salmon were found in only three of these streams in 2001 and two streams in 2002 (CDFG unpublished data). No coho salmon were observed during survey efforts conducted between 1999 and 2001 on Mark West, Santa Rosa, and Millington creeks for SCWA's Russian River Basin Steelhead and Coho Salmon Monitoring Program (Pilot Study). However, CDFG reports coho salmon present in Mark West Creek in 2001 (CDFG unpublished data). Green Valley Creek appears to be the only current stronghold for coho salmon.

Hedgecock *et al.* (2003) suggested that coho salmon inhabiting Green Valley Creek are at risk of rapid genetic drift owing to the small annual effective population size ($N_b = 10$) estimated from juveniles sampled in that tributary. Using a variety of statistical techniques, Hedgecock *et al.* (2003) found that many of the juveniles sampled for genetic analysis were full siblings. As a result, only 64 of 128 juvenile samples collected in 1998 yielded unique information for the analyses. Garza and Gilbert-Horvath (2003) assayed tissue samples from 308 juveniles captured for use as captive broodstock. The genetic analysis included samples from the Russian River including Green Valley Creek (189 samples), Mark West Creek (four samples), and Mayacama Creek (one sample). In addition, 104 samples were collected from Lagunitas/Olema Creek. The report indicates a high probability of a recent bottleneck in Green Valley Creek, and notes that alleleic diversity in Green Valley Creek is approximately half that noted in Lagunitas/Olema Creek. Based on analyses of genetic distance, the report suggests that coho salmon sampled from the three tributaries within the Russian River can be treated as one population and interbred, but cautions against crossing individuals from the Russian River and Lagunitas/Olema Creek. The report concludes that limited genetic variation noted for sampled juveniles suggests that they arose from few spawning adults, supporting the conclusions of Hedgecock *et al.* (2003). As a result, the report warns that Russian River coho salmon run the risk of inbreeding depression even with the implementation of minimum kinship mating protocols, however the risks posed by inbreeding are likely outweighed by the demographic risks imposed by low escapement.

Though limited in sample size, coho salmon data collected since 1989 indicate small numbers of coho salmon exist within relatively isolated pockets of the Russian River. On this basis, it is suggested that coho salmon 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 regard 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 2000a).

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 salmon 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, and 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 salmon program proposed in this HGMP will remove up to 300 juvenile coho salmon from the wild each year, as allowed under existing Permit 1067 (NMFS 2001a). The proposed broodstock collection activities are described in Section 3.7.2 and are very similar to the capture events conducted in 2001 and 2002 under Permit 1067. Depending on the survival exhibited following the first few years of captive rearing, it may be desirable to consider increasing the broodstock take to 600 juvenile coho salmon. Under the conditions of Permit 1067, CDFG will submit a request for permit modification to NOAA Fisheries by October 1 of each year, if and when there are any occurrences in which CDFG wants to change the parameters of the program.

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 coded wire tag (CWT) will be applied. The annual take associated with these activities equates to the release goal of 100,000 fish. PIT tags are expected to provide information only upon adult return, and there are no plans at this time to install PIT tag detectors that would enable information to be collected regarding juvenile outmigration.

Monitoring and evaluation efforts for the proposed coho salmon 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 salmon 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 (BMPs) will be utilized for all program activities, some unintentional mortalities will 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 lifestage (juvenile and adult) quantified (to the extent feasible) by the type of "take" resulting from the hatchery program (e.g., capture, handling, tagging, injury, or lethal take).

See Table 2, which follows Section 3.14 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 salmon collected for broodstock will be completed after each capture event to ensure the "take" does not exceed the permitted level.

- At the first indication that the artificial production component may exceed the 100,000 smolt production goal, NOAA Fisheries will be notified of the condition. The TOC will debate the possible alternatives and make a recommendation to NOAA Fisheries regarding disposition of any excess eggs, fingerling, or smolts beyond the current 100,000 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 NOAA Fisheries 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 salmon 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.

Currently, CDFG operates DCFH under USACE Contract No. DACW07-03-R-0011, as accepted in April 2004 (USACE 2004). The period of this contract extends through September 2004, with an option of four yearly extensions being granted through the same contract.

The USACE, SCWA, and NOAA Fisheries have entered into a 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 NOAA Fisheries, USACE, CDFG, California Resources Agency, California Environmental Protection Agency, SWRCB, NCRWQCB, BML, 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 NOAA Fisheries in December 2000 (CDFG 2000a). The draft plan is currently under review by NOAA Fisheries. The draft HGMP discusses activities of the steelhead program that have the potential to affect the DCFH coho salmon program.

CDFG developed a draft Russian River Basin Fisheries Restoration Plan that was released in August 2002 (CDFG 2002). The coho salmon 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 salmon must be returned to the water unharmed. This strategy is effective in minimizing direct fishing mortality to listed coho salmon, steelhead, and Chinook salmon. 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 salmon 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 past 12 years (1988 to 1999), if available.

There are no fisheries benefits intended from the coho salmon program.

3.3.4 Relationship to Habitat Protection and Recovery Strategies

3.3.4.1 Factors Affecting Natural Production

Several varied factors are believed to affect the natural production of coho salmon, steelhead, and Chinook salmon in the Russian River basin. The major factor is most likely the loss or severe 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, because no fisheries target coho salmon. Potential effects that may have been derived from the original Russian River coho salmon mitigation/enhancement operations are believed to be minimal, especially with implementation of CDFG policies in the late 1990s restricting inter-basin fish transfers (FishPro and ENTRIX, Inc. 2000).

3.3.4.2 Habitat Protection Efforts

Ongoing habitat restoration activities have been initiated in the Russian River basin at many locations. All survey activities have been carried out in accordance with techniques outlined in the California Salmonid Stream Habitat Restoration Manual (CDFG 1998). CDFG, SWCA, and their partners and volunteers competed surveys of approximately 96 percent of the streams in the watershed between 1994 and 2003. Inventories in the remaining 10 streams could not be completed due to inability to secure landowner permission. 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

3.3.5.1 Organisms that Could Negatively Impact Program

Organisms that have the greatest potential to cause significant negative effects to the DCFH coho salmon recovery program are predators (fish, otters, birds, and marine mammals) that consume coho salmon 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 (Chase et al. 2000). Snorkel surveys conducted in the mainstem Russian River between Ukiah and Healdsburg in 2002 documented native and non-native species, including, among others, pikeminnow, smallmouth bass, carp, and green sunfish (Cook 2003).

The relative abundance of predator species is not known for most of the tributaries of the Lower Russian River basin where key coho salmon habitat occurs. During SCWA's Russian River Basin Steelhead and Coho Salmon Monitoring Program, native and non-native warmwater species, including Sacramento pikeminnow, were documented in a lower reach (in a channelized section designated as a Rosgen F4 channel) of Mark West Creek, but the sampled population in the upper Rosgen B2 (natural) channel headwaters was composed entirely of steelhead. Snorkel surveys in Sheephouse Creek in 2000 documented steelhead, sculpin and suckers, and in Green Valley in 2001 documented, steelhead, coho salmon, roach, stickleback, green sunfish, and sculpin (Cook et al. 2002).

3.3.5.2 Organisms that Could Be Negatively Impacted by Program

The DCFH coho salmon recovery program has the potential to negatively affect 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 ENTRIX, Inc. 2002).

3.3.5.3 Organisms that Could Positively Impact Program

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

3.3.5.4 Organisms that Could Be Positively Impacted by Program

Because the population level of wild Russian River coho salmon is believed to be below the critical population threshold, any hatchery-origin coho salmon 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.

3.4.1.1 Existing DCFH Water Source

Attachment 2 provides flow schematics, hydraulic schematics, and piping diagrams of the DCFH process water system that can be useful in understanding the following descriptions.

Surface water is obtained for hatchery use from the stilling basin of Warm Springs Dam. The water released from Lake Sonoma can be taken from four different intake portals. 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. Each portal is located at a different elevation in the lake. When the lake is low, the highest portal may be exposed and no longer available to supply water. (This portal was repaired in 2002 after having been out of service for some time, and it is now operable when submerged.) Water release rates from the various portals are commonly proportioned so that the temperature of the combined flow is between 48° F and 58° F, which provides good conditions for hatchery operations.

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 via a 42-inch pipe to an aeration structure near the hatchery building. The aeration structure consists of a concrete basin, containing approximately 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 DO levels and then allowed to settle. The water then passes through a screening process, at which point it can be routed to the hatchery building for further treatment and use in incubation and early rearing, or to the rearing raceways for use without additional treatment. (Generally, eggs and fry are more sensitive to suboptimal 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 UV 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 gpm.

The total hatchery water demand for full capacity fish production operations is 25 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. Because it is possible to divert all releases through the hatchery, it has not been a problem to obtain all flow necessary to maintain hatchery operations, even under drought conditions. When broodstock collection and adult holding operations are conducted under the 25 cfs limitation of drought conditions, the hatchery manager will typically adjust flow regulation gates and weirs at the aeration basin to ensure that adequate flow is still maintained to the holding ponds and ladder.

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 MSL), and at elevations of 350, 390, and 430 feet MSL. However, because the water level in Lake Sonoma is often lower than elevation 430 feet MSL, there are times when the highest portal is exposed and cannot be used for releases. 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, turbidity levels in the lower levels of the lake are often higher than desirable to be used in the hatchery (R. Gunter, CDFG, pers. comm. August 19, 1999). As a result, only the two intermediate portals are typically used to provide water for the hatchery and for downstream releases.

An EWS 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 EWS 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. USACE personnel follow procedures to fill the 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 EWS requirements. A standby generator is available to provide power for operations during a power outage.

The EWS 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 EWS 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, but this limited supply would support only approximately 10 percent of the typical facility demand. As another option, two 75 HP pumps located near the effluent discharge location (normally used to prevent backflow inundation of the facility under high stream flow conditions) can recirculate effluent water from the settling basins to the aeration structure. Past use of this recirculation system, however, exhibited high mortality to the extent that its use is generally discouraged. 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, nonchilled 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 discontinued use. In the expansion raceways, the water passes from the raceways to a 36-inch drainpipe that carries it to the pollution control pond. Thus, water is continually delivered to the raceway from the aeration structure, rather than recirculating back through the system.

3.4.1.2 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 EWS system and the existing emergency supply pipeline would be subsequently removed, thereby removing a dam safety issue. A feasibility study to determine the best design option is planned for 2005-2006, with possible construction starting in December 2007 or later (USACE 2003).

3.4.1.3 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 NOAA FISHERIES 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 NCRWQCB 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 coho salmon, steelhead, and Chinook salmon. 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
DO	> 7.0 mg/l
Flow – DCFH	15.5 million gallons/day

mg/l = milligrams per liter

Compliance is monitored by sampling the facility effluent two times per month, with results submitted in a monthly report to the NCRWQCB. It is further stipulated that sampling occur during cleaning operations, because this is the aspect of fish production 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 DO level in the receiving waters during times of low flows may drop below the 7 mg/l limit and therefore may benefit from the hatchery maintaining an effluent limit greater than 7 mg/l. Effluent from the hatchery will contribute to the total load of solids in the receiving waters. The settleable and suspended solids levels discharged are slightly higher than that of 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 YOY juvenile coho salmon 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. It is desirable that the sampling be conducted only when water temperatures are less than 65° F. Unfortunately, due to the limited opportunity to conduct the field sampling, it will likely not be possible to schedule backup dates in case of warmer temperature. Hand seining will be the only capture method employed when temperatures exceed 65° F. 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 salmon, 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 salmon program is used for the following activities:

- Transport of captured juveniles from their capture stream to DCFH;
- Transport and release of coho salmon fingerling from DCFH to selected release points; and

- Transfer of coho salmon 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 1,200-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 equipment, but the tanks are well-insulated. The transit time for DCFH/CVFF fish transport activities generally require less than 45 minutes of travel and occur during the cooler months of December through April. Because transport loads show no change in water temperature when discharged, there is no need to chill the water with ice. Transport densities are monitored to stay below 1,300 pounds of fish per load for the 800-gallon truck and 1,800 pounds of fish per load for the 1,200-gallon truck.

Smaller-scale transport units are sometimes used at either facility consisting of 150-gallon or 350-gallon insulated tanks outfitted for use in pickup trucks. The 150-gallon units are oxygenated using bottled oxygen and air stones and are loaded to carry no more than 50 pounds of fish. The 350-gallon unit has a fresh-flow aerator and is operated to carry a maximum load of 500 pounds of fish.

Captured broodstock will also be transported in aerated coolers when sampling in remote locations. Temperature and stress are routinely monitored when aerated coolers are used.

DCFH and CVFF training for transport operations includes instruction on response to unforeseen delays, such as truck breakdowns or traffic hold-ups. Staff are instructed to 1) notify the DCFH office immediately to begin procedures for sending backup transport trucks (or other arrangements as appropriate); 2) begin monitoring of water temperatures and DO levels in the tank; 3) determine the nearest stream release location; and 4) if the environmental conditions within the tank approach conditions that are lethal for fish, go to the release location and release the fish.

3.5.3 BROODSTOCK HOLDING AND SPAWNING FACILITIES

From the start-up of the coho salmon recovery program through July 2003, juvenile captive broodstock were held 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 were modified with additional screen guides to increase the number of separate groups that were able to be segregated within an individual tank.

As of July 2003, the fish on hand for the coho salmon recovery program were introduced into newly constructed facilities at DCFH. The facilities include six intermediate juvenile rearing troughs measuring 16 feet long by 3 feet wide with a 2.5-foot water depth. Also included for the broodstock are six circular tanks, 20 feet in diameter, with a 4.5-foot water depth. An additional expansion is planned for 2004 to double the number of troughs and tanks and provide a building enclosure for the area. Rearing-pond densities for the captive broodstock will be managed so they do not exceed a maximum density of 1.0 lb of fish per ft^3 of space.

Specific procedures for spawning the captive broodstock will be decided by the TOC prior to the first spawn, anticipated in late 2003 or early 2004. At present, the spawning facilities are expected to involve the following. 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. Coho eggs are expected to be incubated at 52°F.

Ideally, coho salmon egg incubation would be conducted in the new coho salmon building constructed in 2003. However, as the water supply to the new building does not have provisions for filtration and UV disinfection, it will be preferable to conduct coho salmon incubation in the DCFH hatchery building.

3.5.5 Rearing Facilities

New facilities for the coho program were constructed at DCFH during early 2003. Fingerling rearing will be conducted in six intermediate juvenile rearing troughs measuring 16 feet long by 3 feet wide with a 2.5-foot water depth. An additional expansion is planned for 2004 to double the number of rearing troughs and provide a building enclosure for the area. There are potential plans to provide equipment for filtration and disinfection during the expansion.

3.5.6 Acclimation/Release Facilities

Fingerlings will be directly released in the late spring and advanced fingerlings will be directly released in the late fall. Releases will occur in Sheephouse, Freezeout, and Austin Creek (and tributaries including Ward, Gilliam, and Gray), Mill Creek (and tributaries including Felta, Palmer, and Dutchbill). Release locations were selected by CDFG based on habitat inventories (Flosi et al. 1998). Release group size is based on reviews of the scientific literature and observed fry and smolt density from long-term studies on Green Valley Creek, Russian River and Olema Creek, Lagunitas system (NPS – Brannon Ketchum and Merrit-Smith Consulting – Mike Fawcett). The first release of coho salmon fingerlings is scheduled to occur in 2004.

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 51,000 coho salmon, 100,200 steelhead trout, and 9,300 Chinook salmon. 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 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 approximately 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.

The facility has been modified to provide additional backup provisions, including:

- Addition of a bypass pipeline for EWS;
- 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.

Training of personnel now includes routine practice drills for appropriate response to emergency conditions. These practice drills are conducted two times per year.

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

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 salmon program will be 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, 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. NOAA Fisheries has concluded from available data that the basin has an abundance of coho salmon greater than the viable population threshold, and therefore the population will not be significantly affected by an annual removal of approximately 150 to 300 individuals. However, genetic analyses of the 2001 broodyear from Olema Creek indicate that it is genetically isolated from the Russian River stock and not appropriate for use in Russian River recovery efforts (Garza and Gilbert-Horvath 2003). Genetic analysis of the 2 subsequent broodyears is underway to determine whether this large genetic distance is temporally stable. Additionally, these genetic analyses indicated that coho salmon from three tributaries (Green Valley, Mark West and Maacama) of the Russian River were very closely related, suggesting that the extant populations in the river can be managed as one stock. Initial consideration for broodstock sources had also been given to the Albion and Noyo basins in Mendocino County, but genetic analyses indicate that the Noyo is also genetically isolated, and thus inappropriate for use in the Russian River, and the status of the Albion coho salmon stock is unknown. Coho salmon previously collected for broodstock purposes could be released into Walker Creek (Garza and Gilbert-Horvath 2003). Releasing these fish in Walker Creek could be considered beneficial, since coho are considered extinct in that location.

Parallel to broodstock capture efforts, CDFG has undertaken a statewide presence absence survey for coho salmon, funded under a cooperative contract with the Pacific States Marine Fisheries Commission. Within the Russian River, beginning in 2001, crews performed a modified ten pool protocol (Hankin 2000) to identify the presence of coho salmon in 32 historically occupied streams.

To date, capture crew collected Russian River coho salmon juveniles from Green Valley Creek, Redwood, and Mark West Creeks (2001), Green Valley and Dutchbill Creeks (2002), and Green Valley Creek (2003). Capture locations for 2004 will be determined using recent genetic information (Garza and Gilbert-Horvath 2003).

With approval of NOAA Fisheries, the CDFG may discretionarily rescue juvenile coho salmon from receding pools and release them in perennial habitats. Alternatively, these juveniles may be held at the hatchery and released in the fall when streamflows increase.

3.6.2 SUPPORTING INFORMATION

3.6.2.1 History

Between 1937 and 1998, approximately 2.3 million hatchery coho salmon were planted in the Russian River basin. Most of these outplants (approximately 70 percent) occurred between 1981 and 1998 with implementation of the USACE coho mitigation and enhancement program. This program was discontinued in 1999 due to the lack of sufficient numbers of Russian River coho salmon broodstock.

A detailed review of hatchery records conducted by SEC (1996) revealed that at least five out-of-basin coho salmon stocks were introduced to the Russian River as a result of outplanting, most of them from hatcheries in the North Coast region. These out-of-basin broodstock sources (with the last known year of planting noted in parentheses) included the Alsea River, Oregon (1972), Eel River (1990), Klamath River (1988), Noyo River (1998), and Soos Creek, Washington (1978). The management plan developed for implementation of the DCFH and CVFF programs stated that coho eggs from the Noyo and Eel rivers were acceptable to use to meet the mitigation and enhancement goals for the DCFH coho program. Russian River coho salmon served as the broodstock for 32 percent of all outplants between 1937 and 1998.

Implementation of the RRCSRP in 2001 began with the collection of 227 YOY juvenile coho salmon 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 salmon. The actual selection of broodstock for the coho salmon 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 NOAA Fisheries 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 salmon population.

Broodstock Source[1]	Years Outplanted	Total Outplants[2]
Russian River	1983, 85-98	752,372
Alsea River, Oregon	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, 86-91, 93, 97-98	687,820
Soos Creek, Washington	1978	8,420
Unknown		403,340
Total		**2,387,225**
Percent Russian River Origin[3]		**32%**

Notes:

1. The first outplants from DCFH occurred in 1981. All coho outplants prior to 1981 were transferred in to the basin from other facilities and directly released in the Russian River
2. Data compiled from SEC (1996) and DCFH (1996, 1997, and 1998). Some historical records are incomplete. This compilation is intended to convey general magnitude of hatchery planting rather than exact numbers.
3. As planting records are incomplete, this is only an estimate based on numbers presented in this table. Out-of-basin sources were planted extensively in the past, but this practice was diminished and then discontinued in more recent years.

3.6.2.2 Annual Size

The proposed broodstock collection goal as described in this HGMP is to collect 300 to 600 juvenile coho salmon annually. The current goal as described in Permit 1067 is to collect 200 to 300 juvenile coho salmon annually. Justification for the proposed increase is presented in Section 3.7.4. Actual numbers collected each year will be entered into CDFG inventory forms and included in the Permit 1067 annual report provided to NMFS. Any mortalities from the collection efforts, or any mortalities in the hatchery following collection, will be documented on CDFG loss sheets, entered into inventory, and included with the annual report.

3.6.2.3 Past and Proposed Level of Natural Fish in Broodstock

With the original coho salmon mitigation/enhancement program, there was no way to determine (with absolute certainty) whether coho salmon 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

Two pertinent studies of coho salmon genetics have been completed, and are discussed in this section.

3.6.2.4.1 Hedgecock et al. 2003

Genetic variation in coho salmon across the entire Pacific Northwest was examined (Hedgecock et al. 2003). 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 less than 24 per region). The author suggested that modern coho salmon arose recently from a single ancestral population, historical coho salmon 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 that 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 NOAA Fisheries 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 salmon 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 Springs 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 salmon broodstock program (Hedgecock et al. 2001). (Samples analyzed were not from the 2001 collection program). Coho salmon 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 that 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 three populations to test for sibling relationships, including the Green Valley population. The Green Valley coho salmon 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 CCC stocks (Noyo to Olema) to restock the Russian River is justified.

BML used nuclear DNA to document coho salmon population diversity within the CCC ESU, with a special emphasis on the Russian River basin (Hedgecock et al. 2003). Low numbers of spawners in the Russian River watershed have resulted in extensive reliance on the sampling of juveniles, so molecular markers were developed to distinguish coho salmon from Chinook salmon and steelhead.

The BML study generally supported the California ESU structure, which includes the CCC, the South of San Francisco ESU recognized by California's ESA, and the Eel and Mattole River samples from the Southern Oregon/Northern California ESU. However, even after the genetic tree was adjusted for admixture and family structure, the node separating the South of San Francisco ESU and a large proportion of the CCC ESU was not supported. Green Valley Creek in the Russian River and Redwood Creek in Marin were outliers in the genetic tree.

3.6.2.4.2 Garza and Gilbert-Horvath 2003

The NOAA Fisheries 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.

To date, this study has reported results from tissue samples of 308 juveniles captured for use as captive broodstock. The genetic analysis included samples from the Russian River including Green Valley Creek (189 samples), Mark West Creek (four samples), and Mayacama Creek (one sample). In addition, 104 samples were collected from Lagunitas/Olema Creek. The report indicates a high probability of a recent bottleneck in Green Valley Creek, and notes that alleleic diversity in Green Valley Creek is approximately half that noted in Lagunitas/Olema Creek. Based on analyses of genetic distance, the report suggests that coho salmon sampled from the three tributaries within the Russian River can be treated as one population and interbred, but cautions against crossing individuals from the Russian River and Lagunitas/Olema Creek. The report concludes that limited genetic variation noted for sampled juveniles suggests that they arose from few spawning adults, supporting the conclusions of Hedgecock *et al.* (2003). As a result, the report warns that Russian River coho salmon run the risk of inbreeding depression even with the implementation of minimum kinship mating protocols, however the risks posed by inbreeding are likely outweighed by the demographic risks imposed by low escapement.

3.6.2.5 Reasons for Choosing

A preference is given to Russian River coho salmon in order to ensure 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 salmon 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 salmon recovery program will collect only YOY juvenile coho salmon.

3.7.2 COLLECTION OR SAMPLING DESIGN

The coho salmon program proposes to collect 300 to 600 juvenile coho salmon 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 to 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. 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 salmon 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 retention of 10 coho salmon per pool for broodstock. When more than 10 juveniles are collected from a receding pool, they will be released in alternate locations at the discretion of the CDFG field biologist. Where many coho salmon 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 year-class and to reduce chances of relatedness between individuals.

Captured juveniles will be transported to the hatchery in aerated coolers with non-chlorinated ice for temperature regulation. Upon arrival juveniles will be inspected by a CDFG pathologist. Following the health inspection fish will be measured, weighed, and placed into troughs. Juveniles from different streams and potentially different reaches will be placed into separate troughs. Tissue samples will be taken once juvenile fish reach a size deemed appropriate.

3.7.3 IDENTIFICATION

Hatchery origin fingerlings will be marked with a single coded wire tag (CWT) and adipose fin clip. Advanced fingerlings will have a CWT implant in the snout and caudal region as well as an adipose fin clip. Visual implant elastomer tags will be deployed when multiple tributaries are stocked. All juvenile fish collected as part of the broodstock collection efforts will be evaluated for marks. Any captured coho salmon found to contain a mark will not be used for broodstock and will be released back to the capture location after recording mark information.

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 300 juvenile coho annually; the current goal as described in Permit 1067 is 200 to 300 juvenile coho salmon annually. Current program goals will be followed until such time as NOAA Fisheries and TOC recommendations can be evaluated, and facility capacity can be assessed.

A benefit-risk analysis recently completed to assess Russian River coho salmon program alternatives recommends a conservative broodstock collection goal of 500 to 600 juvenile coho salmon annually (FishPro and ENTRIX, Inc. 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 salmon 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 the numbers as needed to maintain management goals.

3.7.4.2 Broodstock Collection Levels for the Past 12 Years, or for Most Recent Years Available

Brood Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
2000	122	114	0	29	309
2001	NA	NA	11	NA	461
2002	NA	NA	NA	NA	397
2003	NA	NA	NA	NA	302

Data source: DCFH 2003; L. Conrad, pers. comm. 7/19/04.

Brood Year	Pre-Spawn Mortality Rate (to date)	Current Number
2000	13%	0
2001	17%	371
2002	0.25%	396
2003*	0%	302

*Brood year 2003 juveniles were recently selected from brood year 2000 progeny.

3.7.5 Disposition of Hatchery-Origin Fish Collected in Surplus of Broodstock Needs

No hatchery-origin fish will be collected to serve as broodstock for the coho salmon recovery program.

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. At the capture location, the transport truck will be filled with stream water using a portable, screened pump. When the transport vehicle reaches DCFH, an acclimation period will be enacted as necessary if the vehicle haul water differs by more than five degrees Fahrenheit from the temperature of the facility receiving water. This is typically done by slowly adding facility water to the haul water, until they match.

The transit time for hauling from the capture locations to DCFH is estimated at 1 to 2 hours.

Smaller-scale transport units are sometimes used at either facility consisting of 150-gallon or 350-gallon insulated tanks outfitted for use in pickup trucks. The 150-gallon units are oxygenated using bottled oxygen and air stones and are loaded to carry no more than 50 pounds of fish. The 350-gallon unit has a fresh-flow aerator and is operated to carry a maximum load of 500 pounds of fish.

Captured broodstock will also be transported in aerated coolers when sampling in remote locations. Temperature and stress are routinely monitored when aerated coolers are used.

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 salmon throughout the duration of captive broodstock holding.

Captured juveniles brought to DCFH will be treated with an eight hour oxytetracycline bath followed by a three day course consisting of a one hour formalin drip at 170 parts per million. 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. During 2001, the fish experienced problems due to fungus, therefore since 2001, the fish have received a 3-day iodophore treatment that has been very successful in treating fungus. Following a two week quarantine period, the captured juveniles will be combined with other individuals from the same watershed group.

3.7.8 DISPOSITION OF CARCASSES

Carcasses arising from hatchery mortalities are generally disposed of through the DCFH solid waste disposal system, which involves ultimate disposal at the municipal disposal facilities. Any carcasses derived from mortalities that have undergone adequate depuration following chemical treatment could presumably be used to provide nutrient loading in streams, and it is anticipated that the TOC will explore this option.

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° F at the capture site. It is desirable that the sampling be conducted only when water temperatures are less than 65° F. Unfortunately, due to the limited opportunity to conduct the field sampling, it will likely not be possible to schedule backup dates in case of warmer temperature. Hand seining will be the sole sampling method employed when temperatures exceed 65° F.

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. (These efforts will likely be led by the genetics committee chair, Carlos Garza.) 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 salmon to use in the spawning process. There are no plans at this time to develop a second, duplicate holding population that might serve as a backup in the event of catastrophic loss.

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 precociousness may be induced through hormone treatments. It is also possible that some captive brood will mature late due to slower growth rates in captivity (Oregon Department of Fish and Wildlife [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, and weigh this against the potential risk of increasing the incidence of precocity in the natural population.

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. Effluent from hatching jars undergoing isolation incubation is discharged directly to the DCFH settling basin, and the effluent therefore has no opportunity to transmit pathogens to other fish in the DCFH environment. When the results of pathological analysis are known, fish can be relocated, treated, or destroyed as appropriate.

3.8.4 CRYOPRESERVED GAMETES

Cryopreservation equipment has been purchased to allow long-term storage of milt.

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 salmon 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 salmon 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 salmon program operated by the ODFW has experienced an average prespawning mortality approaching 40 percent (T. Hofnagel, ODFW, pers. comm. 2001), while a captive coho salmon 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 salmon mitigation/enhancement program at DCFH had assumed a fecundity of 2,000 eggs per female (FishPro and ENTRIX, Inc. 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 salmon pilot project was 1,909, though the broodstock were derived from hatchery returns rather than juveniles captured from the wild (ODFW 2001).

The coho salmon program permit application assumed an egg take of 230,000 and the availability of 200,000 fingerlings, suggesting an overall mortality of 17 percent from green egg to fingerlings. The Alsea captive coho salmon 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 salmon recovery program is the reason for suggesting future consideration of a broodstock collection goal greater than 300 fish, 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 production goal of 100,000 advanced fingerlings, NOAA Fisheries will be notified of the condition. The TOC will discuss the possible alternatives and make a recommendation to NOAA Fisheries regarding disposition of any excess eggs, fingerlings, or smolts beyond the current goal of 100,000 advanced fingerlings.

3.9.1.3 Loading Densities Applied during Incubation

Vertical flow incubators (Heath Trays) are used at DCFH only for disease segregation purposes. Individual female egg lots that test positive are isolated in a single tray of a dedicated stack until tests for BKD confirm that disease is no longer a risk. Following this period, up to 16 trays can be combined in a stack to reduce water demand. Alternatively, most eggs are reared 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: 4 inch – 112.6 cubic inches, 6-inch – 254.4 cubic inches, 8-inch – 452.2 cubic inches, 10-inch – 706.5 cubic inches, and 12-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 3 to 12 gpm and adjustment can be made for individual units.

Eggs from each coho salmon female will be incubated in a separate hatching jar until lab tests for 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 DO levels of around 9 to 10 mg/l. Silt is controlled through the use of sand filters; however, the filters can be only marginally effective following the first storm event of each year. 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° F to 54° F. Upon swimup, the larval coho salmon will flow out of the hatch jar into the nursery tank in which the hatch jar is located. Coho salmon released as fingerlings will be reared in the nursery tanks until the time of release. Coho salmon to be released as smolts will be reared in the nursery tanks for approximately 6 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 CDFG 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 lifestage (fry to fingerling, fingerling to smolt) for the most recent 12 years (1988 to 1999), or for years dependable data are available.

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

Management guidelines for the original coho salmon mitigation/enhancement program at DCFH had assumed a survival rate from unfertilized egg to stocked yearling of 50 percent. These early management guidelines were often conservative to assure that production goals were attained, although it is assumed that the values had some basis in performance measured at other hatcheries throughout the state.

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 12 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 fingerlings, and are classified as fingerlings until they reach 20 fpp, at which time they are classified as yearlings. Yearling smolts are classified as such when they approach 4 to 5 fpp.

3.9.2.2 Density and Loading Criteria (Goals and Actual Levels)

Rearing-pond densities for fish to be released will be held at low densities so they do not exceed 1.5 lb/ft^3. Lower densities will be maintained whenever possible. Fish will be reared to a target release size that mimics the size of natural fish of the same age, to minimize the risk of predation and competition with natural fish upon release.

3.9.2.3 Fish Rearing Conditions

All coho salmon 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. DO of influent and effluent is analyzed in the laboratory weekly (Winkler Titration) and can be checked as needed at other times with a DO meter. Other water quality data that are collected during laboratory analysis include 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.

The biological staff collect fish weight and fork length on a quarterly basis for all coho broodstock. Progeny are weighed quarterly, with periodic length measurements. Data are used to calculate condition factor and track growth.

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 have 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). Weight-count measurements are conducted by placing a bucket of water on a scale and weighing it, introducing a known number of fish into the bucket, and recording the weight of the fish after subtracting the tare weight of the bucket and water. The procedure is repeated 3 to 4 times and used to determine an average fish weight. Fish length data are collected quarterly for broodstock and periodically for progeny.

3.9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g., Percent body weight/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. In general, however, coho salmon captive brood are being fed at the same rates as comparably sized production fish.

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 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 lifestages of coho salmon 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 salmon program.

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

The "natural" rearing methods described by the Conceptual Framework for Conservation Hatcheries (Flagg and Nash 1999) that are used in the coho salmon program include low-density rearing and shaded ponds.

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 minimize 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	83,400 (ranging 4,300 to 36,600 depending on stream)	120	May-Jun	5 streams: Felta, Mill, Freezeout, Sheephouse, Ward
Fingerling (advanced size)	4,650 (ranging 1,000 to 2,000 depending on stream)	16-60	Oct-Nov	5 streams: Felta, Mill, Freezeout, Sheephouse, Ward
Yearling	0	NA	NA	NA

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

Release point:	Up to 5 watersheds: Mill, Freezeout, Sheephouse, Austin, Green Valley, Butchbill
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 releases is anticipated in 2004. The numbers of fish to be released in 2004 will be dependent on the rearing survival of this first group of fish. The release strategy currently being considered by the TOC involves release of approximately 60 percent of available fish as fingerlings in late spring, with subsequent release of the remaining 40 percent as advanced fingerlings in the fall. Numbers released to each of five streams will vary according to habitat availability; preliminary estimates of maximum release numbers to each of five proposed release streams in 2004 are as follows:

Stream	Fingerling	Advanced Fingerling
Felta	4,300	200
Mill	30,600	1,700
Freezeout	4,800	300
Sheephouse	7,500	400
Ward	36,600	2,000
Total	**83,800**	**4,600**

3.10.4 ACTUAL DATES OF RELEASE AND DESCRIPTION OF RELEASE PROTOCOLS

The first fish release is anticipated in late spring 2004 for fingerlings, and fall 2004 for advanced fingerlings. Release protocols for fingerlings and advanced fingerlings will be developed by the TOC prior to release.

3.10.5 FISH TRANSPORTATION PROCEDURES, IF APPLICABLE

Juvenile fish are typically loaded into transport vehicles manually using collers, buckets, backpacks, 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 and aerated coolers. 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

A subsample of coho salmon released as advanced fingerlings would be acclimated for 72 hours to monitor mortality and then released.

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

All hatchery origin fingerlings will be marked with a single coded wire tag (CWT) and adipose fin clip. All hatchery origin advanced fingerlings will have a CWT implant in the snout and caudal region as well as an adipose fin clip. Visual implant elastomer tags will be deployed when multiple tributaries are stocked. 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 production goal of 100,000 advanced fingerlings, NOAA Fisheries will be notified of the condition. The TOC will discuss the possible alternatives and make a recommendation to NOAA Fisheries regarding disposition of any excess eggs, fingerlings, or smolts beyond the current 100,000 production 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 emergency bypass water pipeline and well water and 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. Although 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 EWS bypass pipeline, hatchery personnel must first contact the USACE office to request the EWS 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

EWS 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 EWS bypass pipeline. This 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 (for example, 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 that would require the use of the EWS bypass line. Power system failures requiring the operation of the standby generator are the most common operational difficulties encountered at DCFH occurring frequently 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 DO 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. Juvenile fish would be able to swim voluntarily from the water-pollution control pond through an adult bar-screen and 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, advanced fingerling releases will occur where there are no known extant populations or current-year classes of wild fish.

Advanced fingerling releases will be similar in size 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. Data collection efforts of CDFG, NOAA Fisheries, and TOC are underway, which address many of the Performance Indicators. 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 "Recommended" indicates that data collection efforts have yet to be implemented. At present, there is no firm timeline for completing the implementation of these performance indicators. It is assumed that final definition and implementation of the performance indicators will be included in the Section 7 Consultation with NOAA Fisheries.

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, Inc. 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
B1.	**Conservation of genetic and life-history diversity.**		
B1A.	Use number of adults necessary to achieve MEPS. Trend target in 4 out of 5 years + 10%.	Ongoing	3.2
B1B.	Evaluate whether life-history characteristics were maintained by comparing baseline at year 1 with 5-year survey, or after one generation.	Ongoing	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.	Ongoing	1.2, 2.1
B1E.	Cryopreservation - implement RM&E plan.	Ongoing	3.3
B2.	**Restore and create viable naturally-spawning populations.**		
B2A.	Manage for increasing trend of redd counts as index of natural spawning.	Ongoing	2.1
B2B.	Manage for increasing numbers of adult fish.	Ongoing	2.1

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
B2C.	Manage for increasing trend in juvenile anadromous fish rearing densities in #'s/m^2 by habitat.	Ongoing	2.1
B2D.	Manage for increasing trend in nutrients from adult carcasses in tributaries.	Recommended	2.1
B2E.	Manage for increasing F2 spawners.	Ongoing	2.1
B3.	**Coordinate with ongoing research on mainstem passage and habitat utilization, and provide fish as needed.**		
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
B4.	**Conduct within-hatchery research to improve the performance or cost-effectiveness of artificial production hatcheries.**		
B4A.	Develop comprehensive regionally coordinated RM&E plan for all hatcheries in the basin.	Ongoing	5.2
B4B.	Develop a research study plan.	Recommended	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.	Ongoing	2.1
B4E.	Establish research priorities by evaluating performance indicators which haven't been met. Standard is adaptive management.	Ongoing	1.1
B5.	**Fulfill mitigation/policy obligations.**		
B5A.	Assure that mitigation and policy obligations of the hatchery are met.	Ongoing	None
B6.	**Achieve within-hatchery performance standards.**		
B6A.	Assure that hatchery performance standards established in the DCFH/CVFF Management Plan are achieved.	Ongoing	1.1.1
B6B.	Relevant statewide hatchery performance standards are achieved.	Ongoing	1.1.1
B7.	**Recommend improved performance indicators to better measure performance standards.**		
B7A.	Evaluate effectiveness of performance indicators using adaptive management in order to more accurately measure performance through audit process.	Ongoing	5.2
B7B.	Evaluate and implement relevant regional hatchery production guidelines.	Ongoing	5.2
B8.	**Minimize management, administrative, and overhead costs.**		
B8A.	Manage the process to accomplish declining expenditures for	Ongoing	None

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
	administrative overhead.		
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.	In Development	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
R1.	**Assess detrimental genetic effects among hatchery vs. wild stocks where interaction exists.**		
R1A.	Implement specific genetic effects measurements on a selected basis.	Ongoing	3.1. 3.2
R2.	**Assess survival of captive broodstock progeny vs. wild cohorts.**		
R2A.	Achieve increased survival threshold for captive broodstock over wild adults.	Ongoing	1.2, 2.1
R2B.	Implement HGMP where appropriate.	Ongoing	5.3
R2C.	Evaluate and implement relevant regional hatchery production guidelines.	Ongoing	5.3
R3.	**Assure there is no depletion of naturally-spawning populations through broodstock collection.**		
R3A	Document stable or increasing trend of redd counts as index of natural spawning.	Ongoing	2.1
R3B	Document stable or increasing numbers of adult fish.	Ongoing	2.1
R3C	Document hatchery spawner to recruit ratio equal to or greater than 1.	Ongoing	2.1
R4.	**Assure there is a predictable egg supply to achieve egg take goals.**		
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
R5.	**Evaluate habitat use and potential detrimental ecological interactions.**		
R5A.	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
R6.	**Assure that program does not exceed the carrying-capacity of fluvial and lacustrine habitats.**		
R6A.	Develop an appropriate RM&E plan to assure program does not exceed the carrying-capacity of freshwater habitats.	Needed	2.1.3
R7.	**Evaluate effect on life-history traits of wild and hatchery fish, from harvest and spawning escapement.**		

	Performance Indicator	Monitoring Status	Cross-Reference to M&E Plan Activity
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
R8.	**Avoid disease transfer from hatchery to wild fish and vice versa.**		
R8A.	Establish comparative annual sampling of disease in hatchery and wild populations.	Ongoing	4.2.1
R8B.	Comply with CDFG standards and NOAA Fisheries 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.	Ongoing	4.2.2

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 salmon 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 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* (FishPro and ENTRIX, Inc. 2002) 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;
- Ongoing effort related to the activity;
- The responsible party for supervising the data collection and reporting efforts; and
- The existing or potential funding source for the activity.

Coho Program

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 HGMP to ensure consistency of hatchery production approaches and quantification of results achieved.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.1	Determine egg-to-fry, fry-to-parr, parr-to-smolt survival rates for each release group.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.2	Document numbers, size, time of release, and release location for all fish.	High	Ongoing	CDFG	USACE
Subactivity 1.1.1.3	Conduct periodic monitoring for size during rearing.	Medium	Ongoing	CDFG	USACE
Subactivity 1.1.1.4	Participate in planning processes for ponding and rearing.	Medium	Ongoing	CDFG	USACE
Subactivity 1.1.1.5	Prepare and submit tag, mark and release reports.	High	Ongoing	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	Ongoing	CDFG	USACE
Subactivity 1.2.1.1	All hatchery origin coho will have clipped adipose fins, in addition fingerlings will be larked with a snout CWT and advanced fingerling releases with snout and caudal CWTs. Elastomer marks will be applied to some release groups to allow identification of individuals released in proximate tributaries.	Med	Needed	CDFG	TBD
Activity 1.2.2	Estimate abundance of hatchery coho salmon departing as smolts, for both fingerling and smolt release groups.	High	Ongoing	CDFG/UC	FRGP
Activity 1.2.3	Quantify the number of hatchery produced coho salmon adults returning to the Russian River basin.	High	Ongoing	CDFG/UC	FRGP
Subactivity 1.2.3.1	Operate traps and ladders at hatcheries to estimate escapement of hatchery-produced coho.	Low	Rec	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	Ongoing	CDFG/HBS	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.	Med	Rec	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 coho salmon adults to the tributary specific areas.	High	Ongoing	CDFG/UC	FRGP
Subactivity 2.1.2.1	Conduct stratified redd surveys.	High	Ongoing	CDFG/UC	FRGP
Subactivity 2.1.2.3	Conduct mark-recapture studies to estimate adult coho salmon escapement as a back-up population estimate if direct measurement is not achieved.	Low			
Subactivity 2.1.2.4	Collect biological information of fork length, sex, scales, general fish health, examine for marks/tags, scan with CWT scanners, and collect fin tissue sample for DNA analysis (see Objective 3) from all adult coho salmon captured in individual tributaries.	High	Rec	CDFG	TBD
Activity 2.1.3	Conduct juvenile density surveys.	Med	Ongoing	CDFG/UC	FRGP
Activity 2.1.4	Operate juvenile emigration traps to estimate coho salmon production.	High	Ongoing	CDFG/UC	FRGP
Subactivity 2.1.4.1	Tributary specific juvenile emigration trapping.	High	Ongoing	CDFG/UC	FRGP
Subactivity 2.1.4.2	Russian River basin emigration monitoring at Mirabel Dam.	High	Ongoing	SCWA	SCWA
Task 2.2	Collect Physical Habitat, Stream Temperature, and Discharge Data to Correlate with Staff Gage 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	Rec	UC	TBD
Activity 2.2.2	Install a staff gage and collect stream discharge information that is sufficient to develop discharge curves for each key tributary.	Low			

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
Activity 2.2.3	Implement environmental monitoring and assessment program for habitat conditions throughout the entire Russian River basin.	Low			
OBJECTIVE 3.	**GENETICS EVALUATION.**				
TASK 3.1	GENETIC SAMPLE COLLECTION AND ANALYSIS.				
Activity 3.1	Collect samples.	High	Ongoing	CDFG, Various	CDFG/NOAA /USACE
Activity 3.2	Analyze samples.	High	Ongoing	NOAA Fisheries	USACE
TASK 3.2	APPLY DNA DATA TO IMMEDIATE MANAGEMENT NEEDS.				
Activity 3.2.3	Determine the stocks.	High	Ongoing	NOAA Fisheries	USACE
Activity 3.2.2	Determine the extent to which the hatchery stock is representative of the naturally-spawning stock.	High	Rec	CDFG	USACE
Activity 3.2.1	Determine the reproductive success of naturally-spawning hatchery-reared fish.	Low	Rec		
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	Rec		
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	Rec	NOAA	USACE
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	Rec	CDFG/UC	FRGP
Subactivity 4.1.1.1	Snorkel and count fish by species each season, and classify into size intervals.	Low			

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
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.	Med	Rec		
Subactivity 4.2.1.1	Determine the frequency of common fish pathogen presence and virulence in Russian River hatchery produced fish.	Medium	Ongoing	CDFG	CDFG
Subactivity 4.2.1.2	Determine the frequency of common fish pathogen presence and virulence among naturally produced fish in the Russian River basin.	Med	Rec		
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	Rec	CDFG	CDFG
Subactivity 4.2.2.1	Identify and assess factors that caused disease outbreak.	High	Rec	CDFG	CDFG
Subactivity 4.2.2.2	Determine potential adverse effects of any disease outbreak.	High	Rec	CDFG	CDFG
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 NOAA Fisheries/CDFG salmonid research database.	High	Ongoing	CDFG	USACE
Activity 5.1.2	Report Coded-Wire Tagging summary reports to the RMIS database.	Medium	Ongoing	CDFG	USACE
TASK 5.2	COMMUNICATION OF RESULTS AND TRANSFER OF TECHNOLOGY.				
Activity 5.2.1	Develop annual Statement of Work.	Low	Rec	CDFG	USACE
Activity 5.2.2	Develop quarterly reports.	Low	Rec	CDFG	USACE
Activity 5.2.4	Develop ESA Section 7 summary reports.	Medium	Ongoing	SCWA	SCWA
Activity 5.2.5	Develop annual reports.	High	Ongoing	CDFG	USACE
Activity 5.2.6	Develop five-year summary report.	Medium	Ongoing	CDFG	USACE
Activity 5.2.7	Develop peer-reviewed journal publications.	Low			
Activity 5.2.8	Participate in regional conferences and workshops.	High	Ongoing	CDFG	CDFG

ACTIVITY	DESCRIPTION	PRIORITY	STATUS	RESPONSIBLE ENTITY	FUNDING SOURCE
TASK 5.3	DEVELOP AND MAINTAIN OPEN COMMUNICATIONS WITH ALL RESOURCE MANAGERS (COORDINATION).				
Activity 5.3.1	Participate in the RRCWG.	High	Ongoing	CDFG	USACE
Activity 5.3.2	Facilitate hatchery annual review and operating plan modification through an Annual Operating Plan.	High	Ongoing	CDFG	USACE
Activity 5.3.3	Attend coordination meetings regarding hatchery production and salmonid recovery.	High	Ongoing	CDFG	USACE
Subactivity 5.3.3.1	Attend meetings of the Joint Hatchery Review Committee.	High	Ongoing	CDFG	USACE
Subactivity 5.3.3.2	Attend meetings of the Russian River Coho Salmon Recovery Work Group.	Med	Ongoing	CDFG	USACE
Subactivity 5.3.3.3	Attend meetings of additional salmonid recovery teams as they come into existence.	High	Ongoing	CDFG	USACE

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:

- <u>Genetic sampling of tissues taken from the hatchery stock</u>. This has been ongoing for several years. Tissues are randomly sampled from hatchery stocks and evaluated using genetic analysis tools developed by the BML. Most of this work has focused on salmon stocks entering into DCFH; however, tissues were taken from the 1999/2000 brood year of steelhead at DCFH.

- <u>Tissue samples from wild fish and hatchery fish found within the Russian River</u>. CDFG takes random samples 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 NOAA Fisheries 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 (CDFG 2002):

- 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.
- 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 run's genetic makeup.

3.12.2 COOPERATING AND FUNDING AGENCIES

Tissue analysis conducted by the BML using samples collected up through 2000 has been funded by SCWA, while NOAA Fisheries tissue analysis in 2002 and 2003 has been funded by CDFG.

Since 2001, genetic tissue analysis is being carried out at the NOAA Fisheries Santa Cruz Lab and is funded by NOAA Fisheries. 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 NOAA Fisheries Santa Cruz Lab with Chinook salmon 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 BML is Dennis Hedgecock. The principal investigator for the activities at the NOAA Fisheries Santa Cruz Lab is Carlos Garza. Activities relating to sampling of DCFH and CVFF fish is supervised by Brett Wilson, 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 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 chemical bath of MS222. Collection of juvenile fish in the field is accomplished using a beach seine. 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 to 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 beach seining necessary for sampling of wild juveniles. Estimates of mortality due to beach seining 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. An overall mortality associated with tissue sampling is not known at this time.

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 "Take Table" (Table 2)

Levels of estimated take are presented in Table 2, following Section 3.14.

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 salmon in the Russian River are Chinook salmon and steelhead trout. In the BO for the coho salmon program, NOAA Fisheries estimates the unintentional lethal take associated with the coho salmon research activities to be 700 fish. Because research on Russian River Chinook salmon and steelhead will be limited to tissue sampling and will not involve the broodstock collection efforts of the coho salmon program, the estimated mortality from tissue sampling of Chinook salmon 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 steelhead and five Chinook salmon.

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.

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3.14 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 2. Estimated Listed Coho Salmon 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 Lifestage (*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)		100,000		

d. Annual M&E activities
e. Collection for captive broodstock
g. Unintentional mortalities associated with research activities
h. Juvenile coho salmon 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.*

ATTACHMENT 1

DEFINITION OF TERMS REFERENCED IN THE HGMP TEMPLATE

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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) – NOAA Fisheries definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the ESA). 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.

ATTACHMENT 2

FIGURES