

# *Anadromous Fish Restoration Program*

*Restoring fish habitat in California's Central Valley*



## **AFRP OVERVIEW**

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On October 30, 1992, President George Herbert Walker Bush signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102-575), including Title XXXIV, the Central Valley Project Improvement Act [CVPIA](#). The CVPIA directed the Secretary of the Interior to amend previous authorizations of California's Central Valley Project to:

*"include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic use and fish and wildlife enhancement as a project purpose equal to power generation."*

Section 3406(b)(1) of the CVPIA directs the Secretary of the Interior to develop and implement a program that makes all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley streams on a long-term, sustainable basis. The major resulting program is known as the Anadromous Fish Restoration Program. Since 1995, the AFRP has helped implement over 195 projects to restore natural production of anadromous fish.

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## **AFRP OVERVIEW: BACKGROUND**

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450 miles long and 50 miles wide, California's Central Valley contains one-sixth of the irrigated land in the United States and hosts two major river drainages [Sacramento and San Joaquin](#) which meet and drain into the Pacific Ocean through the San Francisco Bay. Authorized by President Franklin D. Roosevelt in 1935, the largest reclamation endeavor ever undertaken, the Central Valley Project (**CVP**) was viewed to be the remedy for the imbalance of environmental impacts associated with power and water production in the Central Valley. The goal of the CVP was a water transportation network to supply irrigation water from dams and reservoirs in the [Sacramento River](#) to the water limited, but highly arable lands of the [San Joaquin River Basin](#). Covering an area over 400 miles long and up to 100 miles wide, the CVP never finished as planned. Ecological impacts to migratory salmon and controversies over dam construction prevented further construction and led to the passage of the [CVPIA](#) in 1992.

Since settlement of the Central Valley in the mid-1800s, populations of native anadromous fishes, in particular, Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), white sturgeon (*Acipenser transmontanus*), and green sturgeon (*A. medirostris*) have declined dramatically. These declines have been so dramatic that several species are currently in danger of extinction. At present, winter-run Chinook salmon are listed as endangered and spring-run Chinook salmon and steelhead are listed as threatened under both the [federal](#) and [state](#) Endangered Species acts, and all other races of Chinook salmon are considered candidates for listing by the [National Marine Fisheries Service](#).

Habitat degradation is the primary cause of these declines. Hydraulic mining for gold was the first major human activity that resulted in large-scale habitat degradation due to sedimentation and diversion of water in many [Central Valley](#) streams. Hydraulic mining was prohibited in 1894, but habitat degradation still continues today. Habitat quantity and quality have declined due to anthropogenic modifications to natural hydrologic regimes by construction of dams and other diversions and barriers to migration, levees and other flood control infrastructure, and gravel mining. Major alterations to watersheds such as these isolate spawning habitat and can lead to other effects such as elevated water temperatures, low available oxygen, sedimentation problems and water pollution. Although the effects of habitat degradation on fish populations were evident by the 1930s, the decline for most anadromous fish species has only accelerated since completion of major water project facilities to meet the increasing demands for Central Valley water.

Other factors that have adversely affected natural stocks of anadromous fish include overharvest by commercial fisheries, illegal harvest, competition and loss of genetic integrity from hatchery produced fish, and introduction of competitors, predators and diseases. Natural events such as drought and poor ocean conditions, such as El Niño, affect water flow and temperature and can severely affect populations. Historically, populations in habitats not so heavily impacted by human activity typically recover within a few years after natural catastrophic events. However, the decline of anadromous fish

populations in the Central Valley has continued through these natural cycles of beneficial and adverse natural conditions, indicating the need for human intervention to improve fish spawning and rearing habitat, the identified ecological crux for continued survival. American shad (*Alosa sapidissima*) and striped bass (*Morone saxatilis*), the two non-native anadromous species identified for restoration by the [CVPIA](#), were introduced into the Sacramento-San Joaquin system in the 1870s. Both species supported valuable sport and commercial fisheries throughout much of this century, but California Department of Fish and Game ([CDFG](#)) data indicate that populations have declined since the mid-1960s. Other diadromous fishes in Central Valley waters include threespine stickleback (*Gasterosteus aculeatus*), brown trout (*Salmo trutta*), and lamprey (*Lampetra* spp.). However these are not identified in [Title 34 of CVPIA](#) and not included in the AFRP restoration goals.

Expanding the accessible range of habitat and improving the quality of fish habitat are important, key features of AFRP sponsored activities to restore natural stocks of anadromous fish. The AFRP coordinates closely with [CALFED](#) and many other agencies and programs focused on restoration of Central Valley streams and the Bay-Delta ecosystem. The AFRP, much like CALFED, has adopted an “adaptive management” [approach](#) towards ecosystem restoration.

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## **AFRP OVERVIEW: GOAL AND OBJECTIVES**

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The goal of the AFRP, is concurrent to section 3406(b)(1) of the [CVPIA](#), to:

*"develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, 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."*

It defined natural production during the baseline period to be:

*"that proportion of production not produced in hatcheries"*

and defined production to be the:

*"number of fish that recruit to adulthood in a given year, including newly recruited fish that are harvested."*

Section 3406(b)(1) also states that:

*"this goal shall not apply to the San Joaquin River between Friant Dam and the Mendota Pool, for which a separate program is authorized under subsection 3406(c) of this title;"*

CVPIA section 3406(b)(1)(A) directs the AFRP to:

*"give first priority to measures which protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to Central Valley Project operations, and implementation of the supporting measures mandated by this subsection;"*

Six general objectives need to be met to achieve this program goal:

- 1) Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat;
- 2) Improve survival rates by reducing or eliminating entrainment of juveniles at diversions;
- 3) Improve the opportunity for adult fish to reach their spawning habitats in a timely manner;

- 4) Collect fish population, health, and habitat data to facilitate evaluation of restoration actions;
- 5) Integrate habitat restoration efforts with harvest and hatchery management;  
and
- 6) Involve [partners](#) in the implementation and evaluation of restoration actions.

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## **AFRP OVERVIEW: SCIENTIFIC RATIONALE**

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Developed by a group of professionals knowledgeable and experienced with the Central Valley fisheries, the scientific rationale for the *Final Draft Restoration Plan for the Anadromous Fish Restoration Program: A Plan to Increase Natural Production of Anadromous Fish in the Central Valley of California* ([Restoration Plan](#)) was based on a comprehensive synthesis of the best available scientific information on the distribution and status of Central Valley anadromous fish populations and the principal factors limiting their production. The basis of this effort was published in the *Working Paper on Restoration Needs: Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California* ([The Working Paper](#)).

The Working Paper was developed under the direction of a scientific Core Group composed mostly of representatives of the U.S. Fish and Wildlife Service [USFWS](#), U.S. Bureau of Reclamation [USBR](#), National Marine Fisheries Service [NMFS](#), U.S. Environmental Protection Agency [EPA](#), California Department of Fish and Game [CDFG](#), and California Department of Water Resources [CDWR](#). The Working Paper actions included both non-flow actions (e.g. gravel restoration or use of fish screens) and flow actions (e.g. the purchase of water to supplement insufficient flows). The Working Paper also included estimates of target levels of long-term, average production for four races of Chinook salmon, steelhead, striped bass, American shad, and white and green sturgeon.

The Working Paper identified a list of restoration actions that, if implemented in its entirety, would likely result in at least doubling the natural production of anadromous fish **without regard to implementation feasibility**. The Working Paper relied on the scientific research that was available at the time, with acknowledgment that scientific uncertainty was a reality in many areas. To best incorporate the most complete science, The Working Paper did not attempt any consideration of whether the actions were "reasonable" as required under the CVPIA. Reasonableness criteria was subsequently addressed and incorporated in the [Restoration Plan](#).

Implementation of the AFRP is guided primarily by The Restoration Plan. The Restoration Plan is a programmatic-level document that presents the goal, objectives, and strategies of the AFRP; lists reasonable restoration actions and evaluations by watershed; and describes how the AFRP identified and prioritized these actions and evaluations. The Restoration Plan defines production targets for each species of anadromous fish covered under the CVPIA and lists specific restoration actions for Central Valley streams that supported anadromous fish populations during the 1967-1991 reference period.

The Restoration Plan is a "static" document that describes the AFRP in broad, programmatic-level terms, and provides long-term focus for the program by watershed region. This web page, by contrast, is meant to function as an active planning tool that encompasses long and short-term time scales as well as spatial scales at Central Valley-wide, regional, watershed and project-levels. It is meant to be a "living" document subject to frequent update and modification as projects are completed, monitoring data

are received and analyzed, and new information becomes available. Its principal objectives are to articulate the rationale guiding implementation of the AFRP, describe past, present and likely future AFRP-sponsored projects, and to facilitate communication between AFRP staff and both existing and potential future partners.

As more information becomes available, the working assumptions, empirical relationships and other aspects of the scientific rationale guiding the AFRP will undoubtedly change, and thus, an adaptive management approach is required. This web page provides an effective way to communicate these changes to AFRP partners, stakeholders and other interested parties and serve as an "Implementation Gateway" for the AFRP.

Prior to the beginning of each federal fiscal year, the AFRP develops an Annual Work Plan (**AWP**) that packages a descriptive program list of projects for the coming fiscal year. The AWP is presented at a public meeting at the beginning of the fiscal year (usually in late September or early October). In addition to projects under development for the coming fiscal year, the AWP summarizes the current status of the AFRP and the principal accomplishments achieved during the previous fiscal year by watershed region. The Restoration Plan acts as an "umbrella" document, providing guidance to all of the Department of the Interior's agency and private partner's efforts to make all reasonable efforts to at least double the natural production of anadromous fish including efforts directed by other sections of the CVPIA. However, this web page and the annual work plans described here include only those efforts that are not specifically included in other sections of the CVPIA such as actions of the [Anadromous Fish Screen Program](#) pursuant to section 3406(b)(21), or the Clear Creek Restoration Program pursuant to section 3406(b)(12) of the CVPIA.

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## **AFRP OVERVIEW: APPROACH**

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The AFRP approach to making all reasonable efforts to at least double natural production of anadromous fish requires [partnerships](#), local involvement, public support, adaptive management, and flexibility.

### **Partnerships**

A single entity cannot double natural production of anadromous fish throughout the Central Valley. Partnerships are needed. Voluntary collaborations to achieve mutual goals and objectives accelerate accomplishments, increase available resources, reduce duplication of efforts, encourage innovative solutions, improve communication, and increase public involvement and support through shared authority and ownership of restoration actions. The AFRP is continually seeking [partners](#) to facilitate restoration.

### **Local Involvement**

The AFRP actively encourages local citizens and groups to share or take the lead in implementing restoration actions. Influences on anadromous fish production in specific watersheds are often related to local water management and land use, which are typically controlled by local individuals and groups. Local people may have innovative approaches to solving problems, and may be able to implement those solutions most efficiently. This approach is consistent with California Biodiversity Council's "[California's Coordinated Regional Strategy to Conserve Biological Diversity](#)" in which 26 state and federal agencies emphasize regional solutions to regional problems.

The AFRP encourages local involvement by joining with existing local restoration groups and supporting the formation of new groups.

### **Public Support**

Public support is both a product and a prerequisite of successful partnerships and local involvement. Public sentiment is an indicator of perceived economic and social effects of restoration actions. Public support for an action facilitates implementation and attracts partners for future actions. The AFRP continually seeks opportunities for the public to assist in planning and implementing restoration actions.

### **Adaptive Management**

The AFRP is employing an adaptive management strategy to increase the effectiveness of restoration actions and to address scientific uncertainty. Adaptive management is an



approach that allows resource managers to learn from past experiences through formal experiment or by altering actions based on their measured effectiveness. Monitoring programs are the foundation of the adaptive management approach.

## **Flexibility**

Implementation of restoration actions needs to be flexible so that unforeseen opportunities can be pursued if they meet the intent of the CVPIA. Also, flexibility will help the AFRP address unforeseen factors that arise or problems that may intensify in the future. The AFRP has the flexibility to work with partners to develop actions consistent with the intent of the CVPIA to address specific problems as they arise or intensify. This flexibility facilitates efforts to maximize the effects of restoration efforts and to sustain benefits to fish production that accrue from these restoration efforts and other management activities.

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To implement this approach, the USFWS established five [Habitat Restoration Coordinator \(HRC\)](#) positions, each assigned a specific geographic area within the Central Valley. Focused in his or her assigned area, each HRC represents the AFRP, develops and nurtures partnerships, develops projects with partners that contribute to making all reasonable efforts to at least double natural production of anadromous fish, and oversees all aspects of implementation of projects in which the AFRP invests funds. In 1998, the AFRP added three more HRCs from the CDFG to this effort, one from each of the CDFG regions within the Central Valley. Together, the USFWS and CDFG HRCs form an interagency team to coordinate, develop and implement restoration projects consistent with the goal, objectives, strategies, processes and priorities described in the Restoration Plan.

Since 1995, the AFRP has been pursuing program objectives by helping to design, fund and manage restoration actions, technical evaluations, and monitoring activities that focus on solving or better understanding a wide variety of problems faced by wild anadromous fish populations at all stages of their life cycles. Many of these projects stem directly from the list of proposed actions developed during the AFRP planning process; others have developed in response to new ideas proposed by a variety of program partners.

AFRP-funded projects to improve habitat have included removal of artificial barriers to migration, installing or upgrading fish ladders, expanding and/or improving the quality of spawning grounds, improving salmon rearing and riparian habitat, developing and nurturing educational programs, investigating salmonid natural history, and acquiring permanent easements in floodplains and riparian corridors. To ensure project effectiveness, all projects include a monitoring component to document pre- and post-project conditions. For detailed project descriptions, see [AFRP Managed Projects](#) .

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## **AFRP OVERVIEW: COOPERATION, COORDINATION AND INTEGRATION OF PARTNERSHIPS**

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In most Sacramento and San Joaquin River tributaries and streams of the Central Valley, the Secretary does not have direct authority to implement actions to restore anadromous fish production because the CVP does not control facilities or flows. Rivers and streams not directly controlled by the CVP include [Battle](#), [Cow](#), [Bear](#), [Cottonwood](#), [Paynes](#), [Antelope](#), [Elder](#), [Thomes](#), [Stony](#), [Mill](#), [Deer](#), [Big Chico](#), and [Butte](#) Creeks and [Feather](#), [Yuba](#), [Bear](#), [American](#), [Cosumnes](#), [Mokelumne](#), [Calaveras](#), [Tuolumne](#) and [Merced](#) Rivers, as well as a portion of the [Sacramento-San Joaquin Delta](#). Private land owners, public and private irrigation districts, utilities, the [State Water Project \(SWP\)](#), municipalities, and industry manage facilities and flows on these streams.

To assist in restoration of these streams, the Secretary needs the cooperation of others. Cooperation through partnerships of the [USFWS](#) and [USBR](#) with other entities that have the authority, interests, and/or resources to facilitate restoration, provides a vital component to implement restoration actions. The [USFWS](#) and [USBR](#) encourage potential partners to enter into voluntary relationships with the agencies to conduct restoration actions.

Mechanisms under which the [USFWS](#) and [USBR](#) can establish and coordinate the funding of cooperative relationships are discussed in the [USFWS](#) publication "Conservation Partnerships: A Field Guide to Public-Private Partnering for Natural Resource Conservation." (For copy call 1-800-344-WILD); The role of the [USFWS](#) or [USBR](#) in relation to the partners will dictate the appropriate mechanism used to establish and coordinate funding including:

### **Interagency Agreements**

Used when one agency is providing payments, goods or services to another agency.

### **Procurement Arrangements**

Used when an agency pays to receive a direct benefit.

### **Memoranda of Understanding**

Most commonly used to establish partnerships and document specific responsibilities; signatories agree to work toward mutual goals, perform joint work, or share research results, however, no obligation of funds may be included.

## Grants

Allow the [USFWS](#) and [USBR](#) to transfer money, property, services or anything of value to an outside group for a project of mutual interest where substantial agency involvement is not anticipated.

## Cooperative Agreements:

Allow the [USFWS](#) and [USBR](#) to transfer money, property, services or anything of value to an outside group for a project of mutual interest where substantial agency involvement is anticipated.

## Challenge Cost-Sharing

Allow the [USFWS](#) and [USBR](#) and other federal agencies to receive funds and requires recipients to match this money with non-federal funds, labor, materials, equipment or land and water, typically of one-to-one.

Through these mechanisms, the [USFWS](#) and [USBR](#) can make agreements and direct funds or services to partners. The partners can then implement specific restoration actions.

Flexibility to use several of the mechanisms for funding non-federal partners is provided to the Secretary in section 3407(e) of the CVPIA:

*"If the Secretary determines that the State of California or an agency or subdivision thereof, an Indian tribe, or a non-profit entity concerned with restoration, protection, or enhancement of fish, wildlife, habitat, or environmental values is able to assist in implementing any action authorized by this title in an efficient, timely, and cost effective manner, the Secretary is authorized to provide funding to such entity on such terms and conditions as he deems necessary to assist in implementing the identified action."*

Funds dispersed through this section are subject to cost-share requirements contained in other sections of the CVPIA.

Some examples of potential partners and mechanisms for working together include:

## Local Agencies and Groups

Watershed workgroups, conservation groups, water districts, non-profit groups, organized school groups, and individual property owners can all help implement restoration actions. Agreements can be reached with these groups, or funds and services can be directed to them through memoranda of understanding, grants, cooperative agreements, and challenge cost-sharing. In areas where there is local

support but no watershed workgroups, the [USFWS](#) and [USBR](#) may provide funds and help to form one.

## State Agencies

The California Department of Fish and Game ([CDFG](#)), California Department of Water Resources ([CDWR](#)), Reclamation Board ([RECB](#)), State Water Resources Control Board ([SWRCB](#)), and other state agencies have expertise, abilities, experience, and are willing to assist in implementing many restoration actions. The [USFWS](#) and [USBR](#) can enter into procurement arrangements, memoranda of understanding, grants, and cooperative agreements with state agencies.

## Other Federal Agencies

The Natural Resources Conservation Service ([NRCS](#)), U.S. Forest Service ([USFS](#)), Bureau of Land Management ([BLM](#)), National Marine Fisheries Service ([NMFS](#)), U.S. Geologic Survey ([USGS](#)), U.S. Army Corps of Engineers ([COE](#)), Western Area Power Administration ([WAPA](#)) and other federal agencies likely have specific expertise and abilities, and are willing to help implement specific actions. Through interagency and procurement arrangements, the [USFWS](#) and [USBR](#) can enter into agreements with other federal agencies to provide funding or services for development, review and implementation of restoration actions.

## CalFed

California Bay-Delta Authority

AFRP staff work with the Restoration Coordinator for the [CALFED](#) Bay-Delta Program to coordinate AFRP funded restoration efforts with [CALFED](#)-funded efforts. A number of AFRP managed projects are funded by the [CALFED](#) program. AFRP staff are active on the [CALFED](#) integration and review panels and participate in a number of other interagency panels.

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## **AFRP OVERVIEW: FUNDING**

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The CVPIA establishes the "Central Valley Project Restoration Fund" and gives the Secretary the authority to use this fund "*to carry out the habitat restoration, improvement and acquisition (from willing sellers) provisions*" of the CVPIA (section 3407). The fund is based in part on Congressional appropriations and on a surcharge imposed on CVP water and power contractors.

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## **AFRP OVERVIEW: GET INVOLVED**

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The AFRP funds restoration actions, monitoring activities, special field studies, modeling studies, riparian land acquisition, and any other activity that has the potential to improve habitat and improve our scientific understanding of the life history, habitat requirements and/or ecosystem processes that support these populations of anadromous fish populations in the Central Valley. If you have a project idea, present it to your local watershed group or to any other interested or potentially affected parties in your area. Projects that have local support are most likely to receive financial assistance from the AFRP or any other restoration program. If there is no watershed group for your area, the AFRP can help you start one.

The next step is to call, write or e-mail the [Habitat Restoration Coordinator](#) for your geographic area. He or she will work with you to develop a project proposal to be integrated into the CALFED PSP process (see [Project Selection Process](#)). If the project is subsequently funded, an HRC will serve to assist in managing and overseeing project implementation.

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USFWS. 2001. [\*Final Restoration Plan for the Anadromous Fish Restoration Program: A plan to increase natural production of anadromous fish in the Central Valley of California.\*](#)

Prepared for the Secretary of the Interior by the United States Fish and Wildlife Service with the assistance from the Anadromous Fish Restoration Program Core Group under authority of the Central Valley Project Improvement Act. Released as a revised draft on May 30, 1997 and adopted as final on January 9, 2001.

USFWS. 1995. [\*Working Paper on Restoration Needs: Habitat restoration actions to double natural production of anadromous fish in the Central Valley of California.\*](#)

Prepared for the U.S. Fish and Wildlife Service under the direction of the Anadromous Fish Restoration Program Core Group. May 9, 1995.