

## **CHAPTER 6: IMPLEMENTATION**

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The recovery of the Sacramento River winter-run chinook salmon population and its removal from the List of Threatened or Endangered Species of the U.S. is dependent upon habitat restoration and reduction or elimination of factors causing mortalities in juvenile and adult populations. These reductions in mortality need to occur in all freshwater, estuarine, and ocean habitats.

### **Mechanisms for Successful Implementation of the Sacramento River Winter-run Chinook Salmon Recovery Program**

Winter-run chinook salmon represent a highly valued biological resource in the Central Valley of California. The continued existence of winter-run chinook salmon is closely linked to overall ecosystem integrity. Due to its life history requirements, typical of all Pacific salmon, winter-run chinook salmon require high quality habitats for migration, holding, spawning, egg incubation, emergence, rearing, and emigration to the ocean. These diverse habitats are still present throughout the Central Valley. The quality and accessibility of the habitats was diminished by human-caused actions, but can be restored to a limited extent through a comprehensive program that strives to restore or repair habitat elements on a systematic basis.

Habitat management and restoration require substantial and consistent funding to be effective. In addition, habitat restoration needs in the Central Valley are so diverse, that a single entity cannot succeed in this arduous task. Successful winter-run chinook salmon restoration will require the participation of federal, state, and local agencies, as well as the participation of interested parties, private landowners, conservation groups, and other land and water management groups.

Several existing programs will be central to the recovery of the Sacramento River winter-run chinook salmon. These programs include: the Central Valley Project Improvement Act (CVPIA); agreement between the California Department of Water Resources (CDWR) and the Department of Fish and Game (CDFG - Four Pumps Agreement); agreement between the U.S. Bureau of Reclamation (USBR) and CDFG (Tracy Pumping Plant Agreement) to fund and implement habitat restoration actions in the Central Valley; and the Category III program resulting from the “Principles For Agreement on Bay-Delta Standards Between the State of California and federal government.” These four funding sources are discussed in further detail.

In addition, the CALFED Bay-Delta Program has embarked on an ambitious effort to develop and implement a comprehensive plan of protection for the Sacramento-San Joaquin Delta Estuary. In developing this plan, the Bay-Delta Program assembled a collection of actions or action categories that cumulatively should provide a comprehensive solution to most Delta “problems.”

### **Central Valley Project Improvement Act**

The CVPIA has great potential to successfully implement many restoration actions needed to protect and restore winter-run chinook salmon. The CVPIA requires the Secretary of the Interior to implement a wide variety of Central Valley Project (CVP) operational modifications and structural repairs in the Central Valley for the benefit of anadromous fish resources. Sections 3406(b)(1) through (21) of the CVPIA authorize and direct the Secretary, in consultation with other state and federal agencies, Indian tribes, and affected interests to take the following actions, all of which will ultimately assist in protecting and restoring winter-run chinook salmon:

- 3406(b)(1)(A) - Modify CVP operations to protect and restore natural channel and riparian values
- 3406(b)(1)(B) - Modify CVP operation based on recommendations of the USFWS after consultation with the CDFG.
- 3406(b)(2) - Manage 800,000 acre-feet of CVP yield for fish, wildlife, and habitat restoration purposes after consultation with USBR and CDWR and in cooperation with the CDFG.
- 3406(b)(3) - Acquire water to supplement the quantity of water dedicated for fish and wildlife water needs under (b)(2), including modifications of CVP operations; water banking; conservation; transfers; conjunctive use; and temporary and permanent land fallowing, including purchase, lease, and option of water, water rights, and associated agricultural land.
- 3406(b)(4) - Mitigate for Tracy Pumping Plant operations.
- 3406(b)(5) - Mitigate for Contra Costa Pumping Plant operations.
- 3406(b)(6) - Install temperature control device at Shasta Dam.
- 3406(b)(7) - Meet flow standards that apply to CVP.
- 3406(b)(8) - Use pulse flows to increase migratory fish survival.
- 3406(b)(9) - Eliminate fish losses due to flow fluctuations of the CVP.
- 3406(b)(10) - Minimize fish passage problems at Red Bluff Diversion Dam.
- 3406(b)(11) - Implement Coleman National Fish Hatchery Plan and modify Keswick Dam Fish Trap.
- 3406(b)(12) - Provide increased flows and improve fish passage and restore habitat in Clear Creek.
- 3406(b)(13) - Replenish spawning gravel and restore riparian habitat below Keswick

- Dam.
- 3406(b)(14) - Install new control structures at the Delta Cross Channel and Georgiana Slough.
  - 3406(b)(15) - Construct, in cooperation with the State and in consultation with local interests, a seasonally operated barrier at the head of Old River.
  - 3406(b)(16) - In cooperation with independent entities and the State, monitor fish and wildlife resources in the Central Valley.
  - 3406(b)(17) - Resolve fish passage and stranding problems at Anderson-Cottonwood Irrigation District Diversion Dam.
  - 3406(b)(19) - Reevaluate carryover storage criteria for reservoirs on the Sacramento and Trinity rivers.
  - 3406(b)(20) - Participate with the State and other federal agencies in the implementation of the on-going program to mitigate for the Glenn-Colusa Irrigation District's Hamilton City Pumping Plant.
  - 3406(b)(21) - Assist the State in efforts to avoid losses of juvenile anadromous fish resulting from unscreened or inadequately screened diversions.

In addition to the aforementioned CVPIA actions, Section 3406(e)(1 through 6) directs the Secretary to investigate and provide recommendations on the feasibility, cost, and desirability of implementing the actions listed below. When completed, these actions will provide additional understanding of the overall ecosystem problems and provide added measures that will benefit winter-run chinook salmon.

- 3406(e)(1) - Measures to maintain suitable temperatures for anadromous fish survival by controlling or relocating the discharge of irrigation return flows and sewage effluent, and by restoring riparian forests.
- 3406(e)(2) - Opportunities for additional hatchery production to mitigate the impacts of water development and operations on, or enhance efforts to increase Central Valley fisheries: PROVIDED, that additional hatchery production shall only be used to supplement or to re-establish natural production while avoiding adverse effects on remaining wild stocks.
- 3406(e)(3) - Measures to eliminate barriers to upstream and downstream migration of salmonids.
- 3406(e)(4) - Installation and operation of temperature control devices at Trinity Dam and Reservoir.
- 3406(e)(5) - Measures to assist in the successful migration of anadromous fish at the Delta Cross Channel and Georgiana Slough.
- 3406(e)(6) - Other measures to protect, restore, and enhance natural production of salmon and steelhead in tributary streams of the Sacramento River.

Section 3406(g) of the CVPIA directs the Secretary to develop models and data to evaluate the ecologic and hydrologic effects of existing and alternate operations of public and private water facilities and systems to improve scientific understanding and enable the Secretary to fulfill requirements of the CVPIA.

Habitat restoration actions not directly addressed in the aforementioned actions, such as restoration measures on streams tributary to the Sacramento River, will be managed by the Anadromous Fish Restoration Program (AFRP) of the USFWS. Section 3406(b)(1) of the CVPIA directs the Secretary to develop and implement a program that makes all reasonable efforts to ensure by 2002 that natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991. The target production goal developed under the AFRP for winter-run chinook salmon is 110,000 adult fish per year (catch plus escapement), well above the recovery goal of 10,000 female spawners (escapement only) recommended in this plan. The AFRP released its draft restoration plan in December 1995 that contains a list of actions deemed necessary to protect and restore anadromous fish throughout the Central Valley including winter-run chinook salmon in the Sacramento Valley.

An important attribute of the CVPIA is that Section 3407 established in the Treasury of the United States the “Central Valley Project Restoration Fund.” Funds up to \$50,000,000 per year are authorized to be appropriated to the Secretary to carry out program, projects, plans, and habitat restoration, improvement, and acquisition. The funds are derived by payments from Central Valley Project water and power users.

**Agreement Between the Department of Water Resources and the Department of Fish and Game to Offset Direct Fish Losses in Relation to the Harvey O. Banks Delta Pumping Plant (Four Pumps Agreement)**

This agreement between the CDWR and CDFG has proven to be a mutually beneficial program to protect and restore habitat for anadromous fish, particularly for chinook salmon. Funding is available through this agreement on a project-by-project basis. Projects that provide quantifiable benefits to winter-run chinook salmon, within specified cost benefit analyses, are generally approved for funding.

**Agreement to Reduce and Offset Direct Fish Losses Associated with the Operation of the Tracy Pumping Plant and Tracy Fish Collection Facility (Tracy Agreement)**

This agreement between the USBR and CDFG provides a mechanism to identify, develop, and implement habitat restoration measures for anadromous fish in a manner similar to the Four Pumps Agreement.

### **Category III**

The “Principles for Agreement on Bay-Delta Standards between the State of California and Federal Government” called for developing a program of so-called “Category III” measures. Category I and II measures address water quantity and water operations while Category III measures address non-flow-related habitat issues. The “Principles” provide for funding Category III activities estimated to be \$60,000,000 annually (for three years), to be secured through a combination of federal and state appropriations, user fees, and other sources. It was further agreed that urban and agricultural water suppliers will work with state and federal agencies and environmental interests in an open process to determine project priorities and financial commitments to implement Category III measures. Presently, only \$10,000,000 are available through this program, well short of the identified need of \$180,000,000.

### **CALFED Bay-Delta Program**

In developing a diverse array of alternatives to solve problems in the Delta and in upstream areas, the CALFED Bay-Delta Program assembled a list of “core actions” that are common to all alternatives being developed (CALFED Bay-Delta Program, Workshop 5 Information Packet Draft Alternatives, February 14, 1996). Although, no funding is presently available through the Program to resolve the identified problem, it is encouraging to note that many core actions are consistent with winter-run chinook salmon recovery actions presented in Chapter 5. The following core actions identified in the Bay-Delta Program are elements needed for protecting, conserving, and recovering winter-run chinook salmon.

- Restore shallow-water habitat
- protect and enhance existing riparian habitat
- improve degraded riparian habitat
- improved and modify levee maintenance practices
- encourage wildlife-friendly agricultural practices
- improve regulations regarding ballast-water releases to reduce introductions of exotic species
- improve flows and temperatures in upstream habitats
- maintain adequate spawning substrates
- encourage gravel-mining practices that protect fish habitat
- modify fish passage at upstream dams
- revegetate degraded riparian habitats
- install screens on unscreened in-Delta diversions
- install or upgrade screens on upstream diversions
- modify hatchery operations to reduce effects on wild populations
- support reasonable effort to provide information needed to improve commercial harvest

regulations

- expand and extend existing programs for pollution source control on agricultural lands
- encourage management of riparian zones to protect water quality
- investigate techniques for beneficial reuse of dredged materials.

In developing alternatives, the CALFED Bay-Delta Program is categorizing actions into several groups: physical/structural, operational/management, and institutional/policy. As a general guide for recovering winter-run chinook salmon, the CALFED Bay-Delta Program should emphasize those elements that protect and restore existing riparian and channel attributes, reduce sources of chemical and thermal pollution, maximize flow volumes in the Sacramento River, reduce entrainment at unscreened diversions, restore tidally influenced shallow water habitats, and generally attempt to emulate historic or natural ecosystem functions.

### **Endangered Species Act Section 6 Funding**

Section 6 of the ESA authorizes the federal government to cooperate to the maximum extent practicable with states in protecting, conserving, and restoring endangered species. To facilitate recovery, the Secretary of Commerce may enter into management agreements with the State of California to administer and manage any area established for the conservation of the endangered Sacramento River winter-run chinook salmon.

Additionally, the Secretary, in furtherance of the purposes of the Act, is authorized to enter into cooperative agreements with the State of California for the conservation of the winter-run chinook salmon. Contingent upon receiving authorization, the State must demonstrate that it has established an acceptable conservation program. Under terms of the cooperative agreement, a state agency is authorized to conduct investigations to determine the status and requirements for survival of the winter-run chinook salmon, and is authorized to establish programs, including the acquisition of land or aquatic habitat for the conservation of winter-run chinook salmon.

An important component of a Section 6 cooperative agreement is that the Secretary would be authorized to provide financial assistance to the state, through its respective agency, to assist in developing programs to conserve winter-run chinook salmon.

### **Consistency between Principles of Agreement, Native Fishes Recovery Plan, Delta Water Quality Control Plan**

During the summer of 1994, numerous state and federal agencies entered into a formal framework agreement establishing a comprehensive program for coordination and communication between the Governor's Water Policy Council of the State of California and the Federal

Ecosystem Directorate. In particular, this framework agreement is intended to increase communication and coordination with respect to improved coordination of water supply operations with endangered species protection and water quality compliance, and to develop a long-term solution to fish and wildlife, water supply reliability, flood control, and water quality problems in the Sacramento-San Joaquin Delta Estuary. In this important agreement, the participating entities pledge to integrate present and future implementation of the federal and state endangered species acts in a coordinated approach to resources management by taking a comprehensive approach to ecosystem problems in the Delta.

Using this agreement as a focus, the agencies can develop a comprehensive approach to the diverse and extensive problems associated with identifying and implementing conservation measures for the winter-run chinook salmon, delta smelt, other native Delta fishes. At the same time they can develop and monitor provision of the newly developing Water Quality Control Plan for the Delta. Delta conservation measures for the Sacramento River winter-run chinook salmon will be required to be consistent with the aforementioned principles.

### **Other Considerations**

**Interagency, Multidisciplinary Restoration Team.** In addition to funding, the ability to implement restoration measures will require significant redirection of existing staff. They will need to fully identify restoration projects, develop project proposals, complete feasibility studies, conduct preliminary and final engineering, accurately estimate total project costs, develop the appropriate National Environmental Policy Act (NEPA) or California Environmental Quality Act (CEQA) documentation, acquire environmental permits, issue and administer construction contracts, and conduct post-project monitoring and evaluations.

A developing opportunity for implementing habitat restoration projects is through the creation of an interagency, multidisciplinary habitat restoration team comprised of fishery biologists, ecologists, hydrologists, engineers, habitat specialists, contract administrators, and clerical staff. The team will represent CDFG, USFWS, NMFS, CDWR, USBR, and other interested entities. The program may be developed under direction of the CALFED program established by the 1994 Framework Agreement.

**Partnerships.** The NMFS cannot succeed in its mission to protect and restore winter-run chinook salmon without establishing, maintaining, and nurturing strong partnerships with the diverse interests serving the needs of the Central Valley. It must establish firm, open partnerships with other state, federal, and local agencies, and private property owners, interested parties, and stakeholder groups to effectively meet the challenges in managing and restoring the winter-run chinook salmon population in the Sacramento Valley. It is essential these partners understand the underlying concepts of habitat protection, enhancement, and restoration and that they participate

in the development of projects to restore winter-run chinook salmon. Any habitat restoration program directed at Sacramento Valley winter-run chinook salmon must not only meet the requirements of NMFS but must also contribute to the needs of its “partners”.

Fortunately, the resource agencies have successfully implemented some of the actions described in the list of action needed to recover the winter-run chinook salmon (Chapter 5). Numerous other actions are in the feasibility, engineering, or environmental permitting process and may be implemented within the next several years. However, implementing the recovery actions described in this plan will require a coordinated and well-funded framework to succeed. For that reason, the Recovery Team believes that recent Congressional action will likely hasten the recovery of winter-run chinook salmon through habitat restoration measures specified in the Central Valley Project Improvement Act (Public Law 102-575) and the complementary effort that may result from the CALFED Bay-Delta Planning Program.

### **Implementation Schedule**

The following tables list all actions presented previously in Chapter 5 and provide a 10-year time line for developing an implementation schedule for winter-run chinook salmon recovery actions. The Recovery Team requests that the National Marine Fisheries Service complete the implementation tables by contacting the respective agencies to develop reasonable timelines and commitments to undertake the recovery actions.



**Table VI-1. Measures to Avoid the Extinction of Winter-run Chinook**

Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Provide suitable water temperatures for spawning, egg incubation, and juvenile rearing between Keswick Dam and Red Bluff. (Priority 1)</b>											
1. Operate the Central Valley Project to attain the State Water Resources Control Board's Order 90-5 for water temperature objectives to the extent possible under different storage and runoff conditions.	January 2000										
<b>USBR</b>											
2. Install and operate a structural temperature control device at Shasta Dam in conjunction with modifications to Central Valley Project operations.	April 1997										
<b>USBR</b>											
3. Operate and maintain temperature control curtains as permanent installations in Whiskeytown and Lewiston reservoirs, and investigate installing an additional temperature curtain on the upstream side of Lewiston Reservoir.	June 1998										
<b>USBR, SWRCB</b>											
4. Actively regulate the river/reservoir system using a comprehensive temperature monitoring program, integrated with a calibrated daily time-step temperature model.	April 1999										
<b>USBR, SWRCB, CDWR</b>											
<b>Reduce pollution in the Sacramento River from Iron Mountain Mine. (Priority 1)</b>											
1. Remedy pollution problems from Iron Mountain Mine to meet Basin Plan standards during the winter-run chinook incubation period.	January 2001										
<b>EPA, CEPA, RWQCB, USBR, CDFG, USFWS, NMFS</b>											
2. Develop, implement, and monitor reliable and proven remedies that ensure continued treatment and control heavy metal waste prior to discharge to the Sacramento River.	January 2000										

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

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		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		<b>EPA, CEPA, RWQCB, USBR, CDFG, USFWS, NMFS</b>									
3. Develop, implement, and monitor remedies that dilute heavy metal waste discharge into the Sacramento River through effective water management.	January 2000										
		<b>EPA, CEPA, RWQCB, USBR, CDFG, USFWS, NMFS</b>									
4. Eliminate scouring of toxic metal-laden sediments in the Spring Creek and Keswick reservoirs.	January 2000										
		<b>EPA, CEPA, RWQCB, USBR, CDFG, USFWS, NMFS</b>									
5. Monitor metal concentrations and waste flows using approved standard methods.	January 1999										
		<b>EPA, CEPA, RWQCB, USBR, CDFG, USFWS, NMFS</b>									
<b>Maximize survival of juveniles at unscreened or inadequately screened diversions on the Sacramento River, Sacramento-San Joaquin Delta, and Suisun Marsh. (Priority 1)</b>											
1. Develop and implement a comprehensive plan to install positive barrier fish screens at unscreened or poorly screened diversions on the Sacramento River, Sacramento-San Joaquin Delta, and Suisun Marsh sloughs.	December 2007										2007
		<b>CDFG, NMFS, USFWS, USBR, NRCS</b>									
2. Evaluate water rights for operators initiating diversions in the winter for rice-stubble decomposition flooding and waterfowl habitat development.	September 1999										
		<b>SWRCB, CDFG, NMFS, USBR, USFWS</b>									
3. Promulgate and implement a Federal Rule to require the screening of water diversions in the critical habitat and natural migratory pathways of winter-run chinook salmon.	January 1999										
		<b>NMFS, USFWS, CDFG</b>									
<b>Maximize the survival of juveniles passing the Red Bluff Diversion Dam (Priority 1)</b>											

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

<b>Winter-run Chinook Salmon Recovery Objective/Action</b>		<b>Complete Long-term Program</b>	<b>Implementation Schedule/Responsible Agency</b>								
			<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
1. Operate the Red Bluff Diversion Dam in a gates-up position from September 1 through May 14 of each year, until a permanent remedy for the facility is implemented.	September 1998										
		<b>USBR, USFWS, NMFS</b>									
2. Complete evaluations of the Archimedes screw pump and the helical pump for their the technological and environmental effectiveness in diverting water to the Tehama-Colusa and Corning canals.	September 1998										
		<b>USBR, USFWS, NMFS</b>									
3. Develop and implement a permanent remedy at the Red Bluff Diversion Dam which provides maximum free passage for juvenile (and adult) winter-run chinook salmon through the Red Bluff area, while minimizing losses of juveniles in water diversion and fish bypass facilities.	January 1999										
		<b>USBR, USFWS, NMFS</b>									
<b>Maximize survival of juvenile winter-run chinook salmon passing the Glenn-Colusa Irrigation District's Hamilton City Pumping Plant (Priority 1)</b>											
1. For the interim, the Glenn-Colusa Irrigation District should maximize the survival of juvenile winter-run chinook by operating the Hamilton City facility as described in the Federal Joint Stipulated Agreement until a new water diversion and fish screening facility is constructed and operational.	January 1998										
		<b>USBR, USFWS, CDFG, NMFS, GCID</b>									
2. Design and construct new positive barrier fish screens at the Glenn-Colusa Irrigation District's Hamilton City Pumping Plant which meet National Marine Fisheries Service and California Department of Fish and Game screening and bypass flow criteria.	January 1999										
		<b>USBR, USFWS, CDFG, NMFS, GCID</b>									
<b>Protect and restore rearing and migratory habitats of winter-run chinook in the lower Sacramento River and Delta to maximize survival of rearing and emigrating fish (Priority 1)</b>											

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<b>Winter-run Chinook Salmon Recovery Objective/Action</b>		<b>Complete Long-term Program</b>	<b>Implementation Schedule/Responsible Agency</b>								
			<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
1. Implement interim measures to protect rearing and emigrating winter-run chinook salmon from November 1 through April 30.	November 1998										
		<b>USFWS, CDFG, CDWR, SWRCB, USBR</b>									
2. For the long-term protection of winter-run chinook salmon, identify and implement actions to significantly improve hydrodynamic conditions in the Delta.	Initiate plan by November 1999										
		<b>CDWR, USBR, CALFED</b>									
3. Evaluate the survival of juvenile winter-run chinook salmon in the Delta using experimental mark-recapture experiments with surrogate chinook salmon or other appropriate methods. Using data from these studies, develop a method which assesses survival under varying hydrologic conditions.	Initiate plan by September 1998										
		<b>USFWS, CDFG, CDWR, USBR, CALFED</b>									
<b>Eliminate or minimize delay and blockage of adults at the Red Bluff Diversion Dam (Priority 1)</b>											
1. Operate the Red Bluff Diversion Dam in a gates-up position from September 1 through May 14 of each year, until a permanent remedy for the facility is implemented.	September 1998										
		<b>USBR, NMFS, USFWS</b>									
2. Develop and implement a permanent remedy that provides maximum free passage for adult (and juvenile) winter-run chinook past the Red Bluff area, while minimizing losses of juveniles in water diversion and fish bypass facilities.	January 1999										
		<b>USBR, NMFS, USFWS</b>									
<b>Minimize straying of adult winter-run chinook from their natural migratory corridor (Priority 1)</b>											
1. Minimize diversion of Sacramento River water to areas outside the natural migratory corridors during the upstream migration period of winter-run chinook.	January 1999										
		<b>CDWR</b>									

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<b>Winter-run Chinook Salmon Recovery Objective/Action</b>		<b>Complete Long-term Program</b>	<b>Implementation Schedule/Responsible Agency</b>											
			<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>		
	2. Develop and implement corrective measures that prevent or reduce the straying of adult fish to the Colusa Basin Drain and the Delta Cross Channel, and allows passage back to the river at the upstream ends of the Sacramento Deep Water Ship Channel and the Sutter and Yolo flood bypass system.	September 1999												
<b>CDWR, USACOE</b>														
<b>Reduce adverse impacts of ocean commercial and recreational salmon fisheries</b>												<b>(Priority 1)</b>		
	1. Reduce ocean harvest rates on winter-run chinook to allow the population to rapidly grow to stable levels and achieve recovery.	January 2000												
<b>NMFS, CDFG</b>														
	2. Assess the feasibility of using genetic Mixed Stock Analysis to improve estimates of harvest rate on winter-run chinook salmon.	January 1999												
<b>NMFS</b>														
<b>Develop information of life cycle and habitat requirements of winter-run chinook</b>												<b>(Priority 1)</b>		

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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1. Develop and implement research programs to further determine life history and habitat requirements of winter-run chinook.  Research is needed in the following area: <ul style="list-style-type: none"> <li>▶ spatial and temporal distribution of winter-run chinook in the river, Delta, and estuary,</li> <li>▶ habitat requirements during spawning, rearing, and migration,</li> <li>▶ juvenile chinook survival rates in Sacramento River reaches, Delta waterways, and Suisun and San Pablo bays,</li> <li>▶ temperature tolerance of chinook salmon</li> <li>▶ environmental factors influencing, emigration, and</li> <li>▶ juvenile chinook microhabitat use in the river, Delta, and estuary.</li> </ul>	Initiate plan by June 1999										
<b>USFWS, CDFG, NMFS</b>											
<b>Develop information for use as management tools (Priority 1)</b>											
1. Develop alternative methods and procedures to estimate annual abundance and genetically effective population size of winter-run chinook returning to the upper Sacramento River.	January 2000										
<b>USFWS, CDFG, NMFS</b>											
2. Develop alternative method for identifying juvenile winter-run chinook.	January 2000										
<b>USFWS, CDFG, NMFS, CDWR, UC</b>											
3. Develop a winter-run chinook life cycle model.	January 2000										
<b>USFWS, CDFG, NMFS, USBR, CDWR, EPA, UC</b>											
4. Develop a Delta hydrodynamic and individual run model.	January 2000										

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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		<b>USFWS, CDFG, NMFS, USBR, CDWR, EPA, UC</b>									
5. Develop a winter-run chinook survival probability model.	January 2000										
		<b>NMFS, CDFG</b>									
<b>Provide optimum flows in the Sacramento River between Keswick Dam and Chipps Island. (Priority 2)</b>											
1. As an interim measure, maintain flows of 5,000 to 5,500 cfs from October through March when possible without compromising carryover storage. When these flows, cannot be achieved, continue to operate the Central Valley Project and State Water Project to meet flow reduction rates and minimum flows as identified in the 1993 Biological Opinion for Operation of the Federal Central Valley Project and the California State Water Project.	June 1999										
		<b>USBR, USFWS, CDFG, NMFS, SWRCB</b>									
2. Develop, implement, and monitor final instream flow recommendations and flow reduction (ramping) rates for the upper Sacramento River.	January 2001										
		<b>USBR, CDFG, NMFS, SWRCB, USFWS</b>									
3. Eliminate adverse flow fluctuations by modifying the Anderson-Cottonwood Irrigation District's dam operations, or by modifying or replacing the facility.	January 2000										
		<b>USBR, USFWS, CDFG, NMFS, ACID</b>									
4. Complete an inventory and assessment of all water withdrawal sites that affect critical habitat, and take action to conserve irrigation water and increase stream flows.	January 2002										
		<b>USBR, CDFG, NMFS, SWRCB, DWR</b>									
<b>Preserve and restore riparian habitat and meander belts along the Sacramento River and the Sacramento-San Joaquin Delta (Priority 2)</b>											

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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
1. Avoid any loss or additional fragmentation of the riparian habitat in acreage, lineal coverage, or habitat value, and provide in-kind mitigation when such losses are unavoidable.	January 1999											<b>USACOE, SLC, DOI, RB, CDWR, CDFG, DPC, USFWS, SFBCDC, NRCS, RWQCB</b>
<b>Preserve and restore tidal marsh habitat</b>		<b>(Priority 2)</b>										
1. Avoid further loss of tidal marsh habitat in either acreage or habitat value, and provide in-kind mitigation when losses are unavoidable.	January 1999											<b>USACOE, SFBCDC, EPA, CDFG, SLC, SFBRWQCB, CVRWQCB</b>
2. Conserve and restore tidal marsh and shallow water habitat within winter-run chinook salmon rearing and migratory habitats.	January 2000											<b>USACOE, SFBCDC, EPA, CDFG, SLC, SFBRWQCB, CVRWQCB</b>
<b>Reduce pollution from industrial, municipal, and agricultural sources</b>		<b>(Priority 2)</b>										



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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1. Control contaminant input from Colusa Basin Drain into the Sacramento River.	January 1999										
<b>RWQCB, EPA, USBR, CEPA</b>											
2. Reduce contaminant input to the Sacramento River, Delta, and San Francisco Bay from municipal treatment plants.	January 2000										
<b>SWRCB, EPA, RWQCB</b>											
3. Control contaminant input to the Sacramento River system by constructing and operating stormwater treatment facilities and implementing industrial Best Management Practices for stormwater and erosion control.	January 2000										
<b>RWQCB</b>											
4. Reduce selenium discharge into the North Bay to levels which protect winter-run chinook and their prey.	January 1999										
<b>RWQCB, EPA, USBR ,CDWR</b>											
5. Conduct an assessment/monitoring program of contaminant input from other major agricultural drainages in the Sacramento River watershed.	January 2000										
<b>RWQCB, EPA, USBR, CDWR</b>											
6. Monitor the contaminant input from dormant orchard spraying in the Sacramento River.	January 1999										
<b>RWQCB, EPA, USBR, CDWR, DPR</b>											
7. Monitor contaminant inputs from rice stubble decomposition flooding and waterfowl habitat development and remedy as needed.	January 1999										
<b>RWQCB, EPA, USBR, CDWR, DPR, USFWS</b>											
<b>Provide suitable water quality in the Sacramento River watershed and the Sacramento-San Joaquin Delta, and San Francisco Bay-Estuary (Priority 2)</b>											

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1. Establish, implement, enforce, and monitor temperature, dissolved oxygen and salinity water quality standards and objectives for the Sacramento-San Joaquin Delta, and San Francisco Bay that protect winter-run chinook.	June 1999										
<b>EPA, SWRCB, RWQCB, CDFG, NMFS, USFWS</b>											
2. Establish numeric water quality objectives for priority pollutants similar to those in the revoked Inland Surface Water Plan and the Enclosed Bays and Estuaries Plan, which protect all life history stages of chinook salmon and their prey.	June 1999										
<b>EPA, SWRCB, RWQCB</b>											
3. Implement, enforce, and monitor all water quality objectives necessary for the protection of fishery uses through the waste discharge permitting process.	June 1999										
<b>EPA, SWRCB, RWQCB</b>											
4. Establish numeric water quality objectives for pesticides, herbicides, and organic and inorganic compounds to protect all life-stages of chinook salmon and their prey.	June 1999										
<b>EPA, SWRCB, RWQCB, CDFG, CDFG</b>											
<b>Eliminate or minimize delay and blockage of adults at the Anderson-Cottonwood Irrigation District dam on the Sacramento River (Priority 2)</b>											
1. Complete a feasibility study to identify, develop, and evaluate alternatives to resolving fish passage problems at the Anderson-Cottonwood Irrigation District dam.	December 1998										
<b>ACID, USBR, CDFG</b>											
2. Develop and implement permanent structural and operational remedies which minimize or eliminate adult passage problems at the Anderson-Cottonwood Irrigation District diversion dam or eliminate passage problems through restoration of the natural channel.	June 1999										
<b>Evaluate and reduce adverse impacts on juveniles associated with operating the Suisun Marsh Salinity Control Structure (Priority 2)</b>											

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

<b>Winter-run Chinook Salmon Recovery Objective/Action</b>		<b>Complete Long-term Program</b>	<b>Implementation Schedule/Responsible Agency</b>								
			<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
1. Complete the assessment on the operational effects of the Suisun Marsh Salinity Control Structure on juvenile (and adult) winter-run chinook salmon detailed in the National Marine Fisheries Service's biological opinion for the Federal Central Valley and State Water projects.	January 1998										
		<b>CDWR, SRCD</b>									
2. Develop and implement corrective actions to minimize or eliminate adverse impacts to juvenile winter-run chinook resulting from operation of the Suisun Marsh Salinity Control Structure.	September 1998										
		<b>CDWR, USBR, SWRCB, SRCD, CDFG</b>									
<b>Evaluate and correct adult passage problems in the Suisun Marsh (Priority 2)</b>											
1. Complete evaluations to assess the effects of Suisun Marsh Salinity Control Structure operations on adult chinook migration.	January 1998										
		<b>CDWR, CDFG, USBR, USACOE, SWRCB</b>									
2. Develop and implement corrective actions which minimize adverse impacts to adult (and juvenile) winter-run chinook from the Suisun Marsh Salinity Control Structure.	September 1998										
		<b>CDWR, USBR</b>									
<b>Evaluate re-establishing additional natural winter-run chinook populations (Priority 2)</b>											
1. Conduct feasibility analysis of establishing viable, naturally self-sustaining populations in other rivers and creeks within the Sacramento River watershed.	January 2000										
		<b>NMFS, USFWS, CDFG</b>									
2. Based on information from feasibility analysis, develop and implement recommendations for establishing supplemental winter-run chinook populations.	January 2001										
		<b>USFWS, CDFG</b>									
<b>Protect and maintain gravel resources in the Sacramento River and its tributaries between Keswick Dam and Red Bluff (Priority 3)</b>											

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1. Restore, replenish, and monitor spawning gravel in the Sacramento River.	September 1998										
		USFWS, NMFS, CDFG, USBR									
2. Develop and implement a plan to protect all natural sources of spawning gravel in the high water channels and along the flood plains of the Sacramento River and its tributaries.	January 1999										
		USACOE, SRB, CDC, CDFG, NMFS, USFWS, SLC									
3. Control excessive silt discharges to protect spawning gravel in the main stem by protecting watersheds in the Sacramento River system.	January 1999										
		CDF, CalTrans, BLM, CVRWQCB, SFBRWQCB, NRCS									
<b>Reduce habitat loss, entrainment, and pollution from dredging and dredge disposal operations (Priority 3)</b>											
1. Conduct dredging and disposal operations to minimize entrainment of juvenile winter-run chinook salmon, habitat loss, and water quality degradation.	September 1998										
		USACOE, EPA, SLC, CDWR, BCDC, RWQCB									
2. Minimize the volume of dredge material disposed into the San Francisco Bay and Estuary.	September 1998										
		EPA, SWRCB, USACOE, SFBCDC, RWQCB									
<b>Winter-run Chinook Salmon Recovery Objective/Action</b>	<b>Complete Long-term Program</b>	<b>Implementation Schedule/Responsible Agency</b>									
		<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
<b>Eliminate entrapment of adult winter-run chinook at the Keswick Dam Stilling Basin (Priority 3)</b>											
1. Monitor the escape channel for its effectiveness in allowing adults to exit from the Keswick Dam stilling basin.	September 1997										
		USBR									
<b>Assist in the recovery of Sacramento River winter-run chinook (Priority 3)</b>											
1. The Winter-run Chinook Salmon Artificial Propagation and Captive Broodstock programs should continue to be evaluated for their effectiveness in supporting the winter-run chinook salmon population.	In place										
		USFWS, UCDBML, CAS									

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2. Develop and implement measures that ensure hatchery produced juvenile winter-run chinook imprinting on the main stem Sacramento River.	January 1998										
USFWS, NMFS											
3. Develop and implement methods that positively identify adult chinook salmon as winter-run chinook prior to conducting breeding crosses.	January 1998										
USFWS, NMFS											
4. Continue to develop, implement, and monitor a comprehensive Genetic Management Plan as an integral part of the Artificial Propagation and Captive Broodstock programs to minimize or avoid genetic differentiation of the hatchery population from the wild population.	In place										
USFWS, NMFS											
5. Minimize disease transmission within and among the wild, hatchery, and captively reared populations.	In place										
USFWS, UCDBML, CAS											
<b>Reduce incidental take from in-river sport fisheries</b>											<b>(Priority 3)</b>
1. The National Marine Fisheries Service and the California Department of Fish and Game should continue monitoring of efforts by State and Federal enforcement personnel to ensure compliance with State fishery regulations.	In place										
NMFS, CDFG											
<b>Develop information on the ocean distribution patterns of winter-run chinook</b>											<b>(Priority 3)</b>
1. Continue assessment of coded-wire-tag data collected from ocean salmon landings to develop additional information regarding winter-run chinook distribution patterns in the Pacific Ocean.	January 2000										
USFWS, CDFG, NMFS											
<b>Minimize impacts from the State and Federal striped bass management and restoration programs</b>											<b>(Priority 3)</b>

*NMFS Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon*

Winter-run Chinook Salmon Recovery Objective/Action		Complete Long-term Program	Implementation Schedule/Responsible Agency									
			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1.	Review and evaluate the affects of predation on the winter-run chinook population.	June 1998										
	<b>USBR, CDWR, CDFG, USFWS, NMFS</b>											
2.	Develop and implement appropriate interim and long-term measures to minimize program impacts on winter-run chinook.	June 1998										
	<b>CDFG, USFWS</b>											
<b>Reduce impacts of State and Federal salmon and steelhead hatchery programs (Priority 3)</b>												
1.	Evaluate impacts and develop, implement, and monitor measures to reduce incidental take resulting from State-operated hatchery programs.	January 1999										
	<b>CDFG, USBR, CDWR, EBMUD</b>											
2.	Continue to implement and monitor measures to reduce incidental take of winter-run chinook resulting from operation of Coleman National Fish Hatchery.	In place										
	<b>USFWS</b>											
3.	Reduce likelihood of disease transmission from hatchery populations to wild winter-run chinook.	January 1999										
	<b>CDFG, USFWS</b>											
<b>Reduce impacts from other fish and wildlife management programs (Priority 3)</b>												
1.	State and Federal fish and wildlife management programs should be reviewed to minimize their impacts on winter-run chinook.	January 1999										
	<b>CDFG, NMFS, CDWR, USFWS, USBR</b>											
<b>Prevent the introduction and establishment of non-indigenous aquatic species (Priority 3)</b>												
1.	Develop, implement and enforce regulations to control discharge of ship ballast water within the estuary and adjacent waters.	January 1999										
	<b>CDFG, CDHS, USCG</b>											

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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2. Develop and implement measures to avoid introductions, particularly by the zebra mussel, via overland transportation vectors and other transport vectors.	January 1999										
<b>CDFA, IWC, CDFG</b>											
3. Prohibit the intentional introduction of aquatic non-indigenous species into the Sacramento River watershed and estuary.	January 1999										
<b>FGC</b>											
4. Develop programs to educate the public about the problems with non-indigenous species and their incidental transport or introduction.	January 1999										
<b>CDFG, CDFA, CDBW</b>											
5. Identify high risk potential invaders and implement measures to avoid their introduction.	January 1999										
<b>CDFG, CDFA</b>											
<b>Evaluate additional factors that may affect the recovery of winter-run chinook (Priority 3)</b>											
1. Evaluate water quality impacts on winter-run chinook.  The following evaluations are needed: <ul style="list-style-type: none"> <li>▶ Impacts of toxic substances</li> <li>▶ Contaminant levels in San Francisco Bay</li> <li>▶ Chronic toxicity data</li> <li>▶ Impacts from turbidity, suspended sediments, and sedimentation</li> <li>▶ Impacts of dredge disposal</li> </ul>	Initiate by June 1999										
<b>USFWS, CDFG, NMFS, USBR, CDWR, EPA, RWQCB, CEPA, USACOE, EPA, USACOE</b>											
2. Evaluate juvenile entrainment to flood bypasses, and assess the impacts of flood control operations on juvenile chinook.	June 1998										
<b>USACOE, USBR, CDWR</b>											
3. Evaluate entrainment of juvenile chinook to the Sacramento Deep Water Ship Channel.	January 1999										
<b>USACOE</b>											

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Winter-run Chinook Salmon Recovery Objective/Action	Complete Long-term Program	Implementation Schedule/Responsible Agency									
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
4. Assess diseases found in both hatchery and natural chinook populations in the Sacramento River.	January 2000										
<b>NMFS, USFWS, CDFG</b>											