RESTORING CENTRAL VALLEY SPRING-RUN CHINOOK SALMON POPULATIONS:

TECHNICAL WORKSHOP TO IDENTIFY CANDIDATE PROGRAMS AND PROJECTS FOR CATEGORY III FUNDING

Prepared for
Category III Steering Committee
and
CALFED Bay-Delta Program

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September 12, 1996

1.0 Introduction

On December 15, 1994, the State of California, U.S. Federal government, participating California water user organizations, and interested fishing and environmental interest groups entered into an historic agreement to protect the San Francisco Bay / Sacramento-San Joaquin ecosystems. The Bay-Delta Accord not only created a framework for implementing strategies to preserve and enhance habitat, it also stated that the signatories were committed to implementing and financing "Category III" measures to address non-flow factors, as part of a comprehensive ecosystem protection and restoration plan.'

In 1995, the Category III program approved nine projects and contributed $4,176,500 towards those projects. Guiding these efforts is the Category III Mission Statement, developed by the current Steering Committee:

> *To develop and carry out a program of Bay-Delta ecosystem restoration, in coordination with related efforts by others, and specifically targeted to address factors other than waterjlow and operational components directly covered by the Bay-Delta Accord and designed to better understand how these factors affect the ecosystem.*

In achieving this mission, Category III has decided that is appropriate to work closely with the CALFED Bay Delta Program and to receive guidance from them on ecosystem goals and priorities.

For the 1996 round of program and project funding, the Category III Steering Committee elected to adopt a phased approach. The Steering Committee requested CALFED to prepare a document entitled *Category III Guidance Document.* A draft of this report was delivered in April, and included the major recommendation that for 1996, Category III focus resources on spring-run chinook salmon in the Sacramento River system and on Delta habitat. The guidance document included an initial list of recommended projects and programs for funding consideration by the Category III Steering Committee. As an initial step, two high priority, well-developed projects were immediately approved for funding. The Category III Steering Committee and the CALFED Bay-Delta Program then jointly sponsored a technical workshop to review and consider revisions to the list of recommended initiatives intended to benefit spring-run chinook salmon.

1.1 Workshop Objectives

On June 11 and 12, 1996, the Category III Steering Committee and the CALFED Bay-Delta Program jointly conducted a two-day workshop at the California Department of Water Resources facility in Red Bluff. The workshop objectives were to:

- review restoration goals for Sacramento spring-run chinook salmon populations;
- develop conceptual impact hypothesis diagrams illustrating how various factors affect spring-run chinook salmon;
- list key initiatives already underway and map these on the impact hypothesis diagrams;
- identify gaps related to important factors (i.e. needed programs, projects, and information);
- sort needed programs / projects according to ecological priority and identify sequencing needs;

- review other important projects and proposals;
- develop recommendations on a 1996 package for Category III;
- record important information for next year; and
- give feedback to CALFED and the Category III Steering Committee on what worked, didn't work and what would improve this technical process for the next round.

These ambitious objectives were intended not only to improve the list of spring-run chinook programs and projects recommended for 1996 funding by Category III, but also to test a more systematic approach to developing such recommendations.

1.2 Workshop Approach

A copy of the initial workshop agenda is provided in Appendix A. The workshop consisted of a few carefully-selected background presentations, plenary sessions, and subgroup discussions. The nearly 30 participants who attended the workshop (see Appendix B) were divided into three subgroups, each focusing on a separate geographic portion of the Sacramento system: tributaries, mainstem, and delta / ocean.

One of the most important starting points in the workshop was to establish a clear set of restoration goals and objectives. While much attention has already been given in other forums to the current state and plight of spring-run chinook salmon, there are still few comprehensive, quantitative statements outlining an unambiguous set of restoration goals that are universally accepted that can form a design backdrop for technical experts to use in devising a restoration plan for this species. Thus, the workshop participants began by discussing overall goals and specific objectives for protecting and restoring stocks of spring-run chinook salmon. Results of those discussions are presented in Chapter 2.

The workshop process was adaptive, and did not try to rigidly adhere to the agenda. As a result, each of the subgroups took a slightly different approach to their work, as reflected in the contents of Chapters 3, 4, and 5. During the closing plenary session, participants identified a number of broad issues that deserve attention. These are reported in Chapter 6. Finally, the workshop participants were asked for feedback on the process **used** in developing their recommendations. A summary of the comments is provided in Chapter 8.

Chapter 7 represents a synthesis of the programs, projects, and information needs

1.3 Bounding

Before beginning any systems exercise it is important to define in the plenary session the overall boundaries of the discussion, with reference not only to space and time, but also the actions and indicators that will be considered during the deliberations.

13.1 Space

The workshop participants quickly agreed that it is necessary to focus on the full and current range of ail spring-run chinook populations over the entire life cycle. They also recommended including consideration of systems that have a high potential to become part of the species range. This means that workshop participants were to consider both (1) the entire Sacramento River watershed above the American River and below any major dams, with emphasis on existing and potential spawning and

rearing habitats, and (2) the delta and ocean. Key geographic areas for concentration were the Sacramento mainstem, Mill Creek, Deer Creek, Butte Creek, and Battle Creek.

1.3.2 **Time**

Participants agreed to focus attention during the workshop on three time frames: (1) current conditions, (2) four complete salmon life cycles (at 3 years / cycle = 12 years), and (3) landscape time (estimated to be greater than 60 years). As well, participants emphasized the need to ensure that monitoring is not only conducted on an appropriate time frame, but that such efforts are sustained through time (see also Section 6.1).

1.3.3 **Actions**

Concerning 'actions' that would be considered, it was agreed that participants would deliberate the full range of factors that can or do affect any portion of the spring-run chinook salmon life cycle, both flow and non-flow related. While Category III is focused on non-flow factors, from a biological perspective all factors are interrelated, and achieving restoration goals for this species will require simultaneous attention to a wide range of factors. Participants agreed that it made sense to first catalogue all important factors, and then to select those of relevance to Category III for more detailed attention and funding recommendations.

13.4 Indicators

Workshop participants recommended that discussions focus on key processes (e.g., natural production, rearing / feeding, downstream smolt passage, adult inmigration) and habitats of primary importance (e.g., spawning areas, riparian zones, delta, ocean).

2.0 Spring River Chinook

2.1 Goals and Objectives

The group discussed overall goals and objectives from a variety of planning processes as well as principles of salmon conservation biology such as:

1. conserve genetic diversity
2. protect existing spawning populations
3. increase populations to full capacity of existing spawning streams
4. restore viable / self-sustaining populations to streams when feasible to do so.

The participants also discussed some specific population objectives such as average adult escapements in Deer and Mill creeks of 3,500 adults in each stream. They reviewed the goals in the draft Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes which includes restoration criteria that indicates that the goals are (1) self-sustaining populations in excess of 500 spawners in both Deer and Mill creeks; (2) the number of wild spawners in Sacramento River tributaries reaches a mean number of 8000 fish and does not drop below 5000 fish, for 15 years, three of which are dry or critical years, and (3) when the smolt survival rates between Sacramento and Chipps Island approach pre-project levels when the number of adults in the tributary streams is less than 5000. They also discussed some basic population goals such as ensuring that each generation replaced itself at a rate of 1: 1 or higher, ensuring

that there were self sustaining populations in a number of areas to guard against catastrophic events such as toxic spills or fires, and ensuring that conditions allowed for a diversity of life history strategies.

3.0 Tkibutaries

3.1 **Participants**

Harry Rectenwald	CDFG
John Icanberry	USFWS
Colieen Harvey	CDFG
Randy Bailey	Metropolitan Water District. Special Consultant
Chris Leininger	Deer Creek Watershed Conservancy
Ted Sommer	DWR
Jim Lowden	Mill Creek Conservancy
Paul Ward	CDFG (recorder)
Eugenia Laychak	CA Center for Public Dispute Resolution (facilitator)

3.2 **Overview/Introduction**

The purpose of the break-out session was to identify priority projects for Category III funding in 1996 to restore spring-run chinook salmon. The group was tasked with: 1) inventorying factors that currently limit restoration of the species, 2) identifying key initiatives already underway, and 3) prioritizing proposed programs and projects for unaddressed or under addressed factors.

3.3 **Discussion of Session Goals**

The group began its discussion by reviewing the following general goals for its session:

- Optimize the potential for spring-run salmon spawning, rearing and out-migration.
- Optimize long-term (about 3 human generations or 60 years) protection for the fish.

3.4 **Prioritizing Tributaries**

The next step was to prioritize the Sacramento River tributaries that had the highest potential for successful restoration of the species. The group generally followed the priorities listed in Table 2 (page 5) of "Status of Actions to Restore Central Valley Spring-Run Chinook Salmon." Of the 12 listed tributaries, the Group eliminated the following three from consideration, due to their low potential for restoration and lack of genetic purity in the creeks' salmon stocks:

- Cow Creek
- Thomes Creek
- Cottonwood Creek.

The group stressed the importance of attempting restoration on other creeks that had a low potential for restoration. Even if these creeks, individually, yield only a few spring-run salmon, collectively their contributions may be significant. In addition, they provide a "back-up" to streams with higher potentials, in the event of catastrophic emergencies (such as toxic spills) or if restoration goes awry. Another

identified overriding consideration was that all actions or programs should include an evaluation and monitoring component to measure the success of the project.

3.5 Identification of Priority Projects

Following the prioritization exercise, the group fulfilled the tasks listed above, for each of the remaining nine creeks. Results of discussion are summarized below, categorized by creek, in order of restoration of priority. The group referred consistently to the Working Paper on Restoration Needs prepared by the USFWS for identification of limiting factors.

Deer Creek - High Potential for Restoration

Factors Limiting Restoration Potential and Existing Projects to address those factors* - Existing projects are shown in parentheses ( ). Insufficient flows for adult and juvenile access (water exchange program), potential land use impacts (livestock exclusion initiative), upstream migration limited by channel alterations (Bamboo Control and Removal Project), toxic spills from Highway 32.

Recommended Projects and Priorities for Funding - High priority - Additional funds for Deer Creek Watershed Conservancy, evaluation of additional water exchange to ensure passage during critical migration periods, Highway 32 toxic spill contingency plan. Unknown priority - convert pumps used in water exchange program from diesel to electrical power source ($200,000+, contact Stacy Cepello [DWR, 916/529-7352] for more information).

* The Deer Creek Conservancy's watershed management plan is partially funded and addresses all of these factors.

Mill Creek - High Potential for Restoration
Limiting Factors and Existing Projects** - Insufficient flows for adult and juvenile access (water exchange program), fish passage problems at Clough and Ward Dams, and at the mouth due to a riffle, potential land use impacts from animal grazing in upper watershed (monitoring program).

Recommended Projects and Priorities for Funding - High priority - Additional funds for Mill Creek Watershed Conservancy, evaluation for additional water exchange to ensure passage during critical migration periods. Unknown priority - Real time water flow monitoring (estimated cost of $20,000 per year), convert pumps used in water exchange program from diesel to electrical power source ($l00,000+, contact Stacy Cepello for more information)

Modification of Clough Dam, either changes to the fish ladder or through removal of the dam are required, pending negotiations with the landowner. Re-evaluate the need for this action next year.

** The Mill Creek Conservancy's watershed management plan is partially funded and addresses most of these factors.

Butte Creek - High Potential for Restoration
Limiting Factors and Existing Projects - Insufficient flows for adult and juvenile access and entrainment (Western Canal Water District siphon construction and removal of Western Canal, McGowan and

McPherin dams), lethal water temperatures (evaluation/monitoring project), fish stock genetic integrity (Racial Identification Through Genetic Marking study), insufficient spawning and holding habitat, potential land-use impacts from future development.

Recommended Projects and Priorities for Funding - (The following projects are listed in the "CALFED Bay-Delta Program Suggested Projects for 1997 Funding by Category III" attachment) High Priority - Complete construction of fish screens and ladder at Durham-Mutual Dam (increase cost to $1 million), conduct stream channel and habitat restoration below Durham-Mutual Dam, construct fish screen and ladder at Adams Dam, construct fish screen and ladder at Gorrill Dam, conduct site survey and prepare options and engineering analysis for remaining diversion structures along lower Butte Creek (includes White Mallard fish screen and ladder, and Drumheller Slough outfall culvert reconstruction). Low Priority - Purchase screened portable pumps as alternative to Little Dry Creek Diversion.

Additional Projects - High Priority - Funds for watershed planning, including consideration of conservation easements to mitigate for land-use impacts (similar to CSU, Chico proposal for watershed plan). Evaluate habitat above Barrier Falls at Chimney Rock.

Battle Creek - High Potential for Restoration
Limiting Factors and Existing Projects - Inadequate flows for spawning and egg incubation (short term project through CVPIA 3406 (b) (11) regarding implementation of Coleman National Fish Hatchery Plan and Keswick Dam Fish Trap and Category III funded acquisition of increase flows), unscreened water diversions, barriers to adult passage at upstream dams, water temperatures, spawning gravels, hybridization, superimposition, competition with hatchery production, and Coleman Fish Hatchery impacts.

Recommended Projects and Priorities for Funding -High Priority - (The following projects are listed in the "CALFED Bay-Delta Program Suggested Projects for 1997 Funding by Category III" attachment) Fish screen and ladder at Eagle Canyon Diversion (estimated cost $700,000), negotiation and funding of a perpetual instream flow agreement with PG&E, prepare options/feasibility analyses for additional fish screens, ladders and a flow allocation methodology above Eagle Canyon, evaluate options to provide an isolated water supply for Coleman National Fish Hatchery. Moderate to Low Priority - Restore and replenish spawning gravel in North Fork (lower cost estimate from $100,000 to $50,000).

Additional Recommended Project - High Priority - Evaluation of Battle Creek plan (AFRP).

Big Chico Creek - Moderate Potential for Restoration
Limiting Factors and Existing Projects - Inadequate flows for adult and juvenile passage, poaching (warden funding), fish stock genetic integrity, pollution from One Mile pool and recreation area, obstructed access to habitat, potential land-use impacts from development.

Recommended Projects and Priorities for Funding - High Priority - (The following projects are listed in the "CALFED Bay-Delta Program Suggested Projects for 1997 Funding by Category III" attachment)*** Reconstruct existing water control structure at Lindo Channel, replace fish ladder at Iron Canyon, install discharge bypass at One Mile Recreation Area (proposed by City of Chico). Low Priority - Replace fish ladder at One Mile Pool.

Additional Recommended Projects - High Priority - Expand population and genetics monitoring, focus warden efforts on creek during critical times for salmon. Unknown priority - develop a watershed plan.

*** Determine if project cost estimates are accurate.

Clear Creek - Moderate Potential for Restoration
Limiting Factors and Existing Projects - Obstructions to adult and juvenile passage (CVPIA 3406 (b) (12) project to provide increased flows, improve fish passage, and restore habitat, $150,000) inappropriate water temperatures, insufficient gravel recruitment, potential land-use impacts, including erosion and bank instability, inadequate spawning stock.

Recommended Projects and Priorities for Funding - (The following projects are listed in the "CALFED Bay-Delta Program Suggested Projects for 1997 Funding by Category III" attachment) High Priority - facilities for improving fish passage at Saeltzer Dam. Eliminate following project from CALFED Category III 1997 projects list: title search and escrow preparation for BLM land exchange above Saeltzer Dam because it has already been completed without action by Category III.

Additional Recommended Projects - Medium Priority - Erosion control for channel maintenance ($100,000). Low Priority - Pilot flow study to analyze water temperatures (to be re-evaluated for 1998 funding).

Antelope Creek - Low Potential for Restoration
Limiting Factors and Existing Projects - Less than optimal (braided) channel configuration and inadequate flows limit juvenile out-migration and adult upstream migration, potential land use impacts from development, limited quantity of holding habitat, inadequate and intermittent spawning stock.

Recommended Projects and Priorities for Funding - High Priority - (The following project is listed in the "CALFED Bay-Delta Program Suggested Projects for 1997 Funding by Category III" attachment) Conduct an options, feasibility and engineering analysis of fish passage problems and habitat restoration opportunities.
Feather River - Unknown Potential for Restoration
Limiting Factors and Existing Projects - Hybridization and questionable genetic integrity, poaching (special warden program), inappropriate water temperatures for adults (DWR **study).**

Recommended Projects and Priorities for Funding - High Priority - Comprehensive genetic analysis of Feather River fall and spring-run stocks to determine purity or degree of introgression of each race, evaluation and of hatchery practices at Feather River Hatchery.

Yuba River - Unknown Potential for Restoration
Limiting Factors and Existing Projects - Potential fall and spring-run hybridization due to lack of spatial separation at spawning areas, predation/poaching, inappropriate water temperature for juveniles and adults due to inadequate flows (SWRCB/FERC decision), limited summer holding habitat, juvenile stranding after floods, juvenile entrainment (Brown's Valley Irrigation District Diversion engineering analysis), barriers to adult migration, multiple migration channels.

Recommended Projects and Priorities for Funding - High Priority - Comprehensive genetic analysis of Yuba River fall and spring-run stocks to determine purity or degree of introgression of each race, evaluate potential for creating more separation of fall and spring-run spawning habitat to reduce or eliminate hybridization. Defer for future consideration Daguerre Point Dam fish screen, ladder, and dam modifications, until results of genetic analysis are know. Unknown Priority - Lower Englebright Dam.

4.0 Sacramento River Mainstem

4.1 Introduction

Previous restoration plans have often given considerably more attention to tributaries and production-related issues than to the mainstem, and issues related to instream rearing, downstream migration, and inmigration. The Sacramento River constitutes a significant portion of the migration habitat for all populations of spring-run chinook salmon. The Sacramento River is the largest river system in California, and yields about 35% of the state's water supply. Chinook salmon populations from this river supply most of the state's sport and commercial salmon catch.

Subgroup participants were asked to first list and discuss important factors influencing populations of spring-run chinook salmon, then to define needs and priorities for restoring the populations as defined in Chapter 2.

The Sacramento River mainstem subgroup was composed of the following individuals:

Gary Bobker
Burt Bundy
Stacy Cepello
Dick Daniel
Jeff Jaraczeski
Terry Mills
Pete Rhoads
Jim Smith

4.2 Factors, by River Segment

Subgroup participants agreed on the value of dividing the mainstem into distinct river segments, each of which has different - though not necessarily unique - ecological characteristics and 'factors' affecting spring-run chinook salmon. The four river segments chosen for discussion were: 1) Keswick Dam to the Red Bluff Diversion Dam, 2) the Red Bluff Diversion Dam to Chico Landing, 3) Chico Landing to Colusa, and 4) Colusa to the "Delta" (the lower reaches of this segment were not precisely defined). [a map would be helpful here]

To help structure their discussions, subgroup participants also decided to focus on three broad categories of 'factors' affecting spring-run chinook salmon: (i) those related to production (recruitment) and chronic toxicity, (ii) those related to mortality, and (iii) those related to movement, both upstream and downstream.

4.2.1 Keswick Dam – Red Bluff Diversion Dam

Production and Chronic Toxicity

In this river segment, upper and mid-level terraces have altered vegetation complexes, while lower terraces are subject to human development. In some places the river is cut off from the floodplain. Together these factors result in an altered regime of gravel recruitment and contributions of sediments from non-point sources.

Key information needs pertaining to production for this river segment are to: (1) confirm the presence of spring-run chinook populations, (2) identify source(s) of gravel recruitment, and (3) identify interactions with hatchery fish and related issues (e.g., adult straying from other hatcheries, diseases, interbreeding).

Mortality

Participants identified these potentially significant sources of mortality for both adults and juveniles in this river segment: (1) super-imposition from fall run chinook, (2) high temperatures associated with periods of low carryover storage in Shasta Lake during drought periods, and (3) unscreened diversions. In addition, they identified two additional mortality factors that may be important, but of generally lower concern than those listed above: (4) episodic releases of toxic substances from Iron Mountain (1 in 30 year event), and (5) sport angling.

Movement

Three major factors related to movement of adults and juveniles were identified for this river segment: (1) predation at Red Bluff Diversion Dam (RBDD), (2) adult passage at RBDD, and (3) passage at the Anderson-Cottonwood Irrigation District (ACID) dam and stranding below ACID.

4.2.2 Red Bluff Diversion Dam – Chico Landing

Production and Chronic Toxicity

Ecologically, this river segment is characterized by river meandering and a forested riparian zone. Riparian vegetation is important to spring-run chinook salmon not only because of the modifying influence on water temperatures, but also because the contributions of woody debris and allochthonous materials help create suitable rearing habitat. River meandering is a major source of gravel. As this natural process is altered, it not only influences gravel recruitment, but also leads to loss of riparian habitat, with concomitantly reduced inputs of woody debris, and increased water temperatures, thereby degrading the quality of spring-run chinook salmon rearing habitat. Subgroup participants identified two important water temperature factors: (1) water temperatures may now be out of synchrony with those of the tributaries (biological importance?), and (2) because of current water temperatures, this reach is far less suitable for summer "holding" for adults.

Additional production-related factors of concern in this river segment were: (1) the breach potential of non-project levees, and (2) interactions with hatchery fish (e.g., diseases, interbreeding).

Participants identified only one possible concern related to chronic toxicity: quality of agricultural drainage return waters.

Mortality

Four significant mortality factors were identified for the river segment from the Red Bluff Diversion Dam to Chico Landing: (1) the Glenn - Colusa Irrigation District (GCID) diversion, both entrainment and predation, (2) the many unscreened diversions, (3) introduced species that prey on spring-run chinook salmon (e.g. shad, striped bass, and (4) warm water 'reservoirs' (e.g., oxbows) where predators congregate. It should be noted that oxbows also provide highly productive habitat for juveniles which may outweigh any increase in predation.

Movement

Major factors affecting movement in this river segment are: (1) the GCID, and (2) unscreened diversions.

4.2.3 Chico Landing – Colusa

Production and Chronic Toxicity

For flood control purposes, this river segment has been subjected to significant bank stabilization, largely through U.S. Army Corps of Engineers projects. This is also the start of the bypass system to the east. Because of these engineering alterations, there is not only a limited opportunity for river meandering, but also a loss of riparian habitat in the floodplain and upland forests. Subgroup participants identified a general lack of information regarding rearing in this river segment as an important knowledge gap. Nevertheless, it was generally agreed that the Colusa Basin Drain could represent a significant influence on spring-run chinook salmon, not only from a production and chronic toxicity perspective, but also from a mortality and movement perspective.

Other factors of concern in this river segment included: (1) changes in water quality (e.g., water temperature and quality) associated with draining duck production areas, (2) interactions with hatchery fish and attendant risks of disease and interbreeding.

Mortality

The subgroup identified two main classes of mortality factors: (1) predation, and (2) unscreened diversions. Pertaining to the former, they acknowledged a general lack of information concerning predation rates by species such as striped bass, or predation in the bypass system. Related to the latter factor, they noted the large number of unscreened diversions, and suggested that this factor is of greatest concern in the two periods October to December, and February to April. Again, they emphasized the importance of the Colusa Basin Drain.

The group also acknowledged a general lack of vital knowledge concerning the importance of agricultural drainage as a potential source of direct mortality on this species.

Movement

The Sutter Bypass system influences both upstream and downstream movements of spring-run chinook salmon. For example, as the river begins to reach the bankfull stage, some portion of the downstream migrant population enters the bypass system rather than moving into the main stem Sacramento River at Ward's Landing, where they may be subjected to additional predation pressures. For returning adult fish, most probably go upstream via the Sacramento River during normal to low flow years, but in high flow years some portion of the population probably enters the bypass, ending up in Butte Slough and eventually Butte Creek.

4.2.4 Colusa – "Delta"

Note that because the "Delta" boundary was not explicitly defined, there are some overlaps between information presented in this section and information submitted by the Delta / Ocean subgroup (see Chapter 5).

Production and Chronic Toxicity

According to the subgroup participants, from the perspective of spring-run chinook salmon, this segment of the Sacramento River mainstem is biologically rather harsh. There is little or no riparian habitat, minimal hydraulic diversity, little or no canopy for shading (resulting in almost 40 miles with direct sun exposure), and few terrestrial insects. Moreover, not only have allochthonous inputs been decreased, but increased turbidity has resulted in decreased aquatic food production. Collectively, these factors have greatly reduced yearling rearing options in this river segment. The group acknowledged that little is actually known about spring-run chinook salmon biology in this river segment, but as elsewhere, there are concerns related to intermingling with hatchery fish, and consequences related to diseases and interbreeding.

Although engineering efforts succeeded in moving downstream those materials that were deposited during the era of hydraulic mining, now that those materials have been moved out, the river has begun eroding the river banks, with the result that even the remaining riparian habitat is being threatened.

Subgroup participants identified two important concerns involving chronic toxicity, both related to agricultural drains: (1) high temperature return waters, and (2) agricultural chemicals.

Mortality

While acknowledging the paucity of detailed information concerning fish biology in the river segment from Colusa to the "Delta", subgroup participants nonetheless identified three factors that are likely to be important mortality influences on spring-run chinook salmon in this portion of the Sacramento mainstem: (1) Colusa Basin Drain, (2) minor amounts of "fishing", and (3) agriculture chemicals. With reference to factor three, agricultural chemicals, there would appear to be an acute need for an immediate improvement in available information to assist decision-makers in determining whether or not more detailed scientific studies are in fact required. To date, it is possible to neither rule out, nor implicate, toxics in the decline of spring-run chinook salmon populations in the Sacramento River system.

Movement

For reasons already mentioned above, this river segment has reduced rearing options for juveniles, which has implications for their movement patterns. For example, from a fishes' perspective, there is poor "connectivity" between areas of good habitat. This means that juvenile fish must often travel significant distances before encountering good habitat sites.

In the case of adults moving upstream, the presence of the bypass system means that there is the possibility of substantial numbers that may engage in catastrophic straying, ***viz.*** once they enter the bypass system they are effectively 'lost' from the spawning population.

Another factor that may be influencing movement, the importance of which is currently unknown (though likely on the increase), is fall diversions associated with rice production. This water is used to promote decomposition of leftover organic debris, thereby reducing the need to bum this material. These water diversions may result both in decreased flows and in increased water temperatures, either of which may affect fish movements.

4.3 Needed Programs and Projects

After considering the above-listed factors, participants in the mainstem subgroup next turned their attention to identifying and prioritizing programs and projects needed to address the most critical or tractable factors. Special emphasis was given to discussing projects and programs suitable for funding by the Category III program. Results of the subgroup discussions are presented in the following sections, and synthesized in Chapter 7.

After some discussion, the subgroup decided to approach this portion of their task by focusing first on issues related to inmigration, and then on moving on to those related to juvenile rearing and downstream passage.

4.3.1 Inmigration

During the course of the discussion, seven issues related to inmigration of spring-run chinook salmon were identified. They are, in no particular order:

1) catastrophic straying,
2) access to Butte Creek in lower to "normal" water years,
3) information needs concerning flow in Sutter Bypass,
4) managed seasonal wetlands,
5) delay at Red Bluff Diversion Dam,
6) passage at the ACID dam, and
7) open fishing season.

Each of these is discussed below, along with suggested projects and programs to address the issue.

Catastrophic Straying

During adult inmigration, there are any number of ways in which adult salmon can end up in the wrong place where spawning conditions are not suitable. The three greatest causes of catastrophic straying are (1) the Yolo Bypass, (2) the Deep Water Ship Channel, (3) the Sutter Bypass, and (4) the Colusa Basin Drain. Currently this issue is being addressed, albeit minimally, by having DFG personnel undertake visual inspections in the period March through May, where they clear fish ladders and net / relocate fish that have strayed into these sites. Another strategy to reduce stranding that is used infrequently is to operate the lock at the Deep Water Ship Canal. According to the biologists it would be helpful to use this mechanism more frequently, but the necessary funds are unavailable.

Subgroup participants recommended that an options analysis be undertaken to examine feasibility and costing of at least these four initiatives to help reduce catastrophic straying: (I) reconstruct the Yolo Bypass as a tributary of the mainstem (this implies a large engineering project at the Freemont Weir); (2) install a fish ladder at the Deep Water Ship Canal; (3) try to define a mechanism that would help inmigrating adults (and juveniles passing downstream) to avoid straying into the Sutter Bypass; and (4) installing an exclusionary device at the Colusa Basin Drain.

Access to Butte Creek in Lower to "Normal" Water Years

There is some concern that spring-run chinook salmon do not have efficient access to Butte Creek for spawning. This is the result of several factors, one of which is that even in lower to normal water years, there is occasionally water in the Sutter Bypass, which results in some adult spring-run chinook salmon moving up this system instead of up the Sacramento Mainstem. Subgroup participants indicated that it would be helpful to develop a means to "force" spring-run chinook to find Butte Creek via the Sacramento River mainstem. Two possible options include blocking access to Sutter Bypass for inmigrating adults, or to re-engineer the Butte Slough outfall to remove the culvert. The basic problem is that currently there is no clearly-defined mouth of Butte Creek. Another option is to perhaps reduce the frequency with which water is passed down the bypass system from controllable events.

Subgroup participants recommended that an options analysis for Wards Landing be undertaken to examine ways of improving access to and use of Butte Creek by spring-run chinook salmon. They also suggested that this analysis probe issues associated with imprinting fish with Feather River and Butte Creek water.

Flow Measurement at Sutter Bypass

Currently there are few data available describing the frequency with which water is discharged down the Sutter Bypass system from controllable events. Apparently the old flow measurement device needs to be replaced. Subgroup participants suggested adding 1 or 2 more at the same time.

Managed Seasonal Wetlands

The acreage of managed seasonal wetlands (e.g., duck production areas, rice fields) appears to be increasing, along with the associated volumes of needed water (ca. 150,000 ac-ft). When discharged back into the river, the water quality is apparently similar to that from natural floodplain drainage. The subgroup did not feel that this practice is either a significant benefit or detriment to inmigrating spring-run chinook salmon. They noted that both The Nature Conservancy and Paul Ward are already looking at this issue, but primarily from the perspective of waterfowl. It was suggested that the mandate of this study be broadened to include issues related to potential effects (positive and / or negative) on fish.

Delay at Red Bluff Diversion Dam

Currently the gates at the Red Bluff Diversion Dam remain up until May 15, as a temporary solution to the problem of delaying inmigration of adult salmon. Unfortunately, this does not cover the full period of spring-run chinook salmon inmigration. Presently the Bureau of Reclamation is studying and evaluating a number of options including eliminating the diversion dam, operating screw pumps, modifying the dates of gate openings, and evaluating the fish ladder operations. These efforts are ongoing, but subject to adequate funding. Subgroup participants recommended encouraging the Bureau of Reclamation to maintain adequate funding for these studies and evaluation efforts.

ACID Passage

Between the Keswick Dam and Redding, the Sacramento River mainstem has characteristics that in theory make it suitable for spawning of spring-run chinook salmon. However, fish passage and flow problems associated with the Anderson-Cottonwood Irrigation District (ACID) dam present challenges

for spring-run chinook salmon attempting to access and use this river segment, particularly the reach above the ACID dam and below **Keswick** Dam. Subgroup participants questioned whether or not this is a viable area for managing an in-river race of spring-run chinook. Their recommendation was to undertake technical studies to generate information needed to address the management question.

There are two key technical information gaps pertaining to managing this area for spring-run chinook. First, fisheries biologists must determine if there are any pure stock spring-run chinook salmon found at this location, and if so whether they represent a distinct genetic race. Because this segment of the mainstem is also used by other salmon runs, it may not be possible for spring-run chinook to remain genetically distinct at this location. The second key unknown is whether spring-run chinook actually spawn at this location. Some participants also voiced concerns related to gravel quality and quantity; this issue should be clarified when results of a gravel assessment done in this river segment during 1995 are released.

Open Fishing Season

Subgroup participants raised concerns that some spring-run chinook salmon are taken as incidental catch during the open fishing season that begins in July. No specific recommendations were offered. However, there are at least two good options: 1) request fisheries biologists to evaluate the numbers and significance of incidental spring-run chinook salmon catch during the legal fishing season; and 2) request fisheries managers to increase educational efforts to make fisherman more aware of the need to conserve this fish species and encourage safe release of inadvertently caught spring-run chinook salmon.

4.3.2 Juvenile Rearing and Downstream Passage

With respect to juvenile rearing and downstream passage, the subgroup agreed that the three main issues are safe passage, availability of suitable habitat with shaded cover, and adequate food supplies. They also agreed that there is a small, but serviceable, body of scientific data suggesting that the presence of toxic substances in mainstem waters may be important to the survival of juvenile spring-run chinook salmon as they migrate downstream. Subsequent discussions, therefore, focused primarily on: (1) unscreened diversions, (2) riparian habitat, and (3) toxic substances. Each of these topics are discussed in the following sections, along with recommended actions.

Unscreened Diversions

Overview

There was general agreement among subgroup members that, viewed as a group, unscreened water diversions represent an important and serious challenge to successful rearing and passage of juvenile spring-run chinook salmon. However, there are currently three major sets of challenges to adequately addressing this issue: important scientific and technical information gaps remain to be filled, pivotal policy decisions must be made, and cooperation of agricultural and other water users needs to be secured.

With respect to filling scientific and technical information gaps, efforts are now underway to generate an up-to-date inventory of unscreened diversions in the Sacramento mainstem. However, because of equipment and personnel limitations, this process is likely to take another 18 months, or more. Another important information gap is that there has never been a comprehensive synthesis and critical evaluation of successes and failures of previous screening efforts in this river system. Such a review should be

coupled with a literature review of comparable work elsewhere, such as in the Columbia River basin. Such a compilation of information could be very valuable when combined with the completed inventory of unscreened diversions in helping chart an efficient and effective course of remedial actions. The third major scientific information gap pertains to the location of biologically key or "sensitive areas along the mainstem. When viewed from a biological perspective, not all unscreened diversions are likely to be of equal priority for remedial action. Some important biological considerations relate to the diversion itself (e.g., depth in the water column, location relative to the bank, period of use), while others pertain to biological factors (e.g., superior or unique habitats for juvenile rearing, timing of juvenile movements). This gap could be filled through a combination of fieldwork and a synthesis of relevant literature. Above all else the subgroup emphasized the need to avoid duplication of efforts through well-planned coordination.

From a policy perspective, there are several weighty and unresolved issues, including: (I) whether to begin the screening campaign by focusing first on the "largest" water diversion projects, (ii) offering assurances to water users that "a deal is a deal", meaning that once screening at a site is complete the owner will not be asked for extensive additional engineering modifications in the near future, and (iii) differences in applicable state and federal criteria.

Subgroup participants also noted the importance of working with water users to help members of that community better understand both the need for fish screens on diversion projects, as well as ancillary issues pertaining to liability, long term maintenance and operation, and so forth. It was suggested that water users be given an opportunity to participate in setting screening priorities, project evaluation, and other related initiatives. Members of this subgroup recommended creating a fish screening symposium where all relevant issues – science, policy, and stakeholder involvement - could be discussed, and that experiences from other places (e.g. Columbia River Basin) could be offered for consideration and analysis. Beyond the information sharing aspects of such a meeting, several other important features were noted, including the fact that the symposium could serve as a useful 'deadline' to help spur along other initiatives (e.g., inventory of unscreened diversions, synthesis of information on biologically important areas, and the critical evaluation of previous screening efforts). As well, the symposium could help advance the process of formulating consensus on a set of policy issues that require attention from senior decision-makers. Finally, the symposium could also assist those tasked with dealing with this issue by providing them with a forum to discuss coordination and ways of avoiding duplication of efforts.

Unscreened Diversion Inventory

Current efforts by the California Department of Fish and Game to update and improve the database on unscreened diversions are being slowed by inadequate resources. Subgroup participants recommended that Category III offer $100,000 "challenge money" to be matched by other sources to help alleviate resource shortages and accelerate availability of data and information to fill key information gaps for both the inventory of unscreened diversions as well as the biological evaluation (see below). These funds could be put to use in a number of ways. For example, the rate at which the inventory could be completed could apparently be accelerated if technical crews had access to a jet boat.

Biological Evaluation

Once the inventory described above is completed, it will be important to progress swiftly in establishing a comprehensive and sensible strategy for modifying unscreened diversions. Thus, it is important that

good information be available at that time describing the location of biologically key or "sensitive areas along the mainstem. Field studies are an important element in filling this knowledge gap, but some effort should also be devoted to synthesizing relevant literature.

There are at least two three important facets of this biological work. One requires efforts to categorize biological risks associated with different types of diversions, as a function of diversion location, size, water intake design, and so forth. It would be useful if a classification scheme could be devised to help in setting screening priorities and approaches. In this context it would be useful to undertake field tests prior to screening to help compile the information that will later be needed to assist in selecting optimum engineering designs for screening different types of diversions. Undertaking such studies will require not only technical resources (e.g. time for scientists and engineers), but also stakeholder cooperation.

The second type of biological evaluation involves compiling information on the efficacy of different "test" screens to determine not only their effectiveness for solving fish-related problems, but also for providing needed information on operational characteristics that will help in predicting maintenance requirements and costs.

Finally, the subgroup participants recommended that some effort should be devoted to trying to develop a zoning or river reach classification scheme that could aid in mapping biologically important / "sensitive areas along the mainstem. This information could also prove most helpful when establishing a comprehensive and sensible screening strategy.

As noted above, the subgroup recommended that $100,000 "challenge money" to made available to help support the inventory and the biological evaluation. These funds would be used to help ensure that biological data and information are available when needed to assist in formulating a comprehensive screening strategy for the Sacramento River mainstem.

Design Competition

Although there are many large diversions that will need custom-designed fish screens, there are also a significant number of smaller diversions, many operating in the range of 10 to 50 ft^3/s. Some of these may also need screening, perhaps with a more 'standard' solution. Members of the subgroup suggested that an open design competition be held to identify a suitable engineering solution applicable to such small diversions. They suggested that a prize of $25,000 to offered to the winner who is able to invent a screen that has minima1 operational requirements, needs little maintenance, is of reasonable cost, can be transported by pickup truck, and does not require special expertise for proper installation.

Reclamation District 1004 (Princeton Pumping Plant)

The 1996 California Department of Fish and Game report entitled *Status of Actions to Restore Central Valley spring-run chinook salmon,* recommended screening larger water diversions on the Sacramento River, including the pumping plant operated by Reclamation District 1004 (Princeton). Category III has received a proposal requesting approximately $150,000 to support a detailed feasibility study for a positive barrier screen. The subgroup participants recommended: (a) cost sharing the feasibility / engineering study with CVPIA and the project proponents, with the provision that the Category III portion not exceed $75,000 or 50% of the total costs, and (b) that Category III indicate agreement in principle to support the actual project at an appropriate funding level (e.g., 30-40% of the total estimated $4.5 million), with the provision that additional funds come from other funding partners (e.g., CVPIA,

project proponent) and that the proponent accept all responsibility for long-term operating and maintenance costs.

Provident Irrigation District and *Princeton – Codora – Glenn Irrigation District*

As noted above, the *1996* report, *Status of Actions to Restore Central Valley spring-run chinook salmon,* recommended screening larger water diversions on the Sacramento River, including the three pumping plants operated by the Provident Irrigation District and the Princeton – Codora – Glenn Irrigation District. Category III has received a joint proposal on behalf of the two irrigation districts requesting approximately an unspecified financial commitment to assist in consolidating three existing pumped diversions (two of which are on the Sacramento mainstem) into one that is to be equipped with a positive barrier fish screen. Apparently the feasibility study is ongoing, or has now been completed.

As with the Reclamation District 1004 proposal, the subgroup recommended: (a) cost sharing the engineering study with CVPIA and the project proponents, with the provision that the Category III portion not exceed $75,000 or 50% of the total costs, and (b) that Category III indicate agreement in principle, to support the actual project at an appropriate funding level (e.g., 30-40% of the total estimated $6 to 7 million), with the provision that additional funds come from other funding partners (e.g., CVPIA, project proponent) and that the proponent accept all responsibility for long-term operating and maintenance costs.

Because of the cooperative spirit of the proponents, it was suggested that this project might make a nice experimental 'before:after' case study documenting screening benefits. While it is an agreed-upon principle of Category III that all funded projects be subject to after-project monitoring, there are potential problems related to initiating before-project monitoring at this site. The problems pertain to the possibility of discovering listed endangered species in the proponents water system. Should this be found to be the case, it could have adverse impacts on the proponent's operation of their water distribution system. Nonetheless, it does seem as though it should be possible to draw up a legal agreement offering indemnity to the proponent in exchange for participating in such a research program.

Reclamation District 108 (Wilkins Slough Pumping Plant)

Reclamation District 108 is on the list of larger diversions on the Sacramento River mainstem that require screening, according to the 1996 report, *Status of Actions to Restore Central Valley spring-run chinook salmon.* Category III has received a proposal from R.D. No. 108 for financial support toward the estimated $800,000 needed to cover capital costs for continued experimental investigations aimed at testing efficacy of alternative technologies to provide protection for juvenile fish exposed to the pumping facilities. Since 1992, R.D. No. 108 has been engaged in a series of experimental investigations for alternative protection mechanisms, such as electrical and acoustic barriers, coupled with flow distribution facilities. Results to date have been inconclusive.

Subgroup participants rejected the proposal for Category III to provide financial support for additional experimental testing. However, consistent with recommendations for R. D. No. 1004 and the Provident Irrigation District / Princeton – Codora – Glenn Irrigation District, the subgroup did encourage Category III to contribute financial resources to R.D. No. 108 in support of an engineering study examining the

installation of a positive barrier at the Wilkins Slough pumping site'. Suggested terms and conditions are the same as for the other projects: (a) cost sharing the engineering study with CVPIA and the project proponents, with the provision that the Category III portion not exceed $75,000 or 50% of the total costs, and (b) that Category III indicate agreement in principle, to support the actual project at an appropriate funding level (e.g., 30-40% of the total estimated costs), with the provision that additional resources come from other funding partners (e.g., CVPIA, project proponent) and that the proponent accept all responsibility for long-term operating and maintenance costs.

Riparian Ecosystems

Overview

With respect to successful rearing and downstream passage of juvenile spring-run chinook salmon, two of the three main issues identified by the subgroup for the Sacramento mainstem were: (I) availability of suitable habitat with shaded cover, and (ii) adequate food supplies. Both of these factors are largely dependent upon functionally intact, vegetated riparian zones and availability of natural flood plains. Riparian forests not only provide food for juvenile salmonids (e.g., terrestrial insects), but also offer reservoirs of cool air, thus improving conditions for rearing juveniles. Additionally, woody debris from the forest that enters the river can provide protection to, and enhanced conditions for, juvenile salmon'.

Maintaining existing riparian forests in reaches two (Red Bluff Diversion Dam to Chico Landing) and three (Chico Landing to Colusa) is especially important for spring-run chinook salmon. In addition, both the 1996 California Department of Fish and Game report, ***Status of*** *Actions to Restore Central Valley spring-en chinook salmon,* and the 1996 *Category III Guidance Document* recommend projects aimed at protecting and restoring mainstem riparian habitat. In fact, the *Category III Guidance Document* recommended that Category III contribute $300,000 toward cost-sharing a feasibility analysis of restoring shaded riverine habitat along the lower Sacramento River. While the subgroup participants did not endorse that specific recommendation, they did agree with the basic intent to protect and restore mainstem riparian habitat, as reflected in their specific recommendations, recorded below.

Meander Belt

Another strategy, described in an existing Comprehensive Corridor Management Plan (CCMP), is to re-establish a region in which the river meanders naturally during flood periods. According to the Conceptual Plan, such a meander belt could be established in the river segment from Red Bluff to Chico Landing, an area of over 10,000 acres, and in some areas as far downstream as Colusa. Below Colusa there are few options for establishing such a meander belt. Lands within the meander belt would be allowed to flood naturally, thereby expanding the floodplain. While such a plan may have positive implications for both salmon and operation of Shasta Dam (i.e. fewer flood waters would need to be stored), the weak link is the City of Sacramento.

Of the area discussed in the Conceptual Plan (12,000 - 16,000 acres), approximately l/3 is already in public ownership. The remaining land has a value of around $80 M. Thus, the plan calls for a

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'Note that this may already be legally required through other processes.

2The AFRP has suggested that Salmonid fishes would benefit from artificially creating/ adding structure to the river system by introducing boulders and logs.

combination of approaches including working with "willing sellers" and "promoting" easements. Guiding land acquisitions are a series of four Management Principles, in order of priority:

1) preserve existing natural process;
2) allow existing natural processes to continue undiminished (e.g., allow terrestrial vegetation successional forces to achieve climax community status);
3) in places where natural processes have been disturbed or no longer operate, re-institute with the cooperation of land owners; and
4) undertake re-forestation programs.

At this time discussions are underway to explore establishing a non-profit conservancy to implement the CCMP. The conservancy would oversee general land acquisition, and establishment of appropriate easements. Since this mechanism does not yet exist, it is too early for Category III to contribute resources to this effort. However, subgroup members suggested that, should such a body be established in the coming year, that Category III look favorably upon future requests to assist in implementing the CCMP.

Pine Creek Orchards

The U.S. Fish and Wildlife Service is seeking to acquire and restore a 430 acre site within the Sacramento River National Wildlife Refuge. This project is a partnership between the Service, The Nature Conservancy, the California Department of Water Resources, the U.S. Army Corps of Engineers, and the landowner. Up to $5,950,000 in Category III funds are being requested.

The subgroup noted that this project could have some benefits to spring-run chinook salmon, but it is not of high priority for that particular species. Nonetheless, they agreed that this is a worthwhile project, but suggested that it be evaluated as part of a broader, more comprehensive riparian strategy. They recommended that the Category III Steering Committee send a letter urging collective support by CVPIA, CALFED, Four Pumps, and others.

Stream Corridor Mapping

Many individual land use decisions along the river and stream corridor are made according to local zoning information, guidance from local, state, and federal agencies, and by developers. There is an urgent need for good, up-to-date maps that can help influence individual decisions in ways that may be favorable for riparian habitat conservation and protection. Geographic Information Systems (GIS) methodology and techniques are particularly relevant here, and the outputs are directly useful to local agencies. Currently approximately ½ the valley floor has already been mapped in a GIS format.

Category III has now received a proposal to provide upwards to $150,000 to complete this mapping project. The subgroup agreed that, once completed, such a database would be particularly useful for a number of different purposes. For example, such a GIS database would be helpful in evaluating specific land acquisition proposals (e.g., Pine Creek Orchards). Thus, although this initiative is not directly related to spring-run chinook salmon alone, it was recommended for high funding priority.

Funding Assistance to Conservancies

The 1996 *Category III Guidance Document* recommended setting aside $500,000 to fund a grant

program to assist established conservancies in developing or completing stream restoration or watershed management plans. The mainstem subgroup agreed with and supported the intent of this initiative, but recognized that it would be of primary value in an ecosystem restoration context, and not linked directly to spring-run chinook salmon. Nevertheless, they did recommend contributing to such a grant program, but at a lower (unspecified) funding level.

Toxics

Because the subgroup ran out of time, they devoted relatively little discussion to this important topic. However, they did address three issues: (1) Iron Mountain; (2) Sacramento River toxicity; and (3) Expand the Interagency Ecological Program to the Sacramento Valley.

Iron Mountain

There was general consensus that this issue is now under control and that Category III need do nothing at this time. The subgroup members rejected the Category III proposal calling for funds to support research into metal-contaminated sediments in Keswick Reservoir.

Sacramento River Toxicity

Recent data collected from several locations in the Sacramento River, including upstream of the City of Sacramento, suggest that the river water can contain surprisingly high concentrations of (unidentified) toxic substances. There are a number of important uncertainties surrounding these findings. For example, it is unknown whether these data are truly representative of general conditions in the river; they may, for example, be due to localized sources of contaminants. Likewise, the data pertain to a particular species of fish used for the toxicity tests (i.e. fathead minnows). It is unknown how to extrapolate these data to spring-run chinook salmon, although most fisheries biologists would predict that juvenile chinook salmon would to be more sensitive to toxics than the relatively hardy fathead minnow. Despite these uncertainties, the subgroup felt that the growing body of evidence suggest that it is time to investigate this factor in more detail.

Because Category III has a particularly strong mandate to champion factors other than water flow that may be important in causing declines in the health and integrity of the Bay-Delta ecosystem, the subgroup recommended that Category III provide funds to help resolve some of the uncertainties. In particular, they recommended in-situ testing (I) with native organisms (e.g., spring-run chinook salmon), (ii) at various locations along the mainstem, and (iii) using a variety of carefully controlled protocols to eliminate or reduce uncertainties associated with sampling and analytical errors.

Subgroup members recommended that such investigations be coordinated with an expanded IEP that has a broadened geographic focus that encompasses the whole Sacramento River valley (see following section).

Expand IEP to Sacramento Valley

Finally, the subgroup recommended that the geographic focus of the Interagency Ecological Program (IEP) be expanded to include the Sacramento mainstem. As well, the IEP membership should be expanded to include a multi-stakeholder group with a wide diversity of relevant technical experience and local geographic knowledge.

5.0 Delta / Ocean

The Delta subgroup met to consider the charge of identifying: 1) sources of mortality; 2) influences on productivity; and 3) influences on movement for spring-run chinook salmon in the region bordered by the "legal" delta. As spring-run chinook salmon do not spawn in the Delta, influences on productivity were not considered a high priority for review by the group.

The members of the group were:

Bruce Herbold, EPA, Reporter
Deborah McKee, CDF&G
Cindy Darling, USBR
Sharon Kramer, MWD
Leo Winternitz, DWR
Rob Titus, CDF&G
Joe Miyamoto, EBMUD
Cynthia Koehler (partial attendance), NH1
Andy Gunther, Facilitator

The sources of mortality identified by the group were:

1. toxics;
2. predation;
3. entrainment (including predation associated with diversion structures);
4. temperature;
5. lack of rearing habitat;
6. illegal or incidental harvest;
7. stranding; and
8. trophic interactions (indirect effects that increase predation pressure).

At the end of Tuesday the group went around the table and selected what they beiieved to be their top three sources of mortality based upon their best professional judgment. This procedure identified four high priority issues: lack of rearing habitat, stranding, entrainment, and predation.

Factors influencing movement identified by the group were:

1. diversion from migratory corridor and rearing habitat; and
2. alteration of direction and magnitude of flows.

During Tuesday afternoon, the group considered each of these subjects, discussing some of what was known regarding these factors and identifying existing programs examining these issues. On Wednesday the group discussed existing data gaps and priorities for projects addressing these gaps, and summarized these discussions by preparing recommendations for funding for the Category III Steering Committee.

5.1 General Comments

One general point raised by the group was that for many of the above factors, spatial and temporal variation was a critical issue, as the coincidence of spring-run chinook salmon and the identified causative agents (i.e, toxic chemicals or diversion structures) was necessary for damage to occur. The group felt that recent recovery of tagged smolts at Chipps Island in early June was a very important finding, as it documents that spring-run chinook salmon are emigrating to the delta over a longer period than previously believed.

The group felt that some of their efforts were duplicative of other meetings, and recommended the following documents that could provide important information relevant to their deliberations:

- The Winter Run Chinook Recovery Plan
- The Central Valley Action Plan
- The Spring-run Action Plan
- The Delta Fishes Recovery Plan
- The Spring-run Monitoring Plan
- The Anadromous Fish Restoration Plan (AFRP)
- The Comprehensive Assessment Monitoring Plan (CAMP)

The group felt is was important that all projects include monitoring and evaluation elements that can be used to determine the effectiveness of the program. This is critical for providing feedback allowing adaptive management of the spring-run chinook salmon. In addition, for many projects (especially habitat manipulation and unscreened diversion), a review of detailed project plans after engineering design by a group of independent biologists would be desirable to maximize the biological benefits from the project. This is especially important for verifying that an adequate experimental design has been included to allow projects to help fill important data gaps for adaptive management.

The following notes summarize these discussions by subject area.

5.2 Diversion from Migratory Corridor and Rearing Habitat

This issue is important for the deepwater ship channel, the delta cross channel, the Monteczuma Slough salinity control gates (especially operations during the winter that effect spring out-migrants), and agricultural barriers. The operation of these structures can lead to the movement of spring-run chinook juveniles and adults to suboptimal locations, contributing indirectly to mortality.

Existing programs addressing this issue include operational changes instituted at the delta cross channel, and environmental assessment being conducted by DWR on temporary barriers, and monitoring by the USFWS at the delta cross channel and Monteczuma Slough.

The group felt that these issues were more efficiently addressed by CALFED and other entities, and had no recommendations to the Category III Steering Committee.

5.3 Alteration of Direction And Magnitude of Flows

The group identified the influence of the water projects on flows in the delta as an important issue influencing the movement of spring-run chinook salmon. As this issue is being considered in detail by

the IEP and CALFED, little discussion ensued except with reference to the important data gap relative to homing cues of spring-run chinook salmon.

The group concluded that Category III Steering Committee should solicit proposals to evaluate migratory cues for out-migrating salmon smolts in the delta. In addition, the group recommended that support should be given by the Steering Committee to other attempts to fund data collection on the direction and magnitude of flows in delta channels that can be used to validate hydrologic models of the region.

5.4 **Toxics**

The group noted that the spatial and temporal distribution of toxics and toxicity is quite important relative to the presence of spring-run chinook salmon, as the presence of toxics does not ensure that the fish are exposed to these substances. There was concern about the relevance of the test species in toxicity tests to spring-run chinook salmon, and also that existing tests do not adequately address the question of sublethal effects.

Existing programs addressing the abundance, distribution, and toxicity of trace substances include the SWRCB/Dept. of Pesticides efforts on dormant spray pesticides, the County of Sacramento Runoff study, toxicity testing in the Sacramento River conducted by the County of Sacramento and the CVRWQCB, the Regional Monitoring Program for Toxic Contaminants in the San Francisco Estuary (and similar efforts starting up in the Central Valley), the IEP Contaminant Effects working group, and the BIOS program for dormant spray runoff control.

The group recommended that the Category III Steering Committee solicit proposals to evaluate toxic impacts of ambient water, in a sequential fashion, on (I) survival of salmon, (2) growth rates and other chronic endpoints, and (3) ecological processes, especially toxicity to important prey species. Bioassays that utilize salmon fry should be developed and applied.

5.5 **Predation**

This was not a subject that the group felt could be well-addressed by Category III due to the complexity of isolating effects of predation from other factors. Key points in the discussion were differentiating the impact of general predation from that associated with structures where “gauntlets” of predators may develop with devastating effects (Clifton Court, Hood). Some discussion ensued regarding developing a “fish out” for predators. It was pointed out that there is at some point a basic conflict between trying to protect spring-run chinook salmon while at the same time supplementing the production of striped bass, a voracious exotic predator.

The group recommended that a test of the hypothesis “Shallow water habitat protects juvenile spring-run chinook salmon from predation” be included if possible in habitat manipulation projects.

5.6 **Entrainment (Including Predation Associated with Diversion Structures)**

The objective of work conducted to address this source of mortality should be to minimize the loss of spring-run chinook salmon due to entrainment into man-made structures. Understanding the location, volume, and timing of operation of structures is essential for determining the potential mortality for spring-run chinook salmon. Many existing programs have addressed this question, including the agriculture diversion study, changes to facility operations (including new guidelines that are emerging

for the operation of the delta cross channel), studies on the genetics of entrained fish, and the Suisun Marsh Entrainment Study conducted by CDF&G.

Four sets of diversions resulting in entrainment were identified: PG&E (Antioch and Pittsburg power stations), water projects, Suisun Marsh salinity control gates, and agricultural diversions. The first two are active all year, while the agriculture diversions are active mainly in the April-June period of the out-migration, and the salinity control gates are active mainly in winter.
It is essential that the direct losses and predation losses associated with each of the above four groups be estimated. The group recommends that Category III Steering Committee consider work on unscreened diversions in Suisun Marsh for spring-run chinook salmon restoration as a high priority. However, the group felt that there were several sources of existing data on the location, timing, and volume of diversions that should be used the validate this prioritization. Any proposals to go forward on unscreened diversion should make use of these data to justify the work as high priority. For example, discussion on Wednesday afternoon with the whole group suggests that adequate data exist to conclude that entrainment at the PG&E facilities does not seem to be a major problem for spring-run chinook salmon (although intense predation due to the attraction of warm-water exotic predators to the thermal plume from the plants should be considered).

Another recommendation was that the Category III Steering Committee support projects that maximize the operation flexibility of water projects, PG&E power plants, and other diversions to minimize the entrainment of spring-run chinook salmon.

5.7 **Temperature**

This was considered a minor factor in the delta, and much more important for the main stem and the tributaries. Existing programs include ongoing discharger consultation by CDF&G with the Sacramento STP, and broad scale monitoring of temperature in the delta by non-salmon programs. The possible indirect thermal effects of the PG&E facilities (changing migration pattern or concentration of predators) was briefly discussed.

5.8 **Lack of Rearing Habitat**

This issue was considered very important by the group. Everyone agreed, however, that an existing untested assumption is that historically the delta provided valuable rearing habitat for spring-run chinook salmon. This assumption is based upon our knowledge of salmon juveniles from elsewhere that suggests the valuable characteristics of rearing habitat include structural complexity that provides escape cover, velocity shelter, and encourages food availability. We do not really know the importance of the delta as rearing habitat, as apparently the spring-run chinook salmon employ two strategies (development in main stem v. development in delta). A critical hypothesis that should be tested if possible is that the availability of suitable rearing habitat is limiting growth and survival of spring-run chinook salmon in the delta.

Programs currently addressing this issue include real-time monitoring for tagged fish, USFWS seining, and the Bay-Delta Resident Fish program. The group provides the following recommendations:

1. Solicit proposals for rearing habitat restoration in the delta, especially in the north delta. However, any habitat manipulation projects should be designed in an experimental fashion to allow for comparative assessments of different methods and techniques of restoration.

2. Solicit proposals to inventory existing rearing habitats in the delta, and the growth rates of spring-run chinook salmon in those habitats.
3. Solicit proposals that will develop techniques to identify different races of chinook salmon.
4. Solicit proposals to characterize the Yolo Bypass as salmon rearing habitat.

5.9 Illegal or Incidental Harvest

Although this was not considered to be a high priority by the group, it was noted that unlike the main stem and the tributaries fishing is legal in the delta. The Sacramento River Angler survey suggested that incidental harvest is not a problem, but this should be verified. A system-wide creel census has been proposed by CDF&G to the CVPIA to address this question.

5.10 Stranding

Stranding of both juvenile spring-run chinook salmon in the Yolo Bypass (and areas south) and adult spring-run chinook salmon in the Sacramento Deep Water ship channel were considered important issues by the group. There is widespread empirical evidence supporting this position, but little data from systematic study (USFWS has done some work in the ship channel).

The group recommended that the Category III Steering Committee solicit a proposal to examine opportunities to improve drainage and reduce stranding of fish in the Yolo Bypass. These proposals would likely include re-grading, and should address both juveniles and adults. They should suggest ways to test the hypothesis that such manipulations will improve the survival of salmon entering the Bypass. The committee should also solicit a proposal to develop a system to allow passage of adult spring-run chinook salmon out of the deep water ship channel and back to the main stem of the Sacramento River.

5.11 Trophic Interactions (Indirect Effects that Increase Predation Pressure)

This issue was discussed briefly by the group, including factors such as competitive interactions with exotic species, food limitation, and impact of water hyacinth on the availability of valuable shallow water habitat. There was significant overlap of this discussion with that on rearing habitat. It was pointed out that NMFS conducted some studies to address this question.

The only recommendation was that studies might want to compare the condition of fish in the Yolo Bypass at the Sacramento River to get an indirect measure of these potential factors contributing to morbidity or mortality of spring-run chinook salmon.

6.0 Broad Issues

In plenary session at the end of the workshop, participants singled out three broad themes for additional discussion: (1) monitoring, (2) recommended next steps for Category III, and (3) identification of spring - run chinook salmon.

6.1 Monitoring

There was general agreement among all participants of the need for more system-wide ecological monitoring in the Sacramento valley, beyond that which is, or will be, taking place as part of project-

specific studies. Workshop participants were reminded that the Category III Principles include the requirement that monitoring and evaluation be included as part of each approved initiative.

It was also noted that in the Bay-Delta Accord, monitoring was specifically highlighted as one of the six key principles for implementing Category III, and that the Accord called for separate funding of monitoring initiatives. Participants agreed that such monitoring should not be designed or implemented in an ad-hoc manner, but rather guided by a clear, visionary, and stable set of system-level questions. The key issue at this time is who will articulate these questions and coordinate the monitoring activities. Participants again emphasized the need for continuity in, and sustained support for, ecological monitoring over long time periods (also see Section 1.3.2).

The mainstem subgroup recommended this could be done if the geographic focus of the Interagency Ecological Program was expanded to include the entire Sacramento Valley. In the plenary session it was suggested that the Category III Steering Committee set aside a sum of money to be allocated to an expanded IEP to assist them in 'jump starting' design and implementation of an enhanced monitoring program in the Sacramento valley. Although the plenary group decided not to make such a funding recommendation at this time, it did support the idea of having a more system-wide ecological monitoring program in the valley and suggested that such a funding proposal await formation of the Ecosystem Roundtable.

6.2 Next Steps for Category III

Workshop participants were enthusiastic in supporting the idea that Category III engage in a multi-phase funding scheme, as opposed to a once-a-year funding opportunity. They also endorsed the idea of the Category III Steering Committee taking a proactive stance with respect to initiatives outside their jurisdiction, but consistent with the Category III mission. In other words, they recommended that the Category III Steering Committee draft "Letters of Support" for certain initiatives. Some of these opportunities are labeled "Administrative" in the Costing column of the Chapter 7 tables.

There was also encouragement for the idea of forming a multi-stakeholder working group under the auspices of CALFED / Category III to translate results of the workshop into RFP's and requests for modified proposals from selected proponents. This would help ensure implementation of high priority items identified during the workshop.

6.3 Identification of Spring - Run Chinook

A consistent theme throughout the workshop was the difficulty in identifying spring-run chinook salmon stocks. The 1996 *Category III Guidance Document* recommended devoting $275,000 to a project to analyze stock identification and life-history success of chinook salmon through analysis of scales and otolith microstructure. The workshop participants agreed with the need for such a special study, and suggested that some (unspecified) funds be made available for this purpose. Perhaps these funds could be included as part of the resources to be provided the newly expanded IEP (see section 6.1. above). In this way such a special study could become part of a much broader, and more integrated ecosystem study.

The workshop participants also suggested that some funds could be allocated for a special study of the genetics of spring-run chinook salmon. Again, it is reasonable to suggest that if such funds are made available, they be included as part of the resource package provided to an expanded IEP (see section 6.1).

7.0 Recommendations for Projects and Programs

Table 7.1 includes a complete list of all the projects, programs, and study needs identified in the Guidance Document and at the workshop. It includes project location, a brief description of the project, and the current estimate of cost to Category III which, if there are currently no cost sharing partners, is the total project cost. Where cost sharing partners have been identified, it includes this information. A priority has been assigned to each project or program. Where that priority was assigned after the workshop based on the facilitators recollection of the discussion at the workshop, it is followed by a question mark to indicate that it could be revised based on review by the participants.

The last column indicates the stage of development the project or program is at. This column was added after the workshop to assist the Steering Committee. Projects in Tier 1 indicate that there is a proposal that is essentially ready to fund. Projects that are in Tier 2 are currently undergoing feasibility analysis and a complete proposal could be expected once that analysis is complete. Projects in Tier 3 will need to have proposals developed or solicited before they can be considered for funding. Indications that 'a project is Tier 2 or 3 does not change the priority of those projects but merely indicates the level of development of the proposal. It is expected that projects currently in Tier 3 can, in some cases, be quickly turned into complete proposals that are ready to fund.

8.0 Process Recommendations

At the conclusion of the workshop, participants were asked what aspects of the workshop they found most beneficial and for suggestions on how to improve the process for next year.

The mechanics of the workshop seemed to work well for the participants. They rated the facilitators, the structure, and the limiting factors approach fairly high. They appreciated the opening presentations and supported the concept of having outside scientific input. They felt the workshop format could be easily adapted to serve as the building block for an overall ecosystem approach to restoration planning.

The participants suggested that the next cycle of project selection start with a more basic approach that identified the goals on an ecosystem basis. These goals would then be the subject of additional work to prioritize the factors limiting attainment of these ecosystem goals. They also felt it would be useful if, prior to these biological workshops, information could be collected on previous efforts such as the Anadromous Fisheries Restoration Plan and distributed to participants.

Once the priority areas were established on a biological basis, proposals should be solicited to address the highest priority concerns. These proposals would then be the subject of a project selection phase.

In the project selection phase, consistent complete proposals would be solicited, that identified project costs including monitoring, operations and maintenance. Environmental review necessary for each project should be discussed in the proposals. Information on potential cost share partners was also requested. The process to solicit and receive proposals should be more structured and timed so that the proposals can be distributed ahead of the workshop. Clear guidelines on potential conflict of interests should be developed to maintain the credibility of the process.

Additional recommendations focused on streamlining the project selection process through development of a clearinghouse for proposals. Consideration of these proposals would then be coordinated based on shared priorities amongst several restoration efforts.

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	Cost Sharing Information	Priority	Recommended Tier and Potential Actions
Tributaries & Mainstem	Fund a grant program to assist conservancies to develop or complete stream restoration or watershed management plans.	$500,000			High	Tier 3/RFP # 1
Delta	Conduct an interdisciplinary evaluation of breached dike wetland recovery sites in the Delta and upper estuary.	$3 50,000			High	Tier 3/RFP Some proposals have already been submitted. #2
Delta	Conduct an analysis of stock identification and life-history success of chinook salmon through the use of scale and otolith microstructure				High	Tier 3/RFP #7
Delta	Partial cost share and analysis of the feasibility of restoring shaded riverine habitat along the lower Sacramento River	$500,000	$1 ,000,000 for FY 97	USACE	High	Tier I/ Fund USACE local cost share
Delta	Solicit proposals to evaluate migratory cues for outmigrating salmon in the Delta. Also wanted policy support for data collection on direction and magnitude of flows in Delta channels to validate models.				Med	Tier 3/ Work with IEP
Delta	Solicit proposals to evaluate toxic impact of ambient water on salmon survival using bioassays, on growth rates and other chronic endpoints, and on ecological processes, especially toxicity to important prey species.			USEPA, RWQCB	High-Med	Tier 3/RFP # 17
Delta	Unscreened diversions in Suisun Marsh				High	Tier 3/ RFP #8
Delta	Solicit proposals for rearing habitat restoration in the Delta, especially in the north Delta, with a strong preference given to projects that allow for experimentation to assess effectiveness of different restoration techniques and methods. Include monitoring to determine effects on predation.				High	Tier 3/RFP #5
Delta	Solicit proposals to inventory existing rearing habitats in the Delta and determine the relative benefits associated with different restoration techniques and methods.				Med-High	Tier 3/Include in RFP for study of wetlands sites in the Delta RFP #2
Delta	Solicit proposals to develop techniques to identify different races of salmon				Med-High	Tier 3/ RFP #6

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	cost Sharing Information	Priority	Recommended Tier and Potential Actions
Delta	Solicit proposals to characterize Yolo bypass as rearing habitat and potential benefits and negatives of fish using this area. Include evaluation of actions that would be needed to reduce stranding				Med	Tier 3/ RFP #3
Delta	Verify assumption that incidental harvest is not major factor				Low	Tier 3/Unknown
Delta	Solicit proposals to develop passage for adult salmon out of Deep Water Ship Channel				Low/Med	Tier 3/ RFP #4
Sacramento	Catastrophic straying options analysis				Low/Med	Tier 3/Unknown
Sacramento	Options analysis at Wards Landing/Butte Cr to improve fish passage				Med-High	Tier 3/RFP # I2
Sacramento	Flow measurement at Sutter Bypass				Low	Tier 3/Unknown
Sacramento	Ensure continued funding of efforts to resolve passage at Red Bluff Diversion Dan				High	Work with CALFED agencies
Sacramento	Evaluate ACID issues such as genetics of salmon above, viability of managing for in-river production, and gravel supply issues				Low	Tier 3/ Genetic component included in RFP #11
Sacramento	Evaluate incidental catch during legal fishing season				Low	Tier 3/Unknown
Sacramento	Iron Mountain				High	No Category III efforts currently needed
Sacramento	Ensure that on-going inventory of unscreened diversions gets done and that biological priorities are developed to guide future decisions on screening.				High	Work with CALFED agencies to ensure this gets done.
Sacramento	Fish screen symposium				Med	Tier 3/ RFP # 10
Sacramento	Design competition for screening of small diversions	$25,000			Low-Med	Tier 3/ RFP # lO
Sacramento	Reclamation District 1004's Princeton pumping plant positive barrier fish screen	$75,000	$4,500,000	CVPIA	High	Tier I/Fund feasibility study 50/50 split with CVPIA
Sacramento	Princeton-Codura-Glenn Irrigation District/Provident Irrigation District combined pumping plant with positive barrier fish screen		$7,000,000	CVPIA and PCGID/PID	High	Tier 2 /Fund appropriate amount of construction costs which are estimated to be $6 to $7 million

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	cost Sharing Information	Priority	Recommended Tier and Potential Actions
Sacramento	Reclamation District's 108's Wilkins Slough pumping plant positive barrier fish screen	$75,000			High	Tier 2/Contact RD 108 to advise that Category III would consider cost sharing feasibility study and construction costs on a positive barrier fish screen
Sacramento	Support formation of non-profit conservancy to acquire meander belt lands and riparian habitats	$0			Medium	Tier 3/ RFP # 1
Sacramento	Pine Creek Orchards land acquisition and restoration				Low	Submitted proposal was not recommended for funding.
Sacramento	Stream Corridor mapping	$150,000			High	Tier 3/RFP #9
Sacramento	Funding assistance to conservancies	?			High	included in RFP # 1 for watershed conservancies
Sacramento	Metal contaminated sediments in Keswick Reservoir	$262,000			Low'	Submitted proposal was not recommended for funding.
Sacramento	Sacramento River Toxicity Study				High	Included in RFP #I7 called for in Delta section.
Sacramento	Expand IEP concept to Sacramento Valley				High	Work with CALFED agencies
Battle Creek	Install fish screen and ladder at Eagle Canyon Diversion Dam	$700,000		CVPIA?	High	Tier 2/Fund proposal at completion of DWR engineering analysis RFP # 15
Battle Creek	Restore and replenish spawning gravel in the North Fork	$100,000			?	Tier 3/RFP # 16
Battle Creek	Negotiate and fund a perpetual instream flow agreement with Pacific Gas and Electric Co.	$2,000,000			High	Tier 3/RFP # 16: Category III previously committed $500,000 which can be used for Battle Creek proposals.
Battle Creek	Prepare an options, feasibility analysis for additional fish screens and ladders and a flow allocation methodology	$250,000			High	Tier 3/RFP #15 & #16

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	cost Sharing Information	Priority	Recommended Tier and Potential Actions
Battle Creek	Evaluate options to provide an isolated water supply for Coleman National Fish Hatchery	$10,000	Unknown	CVPIA?	High	Tier 3/RFP # I6
Battle Creek	Develop a watershed plan				High	Tier 3/included in watershed conservancy RFP # 1 process
Antelope Creek	Conduct an options, feasibility, and engineering analysis of fish passage problems and habitat restoration opportunities	$250,000			High	Tier 3/RFP # 15
Big Chico Creek	Reconstruct existing water control structure at Lindo Channel.	$100,000			High	Tier 3/RFP # 13
Big Chico Ck	Rebuild fish ladder at Iron Canyon Pool	$200,000			High	Tier 3/RFP # I5
Big Chico Ck	Replace fish ladder at One Mile Pool				Low	Defer
Big Chico Creek	One Mile Pool Bypass	$150,000		City of Chico $40,000 bid for design and $150,000 for construction	High	Tier 2/Fund proposal once reviewed for feasibility.
Big Chico Creek	Expand monitoring for genetic integrity, population levels, escapement and outmigration success				High	Combine into system wide studies RFP # I 1
Big Chico Creek	Increase warden efforts to deter poaching during critical times.				Unknown	Check with DFG
Butte Creek	Construct fish screens at Adams, Gorrill, and Durham Mutual dams.	$ I ,500,000	$3,000,000	CVPIA 50/50 cost share?	High	Tier 2/Fund when DWR engineering work is complete. Original $3 16,500 Cat III commitment can be included in funding. RFP # I5
Butte Creek	Conduct site survey and prepare options and engineering analysis for remaining diversions along lower Butte Creek, including White Mallard diversion	$139,000	$230,000	NFWF $9 l ,000 grant? and CVPIA potentially	High	Tier l/Fund feasibility analysis proposal from TNC

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	cost Sharing Information	Priority	Recommended Tier and Potential Actions
Sacramento	Reclamation District's 108's Wilkins Slough pumping plant positive barrier fish screen	$75,000			High	Tier 2/Contact RD 108 to advise that Category III would consider cost sharing feasibility study and construction costs on a positive barrier fish **screen**
Sacramento	Support formation of non-profit conservancy to acquire meander belt lands and riparian habitats	$0			Medium	Tier 3/ RFP # 1
Sacramento	Pine Creek Orchards land acquisition and restoration				Low	Submitted proposal was not recommended for funding.
Sacramento	Stream Corridor mapping	$150,000			High	Tier 3/RFP #9
Sacramento	Funding assistance to conservancies	?			High	Included in RFP #I for watershed conservancies
Sacramento	Metal contaminated sediments in Keswick Reservoir	$262,000			Low'	Submitted proposal was not recommended for funding.
Sacramento	Sacramento River Toxicity Study				High	Included in RFP # 17 called for in Delta section.
Sacramento	Expand IEP concept to Sacramento Valley				High	Work with CALFED agencies
Battle Creek	Install fish screen and ladder at Eagle Canyon Diversion **Dam**	$700,000		CVPIA?	High	Tier 2/Fund proposal at completion of DWR engineering analysis RFP # IS
Battle **Creek**	Restore and replenish spawning gravel in the North Fork	$100,000			?	Tier 3/RFP # 16
Battle Creek	Negotiate and fund a perpetual instream flow agreement with Pacific Gas and Electric Co.	$2,000,000			High	Tier 3/RFP # 16: Category III previously committed $500,000 which can be used for Battle Creek proposals.
Battle Creek	Prepare an options, feasibility analysis for additional fish screens and ladders and a flow allocation methodology	$250,000			High	Tier3/RFP#15&#16

Table 7.1 Projects and Programs

Location	Description	Category III cost	Total Project cost	cost Sharing Information	Priority	Recommended Tier and Potential Actions
Butte Creek	Purchase screened portable pumps as alternative to Little Dry Creek Diversion	$100,000			LOW	Defer
Butte Creek	Conduct stream channel and habitat restoration below Durham-Mutual Dam	$200,000			High	Tier 2/fund when DWR engineering work is complete RFP # 15
Butte Creek	Reconstruct culvert and riser at Drumheller Slough outfall	$ 10,000				Tier l/Included in TNC feasibility analysis
Butte Creek	Evaluate habitat above barrier falls at Chimney Peak	$100,000			Unknown	Tier 3/RFP
Butte Creek	Watershed planning				High	Evaluate Chico State proposal as part of RFP # l for watershed conservancy funding
Clear Creek	Fund title search and escrow preparation for Bureau of Land Management land exchange above Saeltzer Dam	$0		Already Completed		Completed without Cat III
Clear Creek	Conduct options analysis and design engineering for fish passage at Saeltzer Dam	$750,000		CVPIA?	High	Tier 2/Fund when engineering work is complete RFP #i 15
Clear Creek	Water temperature and pilot flow study	?			Low	Tier 3/ Unknown
Clear Creek	Land use/erosion control for channel maintenance	?			Low	Tier 3/Unknown
Y uba River	Construct fish screen at Browns Valley Irrigation District diversion	$275,000			Low	Defer
Yuba River'	Construct fish screen, fish ladder, and dam modifications at Daguerre Point Dam	$4,700,000			Low	Defer
Mill and Deer Creeks	Evaluation of water exchange to ensure passage during critical times.				High	Tier 3/Unknown
Mill and Deer Creeks	Spill contingency plan for Highway 32				High	Tier 3/RFP # 14
Mill Creek	Modification/removal of Clough Dam					Defer
Mill Creek	Flow measurements to improve water exchange	$20,000				Tier 3/Being funding by CVPIA

Table 7.1 Projects and Programs

Location	Description	Category III Cost	Total Project Cost	Cost Sharing Information	Priority	Recommended Tier and Potential Actions
Mill Creek	Convert diesel pumps to electric and get project power to exchange pumps	$75,000			Unknown	Tier 3/Unknown
Deer Creek	Convert diesel pumps to electric and get project power to exchange pumps	$200,000			Unknown	Tier 3/ Unknown
Feather River	Genetic analysis				High	Tier 3/ RFP #11
Feather River	Check to make sure DBEEP still providing warden coverage					Check with DFG
Feather River	Evaluation and modification of hatchery practices at Feather River Hatchery to ensure appropriate identification of spring and fall run salmon				High	Work with DFG

Appendix A

Category III / CALFED **Bay - Delta Program Workshop**
June 11- 12,1996
Agenda

Day **I**

8:30 am	Introductions
9:00 - 10:00 am	Background Presentations Spring-run: Overview of habitat and population conditions Restoration priority setting
1O:OO - lO:15 am	Workshop Overview
10:15 - IO:30 ***am.***	***Break***
10:30 -Noon	Map out, diagrammatically, how spring-run chinook salmon fit into the ecosystem, identifying important factors and habitat components
Noon - 1:00 pm	***Lunch***
1:00 - 3:00 pm	Complete overall vision
3:OO - ***3:15 pm***	***Break***
3:15 - 5:00 pm	Break into three small groups to inventory key initiatives already underway, identify needed programs, projects and information gaps, and sort proposed programs and projects by priorities. Each group will address a region of the spring-run range.

Day 2

8:30 - 10:00 am	Small groups continue assignment from Day 1
10:00 - IO:15 ***am***	***Break***
lo:15 - Noon	Reconvene; small groups report what they have developed and begin to develop the recommended 1996 package
Noon - 1:OOpm	***Lunch***
1:00 - 3:00 pm	Complete development of 1996 package, including consideration of other important projects, development of any recommendations for future projects or monitoring.
3:OO - 3:15 ***pm***	***Break***
3:15 - 4:15 pm	Discussion on workshop process to give feedback to CALFED > What worked > What didn't work. > What they would like to see in next year's guidance document and workshop **process.**

4:15 - 4:30 pm Wrap-up